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Report of the Comptroller and Auditor General of India on

Renewable Energy Sector in India

Union Government
Ministry of New and Renewable Energy

Report No. 34 of 2015
(Performance Audit)

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Contents

Preface

The Renewable Energy (RE) potential in India is 8,89,508 Mega Watt. The Government of India, in pursuit of energy security and for minimizing impact on environment, has been prioritizing the development of RE sector through its policies and programmes. In this context, the performance audit of the RE sector was conducted to primarily assess the extent to which contribution of RE to the energy mix in the country had increased and whether RE had succeeded in improving access to electricity in the remote and rural areas.

The performance audit revealed that the exploitation of the two largest components i.e. solar energy and wind energy potential was only 0.35 and 21 per cent, respectively and varied significantly across States. Audit observed that while the overarching policy and incentives offered by the Government of India to promote RE remained uniform for the country, the varied development of the sector in States was a result of State specific factors such as the State's RE development policy, the State tariff regime and the conduciveness of the State's implementation environment. Inadequate evacuation and transmission infrastructure was a bottleneck. Problems in maintaining grid stability caused by infirm and variable nature of wind energy remained unaddressed. Renewable Purchase Obligation mechanism designed as a policy instrument to demonstrate commitment and create a demand incentive for the development of RE resources in India, had not been effectively enforced.

We hope that this Report prepared for submission to the President under Article 151 of the Constitution, for being laid before the Parliament, will help the planners and administrators in addressing the problems that are hindering development of the RE sector in India.

Executive Summary and Recommendations

Why did we select this subject for audit?

India supports around 17 *per cent* of the world's population but its energy and electricity consumption is only around five *per cent* of the world's consumption. Its per capita consumption of energy and electricity is less than one-third of the world average.

In order to sustain a growth rate of over eight *per cent* through the next two decades, India would need to grow its primary energy supply by three to four times and electricity supply by at least five to seven times of its current consumption. The country might need to import over 90 *per cent* of its requirement of oil and over 45 *per cent* of its requirement of coal. Energy shortages are currently at an average of 8.7 *per cent* with peak deficit at nine *per cent.*

Fossil fuels, though cost effective and efficient, are depleting. They pollute the environment and contribute to the greenhouse effect and global warming. Renewable Energy is environment friendly and can provide energy security and offers distributed solutions. It is derived from natural processes that are replenished constantly.

India has made voluntary commitment at the United Nations Framework Convention for Climate Change to reduce its carbon emissions intensity by 20-25 *per cent* by 2020 in comparison with the 2005 levels. It is also envisaged that Renewable Energy would constitute 15 *per cent* of the energy mix of India by 2020.

India is endowed with vast Renewable Energy (RE) potential of 8,89,508 MW. The Planning Commission in the 12th Five Year Plan document had stated that the supply from renewables is expected to increase rapidly from 24,503 MW by the end of the 11th Five Year Plan to 54,503 MW by the end of the 12th Five Year Plan, and underlined the need for investments in RE.

Considering the significance of RE as an alternative to meet the ever growing energy demand of India, we decided to take up Performance Audit of Renewable Energy Sector in India for the period 2007-14. Apart from auditing the Ministry of New and Renewable Energy and institutions under it, audit was also conducted in 24 selected States.

What were our audit objectives?

The objectives of the Performance Audit of Renewable Energy Sector were to examine the progress made in:

(i) Increasing the contribution of RE resources in India's energy mix/electricity mix;
(ii) Increasing access to electricity/ lighting needs in remote and rural areas; and
(iii) Promoting research, design, development and demonstration.

What did our Performance Audit reveal?

Compliance with Renewable Purchase Obligation and availing of benefits of Clean Development Mechanism

As per the National Action Plan on Climate Change (NAPCC) announced in June 2008, a target of five *per cent* for purchase of electricity generated from RE sources was set for 2009-10 against the then existing level of around 3.5 *per cent*. This target was to increase by one *per cent* per year for next 10 years i.e. the NAPCC envisaged that RE would constitute 15 *per cent* of the energy mix of India by 2020. It was observed that as against the National Action Plan on Climate Change target of eight and nine *per cent* for the years 2012-13 and 2013-14, the national achievement was only 4.28 and 4.51 *per cent,* respectively.

(Chapter II, Paras 1 and 2.1)

In none of the 24 sampled States, except Himachal Pradesh and Tamil Nadu, Renewable Purchase Obligations (RPO) were fixed in sync with the norms set under the National Action Plan on Climate Change.

(Chapter II, Para 2.2)

Direct purchase of electricity generated from RE sources was still the preferred option to meet RPO. Between 2010 and 2014, only 4.77 *per cent* of RPO compliance was through Renewable Energy Certificate (REC) mode, whereas 95.23 *per cent* was through direct purchase of electricity from RE sources.

(Chapter II, Para 2.4)

Uncertain policy environment and poor RPO enforcement led to a situation, where as of August 2014, 93,64,699 RECs, each valuing at least ₹ 1,500 were lying unredeemed, affecting the planned cash flow of the generators.

(Chapter II, Para 3.2)

The Ministry of New and Renewable Energy (MNRE) had not devised any mechanism for claiming of Clean Development Mechanism (CDM) benefits for the grid connected and off-grid RE projects. There was lack of awareness with respect to claiming CDM benefits.

(Chapter II, Para 4.2)

Recommendations

1. *MNRE needs to pursue with the State Electricity Regulatory Commissions for the adoption of Renewable Purchase Obligation targets in alignment with National Action Plan on Climate Change targets. These targets should be enforced, with due monitoring and collection of penalties for default in compliance.*
2. *MNRE, being the nodal Ministry should ensure firming up of clear guidelines on the life of Renewable Energy Certificates and management of unredeemed Certificates, in a time bound manner.*
3. *MNRE should introduce a comprehensive framework for creating awareness of Clean Development Mechanism and availing benefits under it.*

Grid Connected Renewable Power

Solar Power

The installed capacity of grid interactive solar power in the country at the beginning of the 11th Five Year Plan period was `Nil'. This rose to 2,656 MW by March 2014, which was 0.35 *per cent* of the country's solar energy potential of 7,48,990 MW.

In the ten States endowed with 78 *per cent* of the National solar potential, the exploited potential varied from zero to 2.56 *per cent*. Gujarat and Rajasthan alone created more than 50 *per cent* of the capacity installed in the country but had exploited only 2.56 *per cent* and 0.51 *per cent* of their respective potentials. Jammu & Kashmir and Himachal Pradesh with potentials of 1,11,050 MW and 33,840 MW respectively, had not set up any grid connected solar project.

(Chapter III, Para 2)

As per the Solar Power Policy 2009 of the Government of Gujarat the tariff was fixed in a phased manner and in alignment with the decreasing capital cost of the systems. However, there were anomalies in the schemes introduced by MNRE between 2008 and 2010. The tariff assured and the period of commitment of the Government of India was increased during this period. Immediately thereafter, between 2011 and 2014, the Central Electricity Regulatory Commission tariffs and the reverse bidding rates decreased. Hence, while designing the schemes, MNRE had not provided for any flexibility to review the tariff being assured.

(Chapter III, Para 3.4)

Under Demonstration Programme, Solar Photovoltaic power project developers availing Generation Based Incentive (GBI) were not eligible to avail Accelerated Depreciation (AD) benefit under the Income Tax Act 1961. This was not ensured by MNRE/Indian Renewable Energy Development Agency (IREDA) before releasing GBI claims of ₹ 22.49 crore to Reliance Industries Ltd (RIL). This resulted in both GBI and AD being claimed by RIL in the period August 2010 to December 2012.

(Chapter III, Para 4.1.1)

MNRE had not formulated guidelines for net metering to provide an enabling environment for solar technology penetration in the country at a decentralized level.

(Chapter III, Para 4.3)

Against the target of 500 MW of Solar Thermal projects, projects of 447.50 MW (approximately 90 *per cent*) had not been commissioned (February 2015). Government land of 3,404 acres in Rajasthan leased to six Solar Thermal project developers had not been put to intended use so far. In Demonstration Programme, in one case, 345 acres of land had been leased in excess of requirement for a Solar Photovoltaic power plant.

(Chapter III, Para 4.4.2)

Lack of coordination between NTPC Vidyut Vyapar Nigam Limited, Power Grid Corporation of India Limited and State Agencies led to instances of delay in supply of thermal based

power for bundling arrangement and non availability of Long Term Access for inter-State transmission system to the State Agencies, resulting in disputed claims with distribution companies.

(Chapter III, Paras 4.4.6 and 4.4.7)

Recommendations

4. *MNRE should focus on development of solar energy in the States endowed with high solar energy potential.*
5. *MNRE, while formulating schemes that commit the Government to long term liability for incentives like Generation Based Incentives, must ensure that these are kept flexible to match changes in tariffs and costing structure to avoid unwarranted burden on public exchequer or developers.*
6. *MNRE must formulate guidelines for net metering so as to provide an enabling environment for solar technology penetration in the country at a decentralized level.*
7. *MNRE must ensure that the solar projects are completed as per schedule. In case of delays, the Central/ State Governments must review the status of the public resources like land allotted to the solar power developers and take necessary corrective measures.*
8. *MNRE, in coordination with other Central Government agencies, should ensure timely arrangement for making available conventional power for bundling and Long Term Access to inter-State transmission system, for smooth operation of the schemes.*

Wind Power

The installed capacity of grid interactive wind power in the country at the beginning of the 11th Five Year Plan was 7,091 MW. This rose to 21,137 MW by March 2014, which was 21 *per cent* of the country's wind energy potential of 1,02,788 MW.

(Chapter IV, Para 3.1)

MNRE could not ensure seamless continuation of Generation Based Incentive and Accelerated Depreciation schemes in the 12th Five Year Plan. The break in incentives being provided to wind energy developers between 2012 and 2014 adversely affected the capacity addition during this period.

(Chapter IV, Para 3.2.3.1)

There was no competition in the wind energy sector either with respect to tariff fixation or allocation of sites to the developers. Thirty two stations identified as potential sites allotted to private developers for setting up wind farms were not developed within the extended time frame. These stations were not included in the normal list of potential stations as stipulated in MNRE guidelines, thus depriving potential developers who could be looking for such sites for establishing wind farms of the opportunity to develop projects.

(Chapter IV, Para 3.2.4)

In the ten States endowed with 97 *per cent* of the country's wind potential, the exploitation varied from zero to 68 *per cent* of the States' potential. Maharashtra had the highest

potential exploitation at 68 *per cent* followed by Tamil Nadu at 51 *per cent*. Jammu & Kashmir, Odisha and Uttar Pradesh had not exploited the potential at all. More significantly, of the four highest potential States, three i.e. Gujarat, Andhra Pradesh and Karnataka had very low rates of potential exploitation ranging from five to 17 *per cent*.

(Chapter IV, Para 4.1)

There were problems in evacuation of wind power generated by the States due to non-availability of sufficient transmission infrastructure and non-synchronization of generation. Lack of scientific techniques to predict the wind power also created problems in maintaining grid discipline. In Tamil Nadu, the quantum of wind power backed down was 6,018.43 MUs during 2007-2014, the maximum backing down being in 2012-13 (1,155.27 MU) and 2013-14 (3,419.85 MU), resulting in a loss of revenue to the extent of ₹ 2,040.25 crore during this period.

(Chapter IV, Paras 4.4.3 and 4.4.5)

Repowering of wind turbines could lead to better utilization of wind-rich sites through the installation of latest technology wind turbine models available and improve the capacity utilization factor by almost two to three times. Over 4,600 turbines rated below 500 kilo Watt with an aggregate capacity of 1.6 Giga Watt and operational for more than 10/12 years, were ideal for repowering. No progress had been made with regard to re-powering of old wind turbines.

(Chapter IV, Para 5)

Recommendations

9. *MNRE should focus on development of wind energy in the States endowed with high wind energy potential.*
10. *MNRE may work towards development of adequate transmission and distribution infrastructure, both intra-State and inter-State, to meet the needs of large scale evacuation of wind power and grid stabilization through scientific forecasting techniques.*
11. *MNRE may look into the issue of repowering the old wind turbines and formulate a policy for optimal utilization of existing capacities and their enhancement.*

Small Hydro Power

The installed capacity of grid interactive Small Hydro Power projects in the country at the beginning of the 11th Five Year Plan was 1,976 MW. This rose to 3,803 MW by March 2014, which was 19 *per cent* of the country's Small Hydro Power potential of 19,749 MW. Out of 6,474 potential sites identified by MNRE, projects had been installed on 997 sites and 254 projects were under implementation.

(Chapter V, Para 2.1)

There were delays and problems in conducting feasibility studies for identifying potential sites for setting up Small Hydro Power projects, which was a critical activity for development of Small Hydro Power. In Himachal Pradesh 37 consent letters were issued but the

Independent Power Producers did not submit any Detailed Project Report even after five years; out of 88 Detailed Project Reports submitted by Himurja to the Department of Energy for technical approval none had been approved and the Independent Power Producers had not submitted feasibility study reports for 78 projects allotted to them. Fifty two Small/Mini/Micro projects of 714.40 MW in Arunachal Pradesh and 50 Small Hydro Power projects of 612.25 MW in Chhattisgarh had not been commissioned and were still in the preliminary stages.

(Chapter V, Para 2.3)

Due to delays and problems in according technical approvals to Detailed Project Reports, allotment of projects, acquiring land for setting up projects and obtaining forest and environmental clearances, several projects could not be taken up and completed in time.

(Chapter V, Paras 3.1 to 3.3)

Approved projects could not be completed due to negligence of contractors, midway changes in design, etc. resulting in significant time and cost overruns. In Bihar 15 projects had not been commissioned even after delays of 37 to 88 months and incurring expenditure of ₹ 128.19 crore.

(Chapter V, Para 3.4)

Sixty projects in five States were shut down, under repairs and maintenance or working below capacity, resulting in loss of power generation and revenue.

(Chapter V, Para 4.1)

Recommendations

12. *MNRE must ensure that pre-requisites such as land and statutory clearances are obtained before release of Central Financial Assistance to developers, in order to avoid time and cost overruns.*
13. *MNRE should focus on reviewing Small Hydro Power projects that are held up or are under performing, to find solutions to the problems hindering the completion of these projects.*

Biomass Power

The installed capacity of grid connected biomass power in the country at the beginning of the 11th Five Year Plan period was 1,184 MW. It rose to 4,123 MW by March 2014, which was 23 *per cent* of the country's Biomass potential of 17,981 MW.

(Chapter VI, Para 2.1)

Audit observed instances of non traceable biomass plants, inoperative plants, plants working at lower capacities, plants installed with different specifications than approved and plants using non-permitted fuels. None of the developers had furnished the generation data to MNRE after the commencement of commercial generation of electricity.

(Chapter VI, Paras 5.2 and 6)

Recommendations

14. *MNRE must ensure that the Central Financial Assistance is released only after compliance with conditions and thereafter the implementation of the sanctioned biomass projects should be closely monitored.*
15. *MNRE must review the power generation from the sanctioned biomass projects to ensure that these are operating as per specifications and use approved RE fuel.*

Off-Grid Renewable Power

Solar Photovoltaic Systems

MNRE did not align its off-grid targets with the Jawaharlal Nehru National Solar Mission (JNNSM) targets and only 31 *per cent* of the JNNSM targets were achieved.

(Chapter VII, Para 2)

There were cases of irregularities in distribution of solar devices, delay in distribution, irregular purchases of solar devices, deficiencies in award of works for Solar Power Plants, irregular payments and delays in completion of projects.

(Chapter VII, Para 4)

Cases of irregular installation, non installation of solar devices and poor quality of work were noticed which indicated deficiencies in monitoring and evaluation.

(Chapter VII, Para 4.2)

Maintenance of the off-grid systems was deficient. Physical verification of sampled systems by Audit revealed that 47 *per cent* of the off-grid systems were not working, one *per cent* of the systems were found missing and five *per cent* of the systems were issued to villages already electrified.

(Chapter VII, Paras 4.3 and 4.4)

Recommendations

16. *MNRE must ensure that targets set under the programme are in alignment with Jawaharlal Nehru National Solar Mission.*
17. *MNRE may review all delayed off-grid projects, set clear timelines for completion of these projects by the State Nodal Agencies/State Governments and ensure adherence with the same.*
18. *MNRE may set up an effective mechanism, in coordination with the State agencies, to ensure that the off-grid systems are properly maintained and remain functional through their useful life.*

National Biogas and Manure Management Programme

The total estimated potential for biogas plants was 1.23 crore plants, of which 47.52 lakh biogas plants (39 *per cent*) were installed as of March 2014. However, the planning was done based on the potential assessment of the cattle census of 1981-82. The potential exploitation varied from 95 *per cent* in Mizoram and Maharashtra to 2.37 *per cent* in Jammu & Kashmir.

(Chapter VIII, Para 2.2)

Physical verification of sampled systems by Audit revealed that 26 *per cent* of the biogas plants were not working.

(Chapter VIII, Para 4.3)

Recommendation

19. *MNRE may ensure better compliance with guidelines, particularly with regard to successful functioning of the biogas plants constructed under the programme.*

Remote Village Electrification

The number of remote villages/ hamlets that had been covered under the programme of Remote Village Electrification was 3,254 at the beginning of the 11th Five Year Plan, which increased to 10,318 by March 2014, although the number of villages/ hamlets eligible for electrification was 12,392. There were instances of mismatches between the list of Remote Villages verified by Rural Electrification Corporation Limited, sanctioned by the Ministry of New and Renewable Energy and actually reported as covered by the States.

(Chapter IX, Para 2.1)

Audit also observed shortcomings in implementation of the programme in the States. There were instances of inordinate delays in completion of projects, award of contracts to ineligible contractors, irregular distribution of lighting systems and incomplete/non-installation of Remote Village Electrification systems.

(Chapter IX, Para 3)

Deficiencies in maintenance of systems were noticed across the sampled States due to under collection of user charges and deficiencies in maintenance arrangements. Physical verification of sampled systems by Audit revealed that 20 *per cent* of the Remote Village Electrification systems were not working and six *per cent* of the systems were found missing.

(Chapter IX, Paras 5 and 6)

Recommendations

20. *MNRE must ensure that only eligible villages/hamlets and beneficiaries are covered in the Remote Village Electrification programme.*

21. *MNRE must ensure long term operation, maintenance and sustainability of the Remote Village Electrification systems.*

Ladakh Renewable Energy Initiative

Even after four years of implementation of the Programme, none of the 17 Small and Micro Hydro Power projects sanctioned had been commissioned as of July 2015.

(Chapter X, Para 2.2)

The projects were sanctioned without conducting proper feasibility studies, allotment of land, statutory clearances such as environmental, forest, irrigation clearances and technical approvals. This was compounded by slow progress in execution of projects.

(Chapter X, Para 3)

Off-grid solar power projects were sanctioned without conducting feasibility studies. As a result, two solar plants were installed in a village that was already covered under Rajiv Gandhi Grameen Vidyutikaran Yojana and 702 Solar Home Lighting Systems were distributed to ineligible beneficiaries. There were deficiencies in implementation of the projects.

(Chapter X, Paras 4.3.2 and 4.3.5)

Recommendations

22. *MNRE must ensure that comprehensive and reliable feasibility studies of the sites are conducted before sanctioning projects.*
23. *Prior to sanctioning of the projects all statutory clearances, particularly land clearances, must be taken.*
24. *Evaluation of progress of work during implementation and post implementation must be carried out by MNRE or State Agencies or reliable third parties.*

Prime Minister's Special Package for Arunachal Pradesh

There was shortfall in achievement of Planning Commission targets, mainly on account of non-completion of nine Small Hydro Power projects (36 MW), against which expenditure of ₹ 358.46 crore had been incurred. In addition, the Department of Hydro Power Development did not complete 13 hydel projects (capacity: eight MW) and Arunachal Pradesh Energy Development Agency had not completed 25 hydel projects (capacity: one MW) due to various reasons, such as, delay in completion of projects by turnkey contractors and non-availability of funds. The delay ranged from two to three years. As of 2013-14, only 1,051 i.e. 65 *per cent* of the villages had been electrified.

(Chapter XI, Para 2)

Even after completion, some of the projects were non functioning due to defective equipment, natural calamities, lack of repair, abandoning of projects by contractors, etc. which resulted in losses in power generation.

(Chapter XI, Para 4)

Recommendation

25. *MNRE must review the work done under Prime Minister's Special Package for Arunachal Pradesh and take action in coordination with the State Agencies for completing delayed projects, ensuring operations of commissioned projects and adequate post-project maintenance thereof.*

Research, Design, Development and Demonstration Activities in the Renewable Energy Sector

MNRE sanctioned 190 projects at a cost of ₹ 545.90 crore during the period 2007-14 to various Research & Development organizations, of which 112 projects were completed and 78 projects were under progress.

(Chapter XII, Para 1)

Audit observed that although a large number of sanctioned projects were in alignment with focus areas identified under various divisions, realisation of deliverable outcome was not achieved in a majority of projects. This was partly due to the fact that industry participation could not be secured in the projects where it was envisaged, which limited the commercial exploitation of technologies developed. There were delays in implementation of projects and inability of the implementing agencies to either file patents or publish research papers as envisaged in the projects.

(Chapter XII, Para 2)

Monitoring of the projects by MNRE was lax, as in many cases, project progress reports were not submitted by the implementing agencies and project completion reports were not evaluated by MNRE or by third parties.

(Chapter XII, Para 2)

Recommendations

26. *Project Completion Reports of research projects should invariably be vetted by field experts and peer groups before their acceptance, to validate the presented output.*

27. *Emphasis should be laid on regular monitoring of ongoing projects to ensure that these are completed on time and if required, course correction introduced.*

Chapter - I

Renewable Energy Sector in India

1. Introduction

India supports around 17 *per cent* of the world's population but its energy and electricity consumption is only around five *per cent* of the world's consumption. Its per capita consumption of energy and electricity is less than one-third of the world average. In order to sustain a growth rate of over eight *per cent* through the next two decades, India would need to grow its primary energy[1] supply by three to four times and electricity supply by at least five to seven times of its current consumption. The country might need to import over 90 *per cent* of its requirement of oil and over 45 *per cent* of its requirement of coal[2]. Energy shortages are currently at an average of 8.7 *per cent* with peak deficit at nine *per cent*[3].

Fossil fuels though cost effective and efficient, pollute the environment and contribute to the greenhouse effect and global warming. For instance, mining of coal results in the destruction of wide areas of forest land and is environmentally hazardous. Coal also produces sulphur dioxide which creates acid rain. All fossil fuels have a finite life - the deposits that exist cannot be replenished easily once these are used.

Renewable Energy (RE) is environment friendly and can provide energy security and offers distributed solutions. It is derived from natural processes that are replenished constantly such as sunlight, wind, rain, tides, waves and geothermal heat. RE has the potential to address the growing concern over indiscriminate use of fossil fuels and its impact on climate change. RE technologies are ideally suited to distributed applications and they have substantial potential to provide a reliable and secure energy supply as an alternative to grid extension or as a supplement to grid-provided power.The challenge is to make the RE technologies convenient, efficient, safe and affordable.

Recognising that climate change was a global challenge, India has been actively engaged in multilateral negotiations at the United Nations Framework Convention for Climate Change (UNFCCC) and made voluntary commitment to reduce its carbon emissions intensity by 20-25 *per cent* by 2020 in comparison with 2005 levels[4]. India launched the National Action Plan for Climate Change (NAPCC) in 2008 which had eight missions with a view to mitigate climate change. One of the missions under NAPCC was the National Solar Mission with an aim to install 20,000 MW solar power capacity by 2022. It also envisaged that RE would constitute 15 *per cent* of the energy mix of India by 2020.

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1 Primary energy is an energy form found in nature that has not been subjected to any conversion or transformation process.

2 Address of the Minister MNRE delivered at Institute of International and European Affairs, Dublin, Ireland in June 2012 available at http://mnre.gov.in.

3 As per Energy Statistics 2013 of Central Statistics Office, Ministry of Statistics and Programme Implementation.

4 The Final Report of Expert Group on Low Carbon Strategies for Inclusive Growth of Planning Commission (April 2014)

The grid-connectable renewable power had estimated potential of 8,89,508[5] MW. The Planning Commission in the 12th Five Year Plan (FYP) document has stated that the supply from renewables is expected to increase rapidly from 24,503 MW by the end of the 11th FYP to 54,503 MW by the end of the 12th FYP, and underlined the need for investments in RE.

The installed power generation capacity in India was 2,84,634 Mega Watt (MW) (March 2014) which mainly included 1,99,947 MW (70 *per cent*) from thermal, 40,531 MW (14 *per cent*) from hydro, 4,781 MW from nuclear (two *per cent*) sources and non-utilities[6] accounted for 39,375 MW (14 *per cent*).

In April 2002, RE based power generation installed capacity was 3,475 MW which was two *per cent* of the total installed capacity in the country. As on 31 March 2014 it was 31,719 MW which was around 11 *per cent* of the installed capacity in the country. Grid connected RE installed capacity included Solar (2,656 MW), Wind (21,137 MW), Small Hydro (3,803 MW) and Biomass[7] (4,123 MW). Ten[8] States endowed with 78 *per cent* of the country's Renewable Energy potential varied in terms of potential exploited[9].

Considering the significance of RE as an alternative to meet ever growing energy demand of India we decided to take up Performance Audit of Renewable Energy Sector in India for the period 2007-14.

2. Strategy adopted by the Government of India (GoI) to develop and promote RE

RE had been an important component of India's energy planning process. The GoI's commitment to RE led to establishment of the Department of Non-Conventional Energy Sources in 1982, which was upgraded to a full-fledged Ministry of Non-Conventional Energy Sources (MNES) in 1992, subsequently renamed as Ministry of New and Renewable Energy (MNRE) in October 2006.

MNRE adopted a three-fold strategy for the development, promotion and use of RE technologies across the country. The salient features of the strategy were:

(i) providing budgetary support for research, development and demonstration of technologies;

(ii) facilitating institutional finance through various financial institutions; and

(iii) promoting private investment through fiscal incentives, tax holidays, depreciation allowance and remunerative returns for power fed into the grid.

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5 Solar–7,48,990 MW, Biomass-17,981 MW, Small Hydro-19,749 MW, Wind (at 80 metres)-1,02,788 MW.

6 RE, Captive Power etc.

7 Including biomass power, bagasse cogeneration, urban and industrial waste to energy.

8 Andhra Pradesh, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Rajasthan and Tamil Nadu.

9 State wise details are given in Chapters III, IV, V and VI.

3. Renewable Energy Programme

The RE programme of MNRE included deployment of RE based projects, systems and devices in the categories: (i) grid-connected[10] renewable power, (ii) off-grid[11]/captive renewable power, (iii) energy for rural applications and (iv) RE for urban, industrial and commercial application.

3.1. Grid Connected Renewable Power

This category comprised power generation mainly from - (i) Solar (ii) Wind (iii) Biomass/Bagasse[12] Cogeneration[13] and (iv) Small Hydro resources. The growth of grid connected RE during the 11th and 12th Five Year Plan (FYP) is given in Table 1**.**

Table 1: Capacity addition since 9th Five Year Plan (in MW)

Resource	Estimated Potential	Capacity Addition			
		Prior to 11th FYP	During 11th FYP (2007-2012)	During 12th FYP (2012-14)	Total capacity as on 31 March 2014
Solar power	7,48,990	Nil	940	1,716	2,656
Wind power	1,02,788	7,091	10,267	3,779	21,137
Small Hydro Power	19,749	1,976	1,419	408	3,803
Bio power*	17,981	1,185	2,042	896	4,123
Total	**8,89,508**	**10,252**	**14,668**	**6,799**	**31,719**

Source: MNRE. *Note – including biomass power, bagasse cogeneration, urban and industrial waste to energy.

3.2. Off-Grid Renewable Power

Programmes for deployment of off-grid/ distributed renewable power and decentralized energy systems for rural applications are given in Table 2.

Table 2: Deployment of off-grid RE systems upto 31 March 2014

S.No.	Resources	Cumulative Achievements (in MW)
Off-Grid/Distributed Renewable Power (including Captive/Cogeneration Plants)		
1.	Biomass Power / Cogeneration(non-bagasse) Plants	531.80
2.	Biomass Gasifier Plants	164.70
3.	Waste-to- Energy Projects	132.70
4.	Solar Photovoltaic Power Plants	174.40
5.	Aero-Generators/Hybrid Systems	2.30
6.	Water Mills/Micro Hydel Power Projects	13.21
	Total	**1,019.11**

[10] Energy systems connected with electricity grid for feeding the grid.
[11] Energy systems for local use not connected with electricity grid.
[12] Bagasse is sugarcane fibre waste left after juice extraction.
[13] Cogeneration is the simultaneous generation of both electricity and heat from the same fuel, for useful purposes.

Decentralized Energy Systems		(in numbers or area as applicable)
1.	Family Type Biogas Plants	47.52 lakh
2.	Solar Photovoltaic Home Lighting Systems	11 lakh
3.	Solar Lanterns	9.60 lakh
4.	Solar Photovoltaic Street Lighting Systems	2.75 lakh
5.	Solar Photovoltaic Pumps	11,626
6.	Solar Water Heating - Collector Area[14]	8.08 million sqm.

Source: MNRE.

4. Agencies involved in promotion of Renewable Energy

While MNRE provides the policy direction and monitors the implementation and the impact of the policies, various agencies at the Centre and the States are responsible for implementation of the schemes. A brief description of these agencies and their functions are given below:

4.1. State Government and State Nodal Agencies (SNAs)

Apart from the Central Government's initiatives to promote RE, the State Governments work towards formulating concomitant State policies and implementation of the policies.

SNAs play a critical role in the development of a long-term renewable policy and implementation of sustainable energy programmes across the States. SNAs promote RE technologies and energy conservation measures and popularize them through schemes and programmes formulated in the light of the Central and State policies, viz socially oriented schemes for urban, tribal, remote and underdeveloped regions; commercially oriented schemes; demonstration projects and programmes; aid in the form of subsidies for production and dissemination of RE technologies; support to Research & Development (R&D) activities, and information and education activities, etc.

4.2. Indian Renewable Energy Development Agency (IREDA)

IREDA is a Government Company that was registered as Non-Banking Finance Company with the Reserve Bank of India in 2008. The main objective of IREDA is to give financial support to specific projects and schemes for generating electricity and / or energy through new and renewable sources and conserving energy through energy efficiency. Report No.12 of 2015 Union Government (Ministry of New and Renewable Energy) of the Comptroller and Auditor General of India deals with the Financing of RE Projects by IREDA.

4.3. NTPC Vidyut Vyapar Nigam Limited (NVVN) and Power Grid Corporation of India Ltd. (PGCIL)

NVVN and PGCIL are Government Companies under the Ministry of Power. The main objective of NVVN is to carry on the business of purchase and sale of all forms of electrical power, both conventional and non-conventional. It was decided by MNRE that NVVN would

[14] A Solar Water Heater comprises of an array of solar collectors to collect solar energy and an insulated tank to store hot water.

be the agency responsible for achievement of the target of 1,000 MW of grid connected solar power plants up to March 2013 under the Jawaharlal Nehru National Solar Mission.

PGCIL is the Central Transmission Utility. Its objectives are to undertake transmission of electric power through Inter-State Transmission System; discharge all functions of planning and coordination relating to Inter-State Transmission System with State Transmission Utilities and other stakeholders; and ensure development of an efficient, coordinated and economical system of Inter-State Transmission lines for smooth flow of electricity from generating stations to the load dispatch centres.

4.4. Institutes under MNRE

There are three institutes under MNRE engaged in R&D activity.

4.4.1. National Institute of Wind Energy (NIWE)

NIWE (formerly C-WET[15]) located at Chennai, Tamil Nadu, was established as a technical focal point for wind power development in India to promote and accelerate the pace of utilization of wind energy. A Wind Turbine Test Station had also been established at Kayathar, Tamil Nadu, with technical and financial support from DANIDA, an agency of the Government of Denmark.

MNRE through NIWE had initiated a major project on Solar Radiation Resource Assessment (SRRA) across the nation to assess and quantify the solar radiation availability along with weather parameters with a view to develop Solar Atlas. NIWE had installed a network of 51 SRRA stations in the first phase in different States.

4.4.2. National Institute of Solar Energy (NISE)

NISE (formerly SEC[16]) located at Gurgaon, Haryana, is a dedicated unit of MNRE for development of solar energy technologies and its related science and engineering. To achieve its objective, NISE had been working on various aspects of solar resource utilization and technology development in collaboration with implementing agencies and industry. Over the years, it had developed a variety of technical facilities for technology evaluation and validation, testing and standardization, performance reliability, monitoring and data analysis apart from training.

4.4.3. Sardar Swaran Singh National Institute of Renewable Energy (SSS-NIRE)

SSS-NIRE located at Kapurthala, Punjab, is an up-coming R&D centre with mandate to focus on Bio-energy and develop innovative technologies in the area of renewables and biofuels.

[15] Centre for Wind Energy Technology.
[16] Solar Energy Centre.

5. Audit Objectives

The objectives of the Performance Audit of Renewable Energy Sector were to examine the progress made in:

(i) Increasing the contribution of RE resources in India's energy mix/electricity mix;

(ii) Increasing access to electricity/ lighting needs in remote and rural areas; and

(iii) Promoting research, design, development and demonstration.

6. Scope of Audit

The all India Performance Audit of Renewable Energy Sector in India was taken up by the office of the Principal Director of Audit, Scientific Departments. It included the audit of MNRE and institutions under it - NISE, NIWE, SSS-NIRE. The period covered in audit was from 2007-08 to 2013-14.

The State Accountants General audited the State Nodal Agencies (SNAs) in 24 selected States[17] and other related Departments. These States were selected for audit based on criteria of Central Financial Assistance released, the Renewable Energy potential in the State and the level of its exploitation.

The two offices of the Principal Directors of Commercial Audit & ex- officio Member Audit Board-III & IV, New Delhi audited NVVN, PGCIL and IREDA.

For this audit suitable sample were drawn for grid connected and off-grid programmes. In respect of grid connected programmes the sample is given in **Annexure I**.

7. Audit methodology

A stakeholder's workshop was held on 24 September 2013 in the office of the Comptroller and Auditor General of India to identify audit issues. Experts from MNRE, Regulatory Bodies[18], State Nodal Agencies, Non Governmental Organisations (NGOs) and Generators Association attended the Conference. Subsequently, an Entry Conference was held on 6 August 2014 at MNRE wherein the audit objectives, audit scope and audit methodology were discussed. The meeting was attended by the officials of MNRE led by Secretary MNRE. MNRE agreed with the objectives and methodology adopted in this Performance Audit. The draft Audit Report on Performance Audit of Renewable Energy Sector in India was issued to MNRE on 27 January 2015, to seek their comments on the audit findings and to confirm the facts and figures mentioned in the report. MNRE furnished replies to the draft Audit Report on 18 May 2015.

[17] Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Mizoram, Nagaland, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttarakhand and West Bengal.

[18] Central Electricity Regulatory Commission and Central Electricity Authority.

The draft Audit Report was revised based on the responses received from MNRE in May 2015 and shared with MNRE on 16 June 2015. The Exit Conference was held on 3 July 2015. Subsequent to the Exit Conference, MNRE furnished supplementary replies (July 2015), which have also been considered while finalizing this report.

8. Scope limitation - non production of records

8.1 Biomass projects

MNRE was the custodian of records for biomass projects including the proposals and their evaluation, based on which Central Financial Assistance (CFA) was released. Hence, it was very important to examine the project files of the biomass projects at MNRE with respect to determination of amount of eligible CFA, monitoring, electricity generation and functional/ non-functional aspect of the projects.

MNRE did not provide any register, evidencing, in a chronological order, the comprehensive list of project proposals received and approved. These details were required for random selection of projects for audit scrutiny. Instead MNRE initially provided Audit with seven bagasse and five non bagasse case files of its own selection, which was not as per the required random check envisaged in the audit methodology. This limitation was brought to the attention of the Secretary, MNRE. Thereafter, MNRE furnished a list of 79 biomass bagasse and cogeneration projects which had been funded during 2007-14. The completeness of the list could not be assured in audit. A sample of 20 projects was selected for detailed scrutiny by Audit from this list, but MNRE did not provide project files for eight[19] projects even after repeated request from Audit.

Similarly, MNRE did not furnish the list of non-bagasse project (except Captive Power) to which funds had been released. Audit observed that as per Industrial cogeneration report there were 75 such projects to which CFA had been released by MNRE. Audit requested MNRE to furnish project files for 24 projects of these 75 projects. MNRE furnished only 12 project files and the remaining 12[20] were not made available to Audit. MNRE provided 19 files of bagasse cogeneration and 17 files of non-bagasse projects.

8.2 Small Hydro Projects

MNRE did not provide a complete list of Small Hydro Power (SHP) projects approved by it but provided the list of sanctions of CFA for the projects. 18 SHP projects implemented by private developers were selected for audit scrutiny from the list of sanctioned CFA, however

[19] M/s Sahabad Cooperative Sugar Mil Ltd, Haryana; M/s Athani Farmers Sugar Factory Ltd, Karnataka; M/s Malegaon SSK Ltd, Maharashtra; M/s Vikas SSK Ltd, Maharashtra; M/s Shreenath Mhaskoha Sakhar Karkhana Ltd, Maharashtra; M/s Gurudatta Sugar Ltd, Maharashtra; M/s Sarvana Sugar Ltd, Tamil Nadu and M/s Kesar Industries Ltd, Uttar Pradesh.

[20] M/s Vijaynagar Biotech Ltd, Andhra Pradesh; M/s Bharat Starch Industries, Haryana; M/s Ruchira Papers Ltd Kala Amb, Himachal Pradesh; M/s Diamond Food Products, Kerala; M/s Lanxess India Pvt Ltd, Birlagram, Madhya Pradesh; M/s Mallu Papers Ltd, Maharashtra; M/s Maa Durga Rice Products Pvt. Ltd, Odisha; M/s ABC papers Ltd, Punjab; M/s SEL Manufacturing Company Pvt. Ltd, Punjab; M/s Anand Triplex Board, Meerut, Uttar Pradesh; M/s Sidarth Papers Ltd, Uttarakhand and M/s Paramount Rice Mills, West Bengal.

files and documents pertaining to the same were not provided to Audit by MNRE during the period of audit.

8.3 Research, Design, Development and Demonstration (RDDD)

Audit sought details of projects sanctioned during 2007-08 to 2013-14 from the concerned divisions of MNRE. In response, all divisions of MNRE provided the information, except Solar Photovoltaic and Solar Thermal divisions, which did not provide details of six projects each[21]. Based on this information, detailed records of 117 projects were called for, of which MNRE provided only 58 project records.

Non production of records and production of incomplete records placed a significant constraint and hindrance to audit scrutiny and is reported as scope limitation to audit.

9. Acknowledgement

Audit acknowledges the cooperation received from MNRE, IREDA, NVVN, PGCIL, NIWE, NISE, SSS-NIRE, concerned State Governments and State Nodal Agencies at each stage of this audit. Audit also acknowledges co-operation received from Central Electricity Regulatory Commission and Central Electricity Authority in providing pertinent information.

10. Arrangement of Audit Findings

The audit findings are discussed in four sections with Chapters II to XII. Chapter I of this report provides an introductory perspective.

- **Section I**: National Action Plan on Climate Change – Renewable Purchase Obligation and Clean Development Mechanism.

  Chapter II of this report deals with compliance with Renewable Purchase Obligation and availing benefits of Clean Development Mechanism.

- **Section II**: Grid Connected Renewable Power

  Chapter III of this report deals with Solar Power.

  Chapter IV of this report deals with Wind Power.

  Chapter V of this report deals with Small Hydro Power.

  Chapter VI of this report deals with Biomass Power.

- **Section III**: Off-Grid Renewable Power

  Chapter VII of this report deals with Solar Photovoltaic Systems.

  Chapter VIII of this report deals with National Biogas and Manure Management Programme.

  Chapter IX of this report deals with Remote Village Electrification.

  Chapter X of this report deals with Ladakh Renewable Energy Initiative.

[21] Total number of projects sanctioned for Solar Photovoltaic were 27 and for Solar Thermal were 22.

Chapter XI of this report deals with Prime Minister's Special Package for Arunachal Pradesh.

- **Section IV**: Research, Design, Development and Demonstration Activities

  Chapter XII of this report deals with Research, Design, Development and Demonstration Activities in the Renewable Energy Sector.

All audit findings and data pertaining to Andhra Pradesh in this Audit Report refers to the position before bifurcation into separate States of Andhra Pradesh and Telangana.

Section I –

National Action Plan on Climate Change – Renewable Purchase Obligation and Clean Development Mechanism

Chapter - II

Compliance with Renewable Purchase Obligation and availing benefits of Clean Development Mechanism

1. Renewable Purchase Obligation (RPO)

As a follow up on India's commitment to reduce carbon emission under United Nations Framework Convention on Climate Change (UNFCCC), the Government of India announced (June 2008) a National Action Plan for Climate Change (NAPCC). One of the important measures identified was increasing the share of Renewable Energy (RE) in the total electricity consumption in the country. NAPCC set target of five *per cent* for purchase of electricity generated from RE sources for 2009-10 against the then existing level of around 3.5 *per cent*. This target was to increase by one *per cent* per year for next 10 years i.e. the NAPCC envisaged that RE would constitute 15 *per cent* of the energy mix of India by 2020. National Solar Mission in 2011 further provided that 'within the percentage so made applicable, to start with, the State Electricity Regulatory Commissions (SERCs) shall also reserve a minimum percentage for purchase of solar energy which will go up to 0.25 *per cent* by the end of 2012-2013 and further up to 3 *per cent* by 2022'.

1.1. Authority to set RPO targets

The existing legal framework under Electricity Act 2003 puts the responsibility for promotion of RE on the SERCs. It provides that SERC should ensure 'promotion of cogeneration and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, *and also specify, for purchase of electricity from such sources*[1]*, a percentage of the total consumption of electricity in the area of a distribution licensee*'.

National Tariff Policy 2006 also provides that 'the Appropriate Commission *shall fix a minimum percentage for purchase of energy from such sources taking into account availability of such resources in the region and its impact on retail tariffs'.*

Hence, RPO of distribution companies/ direct buyers of Electricity were to be fixed by SERCs across the States.

1.2. Renewable Energy Certificate (REC)

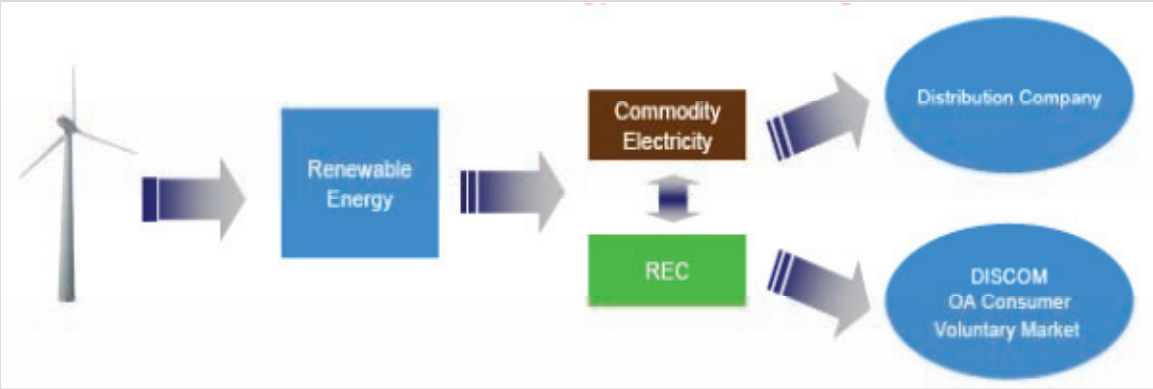
Though India has more than enough RE potential to achieve these targets, availability of RE sources is widely dispersed, and the capacity to meet these targets varies widely from State to State. In some States, the potential for RE is insignificant (e.g. Haryana), whereas some other States have substantial RE sources e.g. wind energy is abundant in Gujarat, Karnataka and Tamil Nadu, solar power is concentrated in the north-west region of the country and small hydro power is concentrated in the States of Himachal Pradesh and Uttarakhand.

[1] Renewable Energy.

MNRE undertook a study (June 2009) and came up with conceptual framework for REC mechanism to possibly address the issue of geographical dispersion of RE resources.

The REC mechanism was based on the premise that the RE generation entails reduction of certain environmental attributes like Green House Gases, apart from electricity generation. Thus, RE generator can sell two different products on account of renewable energy generation. These products are electricity and the associated environmental attributes, in the form of RE Certificate.

Chart 1: REC mechanism



Note: OA-Open Access.

In the proposed mechanism, one REC would be issued to the RE generator for one Mega Watt hour (MWh) electrical energy[2] fed into the grid. The RE generator could sell electricity to the distribution company and associated RECs also to the distribution company or any other obligated entity[3] within the State or outside the State. The REC mechanism would enable obligated entities in any State to procure RECs generated in any of the States in India and surrender the same to satisfy its RPO target. Thus, REC mechanism was supposed to address the issues of scarcity of RE sources in some States which had negligible RPO targets in view of the limited RE potential in the State.

RPO and REC mechanisms were designed as policy instruments to demonstrate commitment and create a demand incentive for the development of RE sources in India.

[2] The solar generating companies registered under REC framework prior to the date of effect of the Third REC Amendment Regulations (1 January 2015) would be eligible for 2.66 REC for one MWh of electricity generated and fed into the grid and this dispensation would be available to such projects for the period upto 31 March 2017, after which the said projects would be eligible for one REC for one MWh of electricity generated.

[3] The entities mandated to purchase a defined quantum of renewable energy of their overall consumption are obligated entities. In a State these may include Distribution Licensees, Captive Consumers, Open Access users etc.

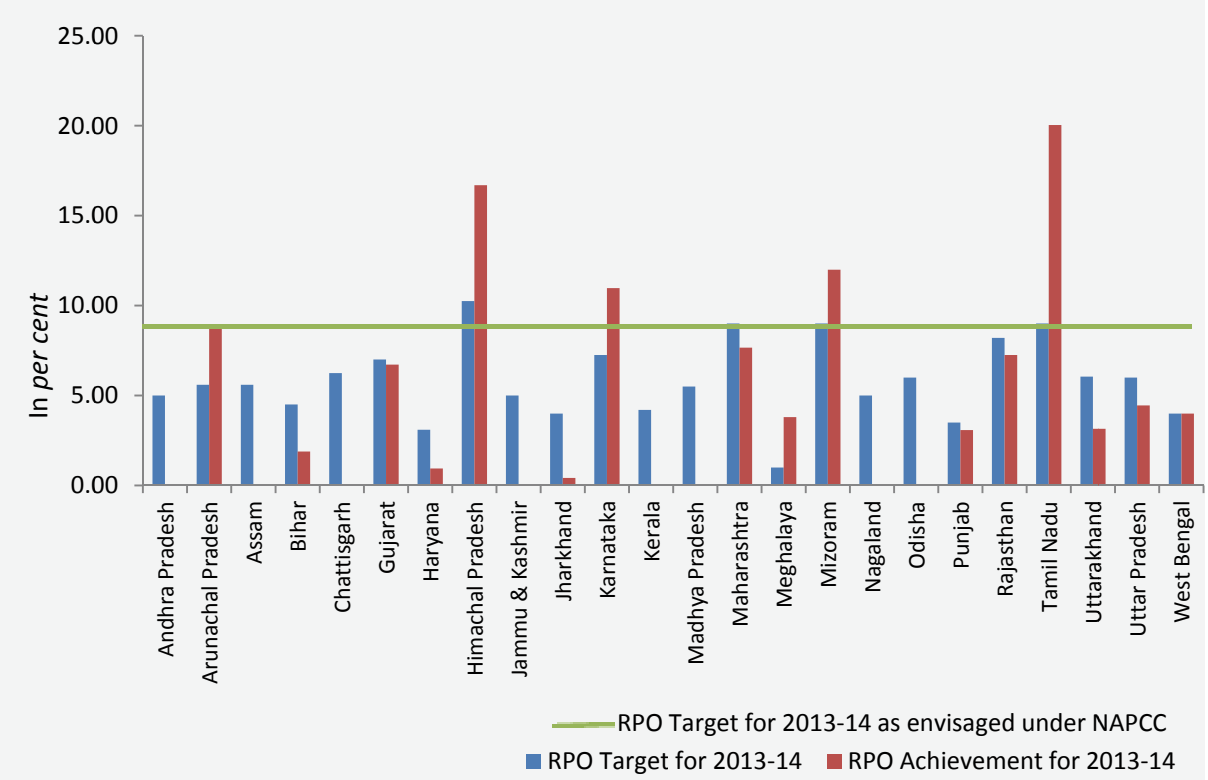
2. Audit Findings

2.1. Shortfall in achieving RPO targets as per NAPCC targets

As stated above the NAPCC targets were to be eight and nine *per cent* for the years 2012-13 and 2013-14 against which the national achievement was only 4.28 and 4.51 *per cent*[4], respectively.

RPO trajectory recommended by NAPCC indicates RPO targets of nine *per cent* for 2013-14. Chart 2 exhibits the targets set for 2013-14 and achievement there against in 24 States sampled.

Chart 2: State wise achievements for RPOs and targets under NAPCC as a percentage of total energy purchased in 2013-14



Source: State Nodal Agencies.

It can be seen from the chart above that even after four years since NAPCC was formulated, only four States (Himachal Pradesh, Karnataka, Mizoram and Tamil Nadu) had been able to achieve their RPO targets in accordance with NAPCC targets.

2.2. State RPO not in keeping with targets set under NAPCC

The targets for RPO set by the SERCs from 2010-11 to 2019-20 in the 24 States test checked in audit are given in **Annexure II**. From the data collected in audit, it was evident that:

[4] Data regarding electricity generation from RE sources was made available by CEA only for the years 2012-13 and 2013-14.

i. In none of the 24 sampled States, except Himachal Pradesh and Tamil Nadu RPO were fixed in sync with the targets set under the National Action Plan on Climate Change;

ii. Only three States[5]set RPO targets for the entire period covered in NAPCC. Setting out RPO targets for a long term i.e. 10 years was required both for setting a road map to meet National commitments as well as to bring policy clarity;

iii. In five of the 24 States, the RPO reported by respective State Nodal Agencies differed from the RPO as per MNRE in these States. The details of differences are given in Table 3.

Table 3: Difference between RPO reported by States and MNRE

State	Year	RPO as per MNRE	RPO as per SNA
Bihar	2011-12	3 *per cent*	2.50 *per cent*
Chhattisgarh	2013-14	5.75 *per cent*	6.25 *per cent*
Mizoram	2013-14	Nil	9 *per cent*
Nagaland	2011-12	7 *per cent*	5 *per cent*
	2012-13	8 *per cent*	5 *per cent*
	2013-14	Nil	5 *per cent*
West Bengal	2011-12	Nil	2 *per cent*
	2012-13	Nil	3 *per cent*

This difference in the data between MNRE and State could hinder proper monitoring and review.

iv. Rajasthan, which had 19 *per cent* of the estimated RE potential of the country, prescribed RPO target upto 2013-14. The RPO were consistently marginally lower than the NAPCC target, though the gap progressively reduced i.e. from one *per cent* in 2011-12 to 0.8 *per cent* in 2013-14;

v. Andhra Pradesh, Gujarat, Jammu & Kashmir and Madhya Pradesh consistently set RPO targets below the target as per NAPCC;

vi. Himachal Pradesh, which has five *per cent* of the estimated RE potential of the country, not only prescribed RPO targets consistently higher than the road map set out in the NAPCC for the entire period of NAPCC; but also surpassed its own targets consistently.

vii. Tamil Nadu, which has four *per cent* of the estimated RE potential of the country, prescribed RPO targets consistently higher than the road map set out in the NAPCC though these have been set out only upto 2015-16 and not the entire period of NAPCC.

viii. Low RE potential States, excepting Mizoram and Nagaland, continued to set substantially lower RPO targets. This indicated that the REC mechanism which was meant to address the issue of disparity in geographical dispersal of RE resources and enable inter-State RE transactions for further promotion and development of RE

[5] Bihar, Himachal Pradesh and Kerala.

sources, had failed to instill confidence in the low RE potential States to set higher RPO targets.

The above analysis indicates the need for greater unity of purpose between the Centre and the States. MNRE stated (May 2015) that the technical document of NAPCC had suggested RPO targets which were not mandatory. Under Electricity Act 2003, the State Regulator was to fix the RPO. The reply needs to be viewed in the context that NAPCC provided the broad framework for RPO compliances to target 15 *per cent* of RE in the energy mix of the country by 2020.

2.3. Status of discharge of Renewable Purchase Obligations

Audit examined the notified RPO across the selected 24 States and their achievements. The status of RPO compliance between 2010-11 and 2013-14 by the 24 States are given in **Annexure III.** Analysis of the data revealed that:

i. Of the 24 States, six States[6] complied with the RPO targets set by the respective State Energy Regulatory Commissions;

ii. Of the six States mentioned above, two States[7] were high potential States. These States not only met the RPO but also exceeded the RPO target set under the NAPCC. Tamil Nadu, which has four *per cent* of the national RE potential, also exceeded the NAPCC targets. Mizoram exceeded the NAPCC targets in 2011-12, 2012-13 and 2013-14. Arunachal Pradesh exceeded these in 2012-13 and 2013-14.

iii. Of the remaining six[8] high RE potential States, the performance of Jammu & Kashmir and Andhra Pradesh was poor. Jammu & Kashmir reported 'Nil' purchase of power from RE sources between 2011-12 to 2013-14, the period for which RPO was notified in the State. Andhra Pradesh reported purchase of electricity from RE sources as 1.75 *per cent* in 2012-13. RPO achievement for 2013-14 was not available. Gujarat, Maharashtra and Rajasthan though not able to achieve the RPO over the years, showed a rising trend in the percentage of electricity purchased from RE sources, which was a positive sign. Madhya Pradesh did not provide the data of RPO adherence.

iv. While Punjab reported a rising trend in the percentage of electricity purchased from RE sources, Assam registered a declining trend.

Inability of RE deficit States to meet their RPO and REC mode contributing in a miniscule manner towards overall compliance[9], indicates poor inclination of the States to meet their targets.

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6 Arunachal Pradesh, Himachal Pradesh, Karnataka, Meghalaya, Mizoram and Tamil Nadu.

7 Himachal Pradesh (36,386 MW) and Karnataka (38,276 MW).

8 Andhra Pradesh, Gujarat, Jammu & Kashmir, Madhya Pradesh, Maharashtra and Rajasthan endowed with 62 *per cent* of the RE potential.

9 Discussed in detail in para 2.4.

2.4. Distribution of purchase of electricity from RE sources and RECs in meeting RPO

The cumulative data of RPO in terms of electricity to be purchased from RE sources, the extent to which it was done directly or through purchase of RECs between 2010 and 2014 is given in **Annexure IV**. From this data collected in audit, it is concluded that:

i. Direct purchase of electricity generated from RE sources was still the preferred option to meet RPO as only 4.77 *per cent* of RPO compliance was through REC mode, whereas 95.23 *per cent* was through direct purchase of electricity from RE sources.

ii. Purchase of RECs was not an attractive option as evident from the fact that despite 17 States falling short of meeting their RPO, only six States reported purchase of RECs, despite RECs being available in the designated exchanges[10]. Gujarat led these States by meeting 43 *per cent* of its RPO through RECs.

2.5. Monitoring of compliances with RPO and penalty for non-compliance

MNRE in its framework for REC mechanism recommended formation/designation of a monitoring committee in the States with the primary objective of monitoring the RPO compliances by designated entities. The monitoring committee was required to secure data on RPO compliances by obligated entities including those which may not be covered in REC mechanism or have on site captive generation. Electricity Act 2003 under Section 142 empowers SERCs to impose penalties for non-compliances of the Act, Rules, Regulations or Provisions. Twenty one States had designated a State agency for submitting a quarterly report to their respective SERCs, indicating RPO compliances and shortfalls. Based on the data received from monitoring committee, SERCs were expected to impose and collect penalties from obligated entities for shortfall.

It was observed that:

i. Rajasthan and Karnataka had not prescribed any rate for levy of penalty, whereas Uttar Pradesh did not even have the provision for penalty in case the obligated entity was not able to meet the RPO.

ii. There was no shortfall in meeting RPO targets in six States. No penalty was collected in 17[11] of the 24 States sampled, which reported shortfall, except collection of a token penalty by Uttarakhand.

iii. Audit estimated penalty leviable on obligated entities for not complying with RPO, based on a conservative assumption that the shortfall in RPO would have been met by buying RECs (non-solar) at the floor price of ₹ 1,500 per REC. The State wise details of the estimate are given in **Annexure V** and indicate that an amount of ₹ 4,234.79 crore was leviable on the obligated entities.

The enforcement of RPO was further diluted by frequent deferring of RPO targets as seen in the cases of Gujarat, Madhya Pradesh, Maharashtra and Uttarakhand.

[10] Discussed in detail in para 3.2.
[11] As per Annexure V.

MNRE stated (May 2015) that the RPO Regulations notified by the respective State Regulator provided for penal provisions for non-compliance of RPO by the obligated entities. These penal provisions were to be invoked by the respective Regulator after taking into consideration the reasons for non-achieving RPO by the obligated entities. It further stated that by not achieving RPOs the distribution companies have not accrued undue benefits because all the power purchased and sold had to be reflected in Annual Revenue Requirements which was approved by SERCs. The reply of the Ministry does not address the issue raised above on non-enforcement of RPO and non-collection of resultant penalties by SERCs as mandated by Electricity Act 2003.

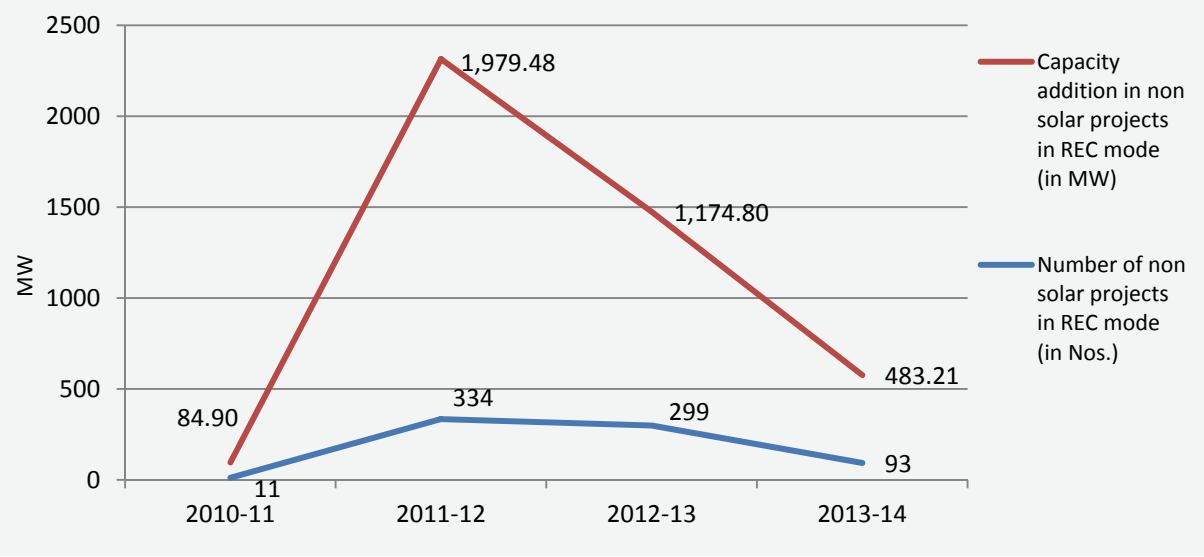
3. Difficulties in RPO compliance

Difficulties in compliance with RPO were posed primarily by REC mechanism not being successful and constraints of infrastructure. These are discussed below:

3.1. Declining trend for projects registered through REC route

MNRE framework for REC mechanism provided that initially RE projects with a minimum of 250 kW capacity were eligible to register in REC mode. It was envisaged that as the REC market matured, off grid technologies could also be considered for inclusion in REC mechanism. Audit observed a declining trend in REC registered projects after an initial spurt, in both solar and non solar mode over the years.

Chart 3: Projects and capacities added in REC mode for non solar category



Source: REC Registry of India.

As can be seen from Chart 3, after an initial thrust towards REC mode, the interest of generators to register under REC mechanism gradually dwindled. The reason for declining interest may be attributed to poor RPO compliances in States. In solar category, only 164 projects (18 *per cent*) with capacity of 368.89 MW (nine *per cent*) had been registered under REC mode since 2012 till date. The State wise list of projects registered under solar and non solar REC mode as on July 2014 is given in **Annexure VI**.

From the trends, it would emerge that the RE participants have gradually lost interest in the REC mechanism.

3.2. Continuously increasing unredeemed RECs

Electricity Act 2003, under Section 66, provides for development of trading markets. Currently RECs are being traded at Indian Energy Exchange and Power Exchange of India Limited. First solar REC was issued in May 2012, whereas first non solar REC was issued in March 2011. Shelf life of RECs was initially kept at one year but Central Electricity Regulatory Commission (CERC) vide order dated February 2013, extended the shelf life to two years. This was further extended by three years in January 2015 on an adhoc basis. RECs were to be issued by REC registry[12] to generators in electronic form within three months of RE generation. Such RECs were to be bought by obligated entities and other voluntary buyers through REC trading platforms.

The details of unredeemed RECs pending in National Load Dispatch Centre[13] (NLDC) are given in Table 4.

Table 4: Details of RECs pending for redemption

Year	No. of RECs pending for redemption at the end of the year
2010-11	108
2011-12	38,545
2012-13	17,76,929
2013-14	56,53,314
2014-15 (till August 2014)	93,64,699

Source: REC Registry of India.

It can be seen from Table 4 that:

i. Due to insufficient RPO compliances, unredeemed RECs have been on an increasing trend. These grew from 108 RECs at the end of 2010-11 to 93.65 lakh RECs as of August 2014. Of the 93.65 lakh RECs pending in August 2014, examination in audit revealed that 5.15 lakh RECs were pending redemption for over a year.

ii. CERC took ad-hoc measures of increasing the shelf life of RECs from initial one year to three years (January 2015).

iii. Uncertain policy environment and poor RPO enforcement led to a situation where 93.65 lakh RECs each valuing at least ₹ 1,500[14] remain unredeemed as of August 2014. Consequently the planned cash flow of REC mode generators was affected.

Huge closing balances of unredeemed RECs at the exchanges require structural and regulatory changes for keeping the viability of REC mechanism as an important growth factor of RE market in India.

[12] REC registry is an online platform governed by National Load Dispatch Centre as a depositary for RECs.
[13] NLDC was the Central Agency for energy accounting and reporting.
[14] Floor price of non-solar REC.

3.3. Supply concentration and transmission constraints

RE was mainly concentrated in a few States and within the State to a few generation pockets. Geographical distribution of such resources caused problems in integrating RE to the grid. RE projects, being location specific cannot be aligned with existing load centres necessarily. The existing grid infrastructure was insufficient at most places to transport renewable power (wind specially) to load centres. State utilities were unable to create sufficient infrastructure for variable power. Hence, construction of new intrastate as well as interstate transmission infrastructure was critical to meet the needs of large scale RE deployment. The matter has been discussed in detail in Chapter IV of this report.

4. Clean Development Mechanism (CDM)

The basic rules for the functioning of the CDM were agreed on at the seventh Conference of Parties (COP-7) to the United Nations Framework Convention on Climate Change (UNFCCC) held in Marrakesh, Morocco in October-November 2001. Projects starting in the year 2000 were eligible to earn Certified Emission Reductions (CERs) if they lead to "real, measurable, and long-term" Green House Gases (GHG) reductions, which were additional to any that would occur in the absence of the CDM project.

At COP-7, it was decided that the following types of projects would qualify for fast-track approval procedures:

- RE projects with output capacity up to 15 MW.
- Energy efficiency improvement projects which reduce energy consumption on the supply and/or demand side by up to 15 Giga Watt hours annually.
- Other project activities that both reduce emissions by sources and directly emit less than 15 kilo tonnes Carbon Dioxide equivalent annually.

While investors profit from CDM projects by obtaining reductions at costs lower than in their own countries, the gains to the developing country host parties are in the form of finance, technology, and sustainable development benefits.

4.1. Introduction of CDM in India

National Action Plan on Climate Change identified possible role of Clean Development Mechanism (CDM)[15] in financing efficient technologies. MNRE perceived it as a new and important window to take up CDM projects with emphasis on households, small enterprises and rural areas. MNRE came up with the framework for programmatic CDM projects in RE in May 2009 and identified seven specific[16] areas for implementation.

[15] Clean Development Mechanism (CDM) was made functional in 2001.

[16] Family Type Biogas Plants programme, Medium and Large Size Biogas Plants programme, Solar Water Heating, Solar Cooking programme, Improved Cook stove programme, Biomass applications in Industry, Village Electrification programme.

4.2. CDM benefits not availed

National Clean Development Mechanism Authority (NCDMA) of India was constituted in 2003 by the Ministry of Environment and Forests, which was the single window clearance for CDM projects in the country. It had devised formats and procedures for submitting the projects for approval under CDM mechanism.

Audit observed that MNRE had not devised any mechanism for claiming of CDM benefits for the grid connected and off-grid RE projects. None of the schemes of MNRE encouraged the developer/ beneficiary to claim the benefits of CDM. There was a lack of awareness with respect to claiming of CDM benefits.

4.3. State wise analysis of status of claiming of CDM benefits

Out of 24 States selected for Audit, 21 did not respond to the Audit queries related to the operationalisation of CDM benefits. The Audit findings with respect of the three States that responded are given below:

Kerala

The Government of India agreed to provide loan to implement Bachat Lamp Yojana in Kerala as part of UNFCCC targets to replace incandescent lamps with Compact Fluorescent Lamps. The repayment was to be made on receipt of fund on sale of carbon credit. If the scheme was not implemented successfully then Kerala State Electricity Board (KSEB) had to bear the cost from its budget and resources. Audit observed that, even though ₹ 52.50 crore was released, KSEB did not claim the benefit under CDM.

Tamil Nadu

i. The Detailed Project Report for the cogeneration plants in the co-operative sugar mills being implemented by Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO) envisaged that each of the plant with 172 days of operation with bagasse would fetch around 31,000 Certified Emission Reductions per annum valued at ₹ 40 lakh[17]. Audit observed that TANGEDCO did not even register the plants with UNFCCC for claiming CDM benefits.

   Similarly, none of the 18 Small Hydro Power projects implemented by TANGEDCO, which were entitled for CDM benefits, had availed the benefits so far.

ii. The Tamil Nadu Regulatory Electricity Commission (TNERC), in its Comprehensive Tariff Orders on Wind Energy issued during 2009 stipulated that CDM benefits should be shared between the promoter and the distribution licensee i.e. TANGEDCO, starting from 100 *per cent* to the promoter in the first year till the sharing becomes equal to both the promoter and TANGEDCO in the sixth year.

   Test check of 33 wind, biomass and cogeneration projects which had energy purchase agreements with TANGEDCO and which had received CERs equivalent to 42,97,177 credits from UNFCCC during the period 2007-08 to 2012-13 revealed that in none of these cases, TANGEDCO initiated action for modification of the

[17] At the rate of two Euros per CER.

agreements providing for sharing of CDM benefits as per the directions of TNERC. TANGEDCO neither received nor claimed its share of CDM benefits from the promoters as of March 2014.

West Bengal

According to the NCDMA, carbon credit of ₹ one per kWh of energy generated was available to West Bengal Green Energy Development Corporation Limited (WBGEDCL) from the two MW solar power plants at Jamuria.

Audit observed that WBGEDCL had not applied in prescribed format to NCDMA and could not avail CDM benefits, estimated around ₹ 49.09 lakh, between August 2009 and March 2014.

5. Reduction in use of Liquified Petroleum Gas (LPG) or conventional fuel and Green House Gas (GHG) emissions

Renewable Energy is a clean fuel and its usage is expected to bring reduction in emission of GHGs. MNRE in its various schemes promoting the use of RE articulated reduction in the use of conventional fossil fuels (Kerosene) and reduction in GHG emission as one of the objectives e.g.

i. National Biogas and Manure Management programme, *inter alia*, aimed at providing clean bio-gaseous fuel mainly for cooking purpose and also for other applications for reducing use of LPG and other conventional fuels,

ii. Solar Photovoltaic (SPV) off-grid programme also aimed to reduce the consumption of kerosene for lighting purpose by replacing the kerosene lanterns and wick lamps with SPV systems and to improve the quality of life in rural areas through the use of environment friendly solar lighting systems, which do not need any fossil fuels, do not emit any pollutants and are free from health and fire hazards.

Audit attempted to examine whether there was reduction in use of LPG/ kerosene and other conventional fuels and in emission of GHGs with the adoption of RE based solutions.

As per MNRE, the estimated abatement of Carbon dioxide (a GHG) by installation of RE systems is given in Table 5.

Table 5: Estimated abatement of Carbon dioxide by installation of RE systems

Technology	Achievement (MW)	Annual Electricity generation (MWh)	Carbon Dioxide emission abated (million tonnes)
Grid connected RE power	31,719	7,63,95,055	75
Off-grid/ Decentralised systems	4,039	1,21,15,984	19
Total	**35,758**	**8,85,11,039**	**94**

Audit observed that though estimates were provided by MNRE, no actual calculations of reduction in GHG emissions were made available by MNRE.

MNRE stated (July 2015) that it attempted to calculate reduction in emission by the biogas plants installed in eight States during the period 2007-08 to 2011-12. Reply of MNRE need to be viewed in light of the fact that this exercise was conducted only for biogas plants, whereas, it was not done for other grid and off-grid RE based capacity created.

Audit test checked records of 24 SNAs and found some studies to estimate reduction in GHG emissions. The audit findings are given below.

Jammu & Kashmir

As per the memorandum for Expenditure Finance Committee of MNRE the annual fuel savings with the installation of 25,000 sqm collector area of Solar Water Heating Systems (SWHSs) were estimated as equivalent to 3,000 tonnes of firewood and 400 kilo litres of diesel but actually only 5,509 sqm collector area was installed and actual saving of conventional fuel was not calculated.

Kerala

Agency for Non-conventional Energy and Rural Technologies (ANERT) conducted studies on reduction in use of conventional fuels, wherein targets were fixed each year for reduction of conventional fuels i.e. LPG, kerosene etc. However, achievements were not assessed/analysed during the period 2007-08 to 2009-10.

Meghalaya

No impact assessments were carried out by Meghalaya Non-Conventional and Rural Energy Development Agency (MNREDA) on the Remote Village Electrification (RVE) projects executed under the scheme to ensure reduction in the use of conventional fuel. However, as per the third party monitoring report relating to the electrification of 70 remote villages completed in January 2010, 92 *per cent* of the beneficiaries reported to have spent less amount on lighting fuels like kerosene after installation of SPV lighting systems at their houses. The consumption of kerosene was reported to have declined to one fourth from around 4.77 liters per month to 1.13 liters per month, resulting in a savings of 64.80 kL per year, or approximately ₹ 9.72 lakh.

In the case of electrification of 52 remote villages completed in May 2010, third party monitoring was yet to be conducted. Hence the impact on the use of conventional fuel could not be assessed.

MNRE stated (May 2015) that the evaluation studies were done by independent organizations from time to time as part of monitoring and evaluation of the programme and this subject was included in such studies.

6. Conclusion

Under the National Action Plan for Climate Change, RPO target of five *per cent* was set (2009-10) for contribution of RE in the total electricity consumption of the country, which could be achieved either by directly purchasing electricity generated from RE sources from the grid or through purchase of RECs from other energy rich States. The RPO was to increase

by one *per cent* over the next 10 years so as to reach 15 *per cent* by 2020. During 2012-13 and 2013-14, against the RPO target of eight and nine *per cent* as envisaged under National Action Plan for Climate Change, national achievement was 4.28 and 4.51 *per cent* respectively.

Only two States had fixed RPO in alignment with National Action Plan for Climate Change norms. Only six out of 24 selected States had managed to meet the RPO fixed by respective SERCs. Despite there being a provision for levy of penalty for non-achievement of RPO targets, no penalty was levied by 17 SERCs. Purchase of RECs was not a preferred mode to meet RPO, as only six States opted for purchase of RECs.

Only 4.77 *per cent* of RPO compliance has been through REC mode, whereas 95.23 *per cent* had been through direct purchase of electricity from RE sources.

Poor RPO compliance by States led to decline in registration of projects in REC mode on the one hand and increase in number of unredeemed RECs available in designated exchanges on the other. There were no policy guidelines for unredeemed RECs, which would affect planned cash flow of generators registered for REC regime. As of August 2014, 93,64,699 RECs were lying unredeemed. On a conservative basis each REC was valuing at least ₹ 1,500.

RE projects are capital intensive, long duration investments which ideally should provide relatively steady returns over the life cycle of the project with minimum variability. The lack of long term RPO targets, weak enforcement by SERC coupled with issues related to liquidity and lifetime of RECs creates uncertainty, which is detrimental to the development of the RE sector.

Audit observed that MNRE had not devised any mechanism for claiming of CDM benefits for the grid and off-grid RE projects. MNRE despite being the nodal Ministry for promotion of RE in the country did not take action to formulate guidelines and create awareness of CDM benefits.

7. Recommendations

- *MNRE needs to pursue with the State Electricity Regulatory Commissions for the adoption of Renewable Purchase Obligation targets in alignment with National Action Plan on Climate Change targets. These targets should be enforced, with due monitoring and collection of penalties for default in compliance.*
- *MNRE, being the nodal Ministry should ensure firming up of clear guidelines on the life of Renewable Energy Certificates and management of unredeemed Certificates, in a time bound manner.*
- *MNRE should introduce a comprehensive framework for creating awareness of Clean Development Mechanism and availing benefits under it.*

Section II –

Grid Connected Renewable Power

Chapter - III

Solar Power

1. Introduction

India is endowed with vast solar energy potential. About 5,000 trillion kilo Watt hour (kWh) per year energy is incident over India's land area with most parts receiving 4-7 kWh per square meter per day. Hence both technology routes for conversion of solar radiation into heat and electricity, namely, solar thermal and solar photovoltaic, can effectively be harnessed, providing huge scalability for solar energy in India. Solar energy also provides the ability to generate power on a distributed basis and enables rapid capacity addition with short lead times. From an energy security perspective, solar is the most secure of all sources, since it is abundantly available.

1.1. Solar resource assessment

MNRE sanctioned (2010), to National Institute of Wind Energy[1] (NIWE) a mission mode project for setting up a network of Solar Radiation Resource Assessment (SRRA) stations all over the country to overcome the deficiencies in the availability of investor grade ground measured solar radiation data. This data was crucial for planning and implementation of solar power projects. NIWE had done an assessment of the solar potential of India and also prepared a solar atlas of the country.

2. Potential, target and achievements

The targets fixed by MNRE and achievements there against during 11th FYP (Five Year Plan) Period (2007-12) and 12th FYP period (upto 2014) are given in Table 6. **Annexure VII** contains State wise details of potential, targets and achievements.

Table 6: Targets and achievement under 11th and 12th FYP

S.No.	Year	Target (in MW)	Achievement (in MW)	Excess(+)/ Shortfall(-) (in *per cent*)
11th Five Year Plan Period (2007-12)				
1	2007-08	Nil	Nil	Nil
2	2008-09	14	Nil	-100
3	2009-10	2	8	+300
4	2010-11	200	27	-87
5	2011-12	200	905	+353
	Total	416	940	
12th Five Year Plan Period (upto 2014)				
6	2012-13	800	754	-6
7	2013-14	1,100	962	-13
	Total	1,900	1,716	
	Grand Total	**2,316**	**2,656**[2]	

Source: MNRE.

[1] Formerly Centre for Wind Energy Technology (C-WET), Chennai.

[2] While the target and achievement in the table above are reflected year wise, the **Annexure VII** contains these figures State wise.

Based on the analysis of data in Table 6 and examination, the following observations are made:

i. At the commencement of the 11th FYP period, the grid interactive solar power installed capacity in the county was `Nil'. During the 11th FYP the target of solar power capacity addition was set at 416 MW which was 0.06 *per cent* of the total potential of the country. Against a target of 416 MW the achievement in solar power capacity addition was 940 MW. MNRE set the target of 1,900 MW for the first two years (2012-14) of the 12th FYP and achieved 1,716 MW up to 31 March 2014.

ii. MNRE did not provide any record based on which these targets were set and State wise breakup of the targets. As can be seen from Table 6 and **Annexure VII**, the consolidated year wise targets set by MNRE for 2007-14 (2,316 MW) did not match with the aggregated targets set State wise for the same period (4,409 MW). Similarly, the achievements as reported by SNAs for the period 2007-14 was 2,412.56 MW as against 2,656 MW reported by MNRE based on year wise aggregate and 2,631.14 MW on State wise aggregate. Thus, there was inconsistency in respect of the data maintained by MNRE and SNAs.

iii. Based on the analysis of State wise details given in **Annexure VII**, it was observed that:

a) As against an estimated potential of 7,48,990 MW, in 29 States and Union Territories, the installed capacity was only 2,631.14 MW[3] (0.35 *per cent*).

b) Only 18 States had installed grid connected solar power but it was a very small *per cent* (0.09 to 2.56 *per cent*), of the estimated potential of the State.

c) Seventeen States had not fixed any targets during the period 2007-14. In the seven States that had fixed targets, there was shortfall in achievement of the targets in each of them.

d) Based on the solar potential assessed in all the State/UTs listed in the annexure, Audit identified that ten States listed in Table 7 accounted for 78 *per cent* of the solar potential of the country.

[3] As per MNRE and 2,412.56 MW as per SNAs.

Table 7: Estimated potential and installed capacity (Grid connected) for the States endowed with 78 *per cent* of country's solar energy potential.

(in MW)

S.No.	State	Estimated potential[4]	Installed capacity	Percent installed
High[5] potential States with 59 *per cent* of the estimated National solar energy potential				
1	Rajasthan	1,42,310	730.10	0.51
2	Jammu & Kashmir	1,11,050	Nil	Nil
3	Maharashtra	64,320	249.25	0.39
4	Madhya Pradesh	61,660	347.17	0.56
5	Andhra Pradesh	58,850	131.84	0.22
	Total	**4,38,190**	**1,458.36**	**0.33**
Medium[6] potential States with 19 *per cent* of the estimated National solar energy potential				
6	Gujarat	35,770	916.40	2.56
7	Himachal Pradesh	33,840	Nil	Nil
8	Odisha	25,780	30.50	0.12
9	Karnataka	24,700	31.00	0.13
10	Uttar Pradesh	22,830	21.08	0.09
	Total	**1,42,920**	**998.98**	**0.70**

Source: MNRE.

The installed capacity in these ten States varied from zero to 2.56 *per cent* of their potential. Gujarat had the highest exploitation of solar energy potential at 2.56 *per cent* followed by Madhya Pradesh. Jammu & Kashmir and Himachal Pradesh had not exploited the potential at all. Gujarat and Rajasthan alone had created more than 50 *per cent* of the total capacity installed in the country.

Thus, unless MNRE and the State Governments of these ten States prioritise exploitation and development of solar power, the impact of the progress made in the sector will remain insignificant.

MNRE accepted the audit observation.

3. Programmes of MNRE for promotion of Solar Power

Between January 2008 and February 2010, MNRE introduced three programmes for promoting generation of electricity from solar energy. These are discussed below:

3.1. Demonstration programme

Under MNRE's Demonstration programme (approved in January 2008), Generation Based Incentive (GBI) of ₹ 12 per kWh for the electricity fed into the grid by Solar Photovoltaic (SPV) power projects[7] was promised. The project had to be commissioned by 31 March 2010, which was subsequently extended up to 31 March 2012. The incentive was available

[4] As per NIWE.
[5] States with estimated potential higher than 50,000 MW.
[6] States with estimated potential between 20,000 MW and 50,000 MW.
[7] With total installed capacity ≥ 1 MW and ≤ 25 MW.

for a maximum duration of 10 years for approved projects. The programme lapsed at the end of 11th FYP.

Seven projects of 20 MW capacity were commissioned during the period September 2009 to March 2012 under this programme.

3.2. Jawaharlal Nehru National Solar Mission (JNNSM)

JNNSM was launched in January 2010 with the aim to deploy 20,000 MW of grid connected solar plants and 2,000 MW of off-grid solar applications by 2022.

During Phase I (upto 2012-13) of the Mission, the target was to set up 1,100 MW grid connected solar plants which included 1,000 MW of large grid solar plants connected to 33 kV and above grid line, and 100 MW of rooftop and small solar power plants connected to grids below 33 kV, to be completed by March 2013.

3.2.1. 1,000 MW capacity from Grid connected Solar Power Plants-JNNSM Phase I

NTPC Vidyut Vyapar Nigam Limited (NVVN) was the nodal agency to purchase 1,000 MW of solar power from the RE project developers, bundle it with the unallocated power made available from the NTPC coal-based stations and sell this "bundled" power to the Distribution Utilities. It was decided to select projects of 1,000 MW capacities based on solar thermal and SPV technologies. The capacity to be installed was equally divided (i.e. 500 MW) between the two technologies. The selection of Solar Thermal projects for 500 MW was completed in FY 2010-11. The selection of SPV grid power projects of 500 MW capacity was done in two batches over two financial years i.e., 2010-2011 and 2011-2012. The projects were selected on reverse bidding[8] basis.

3.2.2. 100 MW capacity from Roof top PV and Small Solar Power Plants

MNRE announced (June 2010) guidelines for Rooftop PV and Small Solar Power Generation Plants (RPSSGP) connected to distribution network below 33 kV. This component of JNNSM was designed essentially as a State driven scheme to encourage the States to declare their solar policy for grid connected projects focusing on distribution network and to strengthen the tail end of the grid. Another purpose of the scheme was to encourage as many States as possible to set up small solar grid connected projects. The RPSSGP projects were selected on *first-come-first* serve basis by IREDA.

3.3. Migration scheme

Migration scheme was launched (February 2010) to facilitate quick start-up of the JNNSM. Under the scheme 16 projects of 84 MW capacities[9] were approved to be commissioned by end of October 2011. Of the 16 approved projects, 11 SPV Projects of 48 MW capacity and one solar thermal project of 2.5 MW capacity had been commissioned by February 2012 and February 2013, respectively.

[8] Developers quoting the lowest tariff rate are selected.

[9] 13 projects of 54 MW of SPV and three projects of 30 MW for solar thermal

The detail of projects sanctioned and commissioned under these schemes is given at Table 8.

Table 8: Scheme wise details of projects sanctioned and commissioned as of April 2014.

Scheme	Type of project	No of projects (capacity in MW) sanctioned	No of projects (capacity in MW) commissioned
Demonstration	SPV	6 (18)	6 (18)
JNNSM Batch- I	SPV	30 (150)	28 (140)
	ST	7 (470)	1 (50)
JNNSM Batch-II	SPV	28 (350)	26 (330)
RPSSGP-SPV	SPV	78 (98)	71 (90.80)
Migration	SPV	13 (54)	11 (48)
	ST	3 (30)	1 (2.50)
Total		**165 (1,170)**	**144 (679.30)**

Note: SPV – Solar Photovoltaic and ST – Solar Thermal.

3.4. Anomalies in design of the schemes

Multiple schemes to develop Solar Power offering assured Generation Based Incentive[10] (GBI) were introduced between 2008 and 2010 as discussed below. The period of these schemes overlapped. The salient features of incentives offered under each scheme are given in Table 9.

Table 9: Comparison of features and incentives offered by the various schemes.

Year	Scheme	Incentive/ Tariff	Government liabilities
January 2008 to March 2012	Demonstration Programme	Maximum GBI of ₹ 12 per kWh for 10 years to be paid through IREDA.	Liability of ₹ 388.55 crore over 10 years.
January 2010 to March/ May 2013	JNNSM Phase I Batch I	Lowest tariff of ₹ 10.85 per kWh for SPV and ₹ 10.49 per kWh for ST as per reverse bidding.	Projects under JNNSM were selected on reverse bidding process by NVVN. Hence, there was no tariff liability on GoI. Tariff assured under Migration scheme was also to be borne by NVVN. However, a Payment Security Scheme with a corpus of ₹ 486.05 crore was set up by MNRE for payment to Solar Power Developers in case of default by Discoms[11].
January 2010 to March 2013	JNNSM Phase I Batch II	Lowest tariff of ₹ 7.49 per kWh for SPV as per reverse bidding.	
February 2010 to March 2013	Migration Scheme	CERC tariff of ₹ 17.91 per kWh for SPV and ₹ 15.39 per kWh for ST, to be paid by NVVN for 25 years.	

[10] GBI is an incentive provided by MNRE to support grid RE power projects connected to the distribution grid.
[11] Electricity Distribution Company.

Year	Scheme	Incentive/ Tariff	Government liabilities
June 2010 to March 2013	RPSSGP	Difference between CERC tariff of ₹ 17.91 per kWh and the base rate of ₹ 5.50 per kWh (for FY 2010-11), to be escalated by three *per cent* every year for 25 years.	Liability for Centre of ₹ 3,899 crore and States of ₹ 3,766 crore created over 25 years.

Audit analysed certain inconsistencies in the schemes due to which the developers could derive unwarranted benefits. These are discussed below:

3.4.1. Increase in tariff in the period registering a downward trend in costs

As can be seen from Table 9, MNRE launched (January 2008) Demonstration programme in which maximum GBI of ₹ 12 per kWh was provided for a maximum duration of 10 years to approved projects. RPSSGP launched in January 2010[12] as part of JNNSM, assured tariff of ₹ 17.91 per kWh for 25 years. The Migration Scheme launched in February 2010 assured ₹ 17.91 per kWh for SPV and ₹ 15.39 per kWh for ST for a period of 25 years. Hence, both the assured tariff/GBI as well as the period of commitment increased between 2008-10 in the schemes devised by MNRE.

Audit observed that:

i. The cost of the SPV plant as well as the tariff as determined by CERC had been decreasing as indicated in the Table 10.

Table 10: CERC estimated cost of the SPV plants and the tariff fixed during 2009-14.

Year	CERC estimated cost of SPV plant (₹ crore per MW)	CERC tariff (₹ per kWh)
2009-10	17	
2010-11	16.90	17.91
2011-12	14.42	15.39
2012-13	10.00	10.39
2013-14	8.00	8.75

ii. Between 2010-12, the lower SPV tariff discovered under JNNSM reverse bidding process was ₹ 10.85 per kWh in 2010-11 and ₹ 7.49 per kWh in 2011-12.

iii. Further, it was observed that as per the Solar Power Policy 2009 of the Government of Gujarat the tariff was fixed in a phased manner and in alignment with the decreasing capital cost of the systems. The tariff structure as per this policy is given in Table 11.

[12] Guidelines were issued in June 2010

Table 11: Tariff structure as per Solar Power Policy 2009 of the Government of Gujarat

Date of commissioning	SPV (₹ per kWh)	ST (₹ per kWh)
Prior to January 2010	₹ 13 for first 12 years and ₹ 3 for next 13 years	₹ 10 for first 12 years and ₹ 3 for next 13 years
After January 2010 and before 31 March 2014	₹ 12 for first 12 years and ₹ 3 for next 13 years	₹ 9 for first 12 years and ₹ 3 for next 13 years

Based on these facts it can be seen that:

a) The tariff in Migration and RPSSGP programmes was for long durations of 25 years. While designing the schemes, MNRE had not provided for any flexibility to review the tariff being assured. The schemes committed GoI to liabilities at a high rate for long periods i.e. 25 years without maintaining any provision for revisions in tariff based on changes in costing structures. The schemes were changed for higher tariffs but kept inflexible at a peak tariff rate with no room of downward review.

MNRE stated (April 2015) that CERC tariff was not available at the time of announcement of Demonstration Scheme and in the year 2010-11, CERC had announced a fixed levelised tariff of ₹ 17.91 per kWh for SPV projects and ₹ 15.31 per kWh for ST projects for 25 years and the same was incorporated in the scheme guidelines.

The reply is not tenable as maximum tariff in Demonstration scheme was ₹ 15 per kWh for 10 years and in the subsequent schemes MNRE increased it to ₹ 17.91 per kWh for 25 years. Further, CERC tariff undergoes frequent revisions to adjust it to the changes in cost as was reflected in the subsequent tariff notifications; whereas, the MNRE schemes committed to inflexible tariffs for a long term i.e. 25 years.

b) The details provided by NVVN disclosed that the Power Purchase Agreements (PPAs) were entered into between the developers and Discoms in advance[13], and the projects were not commissioned as per the scheduled commissioning period. Thus, due to delay in commissioning, the developers could take the benefit of the reduction in capital cost of the plant. Therefore, the tariff should have been fixed on the basis on the tariff of the year in which the project was commissioned instead of the year of signing of the PPA.

MNRE stated in April 2015 that the fixation of tariff based on the year of signing of PPA was a policy decision. It further stated that if MNRE would have fixed the tariff based on year of commissioning, and tariffs could have increased, MNRE would have had to bear increased liability. Reply of MNRE was not tenable because it did not foresee the market trend of decrease in capital cost, which apparently was anticipated by the Gujarat Government in 2009.

[13] JNNSM and Migration schemes.

3.4.2. Case study of M/s Azure power (Punjab) Private Ltd

Audit noted that M/s Azure Power (Punjab) Private Limited (Developer) executed PPA with Punjab State Electricity Board (PSEB) on 27 May 2009 under the New and Renewable Sources of Energy (NRSE) Policy of Punjab 2006. The Developer there after first shifted to Demonstration scheme and later shifted to the Migration scheme of MNRE. The chronology of events is given in Table 12.

Table 12: Chronology of events for M/s Azure Power (Punjab) Private Limited.

Year	Event
March 2008 to March 2009	Bid under NRSE policy 2006 of Punjab for two MW; Allotment of project via tender; Signing of MoU; Preparation of DPR and its submission; Registration of land lease and Implementation agreement signed.
15 April 2009	Targeted date for commencement of project construction.
May 2009	Signing of PPA with PSEB at Tariff of ₹ 7.71 per unit for 2008-09 with annual escalation of five *per cent* up to 2011-12 for 30 years.
October 2009	MNRE approved transfer of project to Demonstration Programme at the Tariff of ₹ 8.50 per unit with GBI of ₹ 1.14 per unit for 10 years. Targeted date of commercial generation was 15 October 2009.
December 2009	One MW plant commissioned. MNRE approved transfer of partially commissioned one MW under Demonstration Scheme at a tariff of ₹ 15 per unit with GBI of ₹ 6.90 per unit for 2009-10 and ₹ 6.50 per unit for 2010-11. GBI of ₹ 76.57 lakh was paid between December 2009 to September 2010. Thereafter no GBI was paid by MNRE.
October 2011	MNRE approved transfer of the entire two MW project to Migration Scheme at the tariff of ₹ 17.91 per unit. Payment to be made through NVVN.
November 2011	Remaining one MW plant commissioned.

MNRE frequently kept changing its schemes and did not allow the schemes to mature. As can be seen from the case of M/s Azure Power (Punjab) Private Ltd, this resulted in the developer migrating to more profitable schemes. MNRE allowed the Developer to benefit by allowing it to change from State scheme to Demonstration Scheme and further to more profitable Migration Scheme.

MNRE stated (May 2015) that on meeting the eligibility criteria for selection, M/s Azure Power (Punjab) Pvt. Ltd, had been selected as one of the Solar Power Developers (SPDs) under the Migration Scheme of JNNSM Phase-I for their then upcoming two MW capacity SPV Power Project. NVVN signed PPA with them on 15 October 2010. As Migration Guidelines do not have any room for partial commissioning of the solar power project, no such provisions had therefore been made in the PPA signed with the qualified Project Developers under the scheme. It further stated that the earlier PPA with PSEB under NRSE Policy 2006 was for 30 years duration while, with NVVN PPA was entered for 25 years duration from date of commercial operations. Thus, the total duration of supply envisaged,

including period prior to NVVN PPA become operational, was less than 30 years (as envisaged under PPA with PSEB).

The reply may be viewed in the light of the fact that the project was submitted through the bidding process of NRSE Policy 2006 of Punjab and the tender of PEDA was independent of MNRE programme and the decided tariff was ₹ 7.71 per kWh (for the year 2008-09) with five *per cent* annual escalation upto 2011-12 for the period of 30 years. Further, while shifting the project to demonstration scheme, MNRE approved the GBI @ ₹ 1.14 and tariff of ₹ 8.50 and the Developer partially commissioned one MW capacity in December 2009. Also, there was no room for partial commissioning of the solar power project in the Migration Scheme and the project was allowed in a phased manner. Moreover, MNRE had no reason for considering the project for Demonstration Scheme as the Developer had already signed the PPA under NRSE policy of Punjab 2006. Therefore, MNRE permitted frequent changes in the scheme opted to the benefit of the Developers.

3.5. Policies of the States for the promotion of solar power

While the overarching policy and incentives offered by the Government of India to promote solar energy across the States remained common, the comparative and varied development of solar energy in these States was dependent on factors such as State policies, evacuation infrastructure, tariff fixed by the SERC, Plant Load Factor (PLF) generated, enforcement of RPO/ REC and overall commitment of the State Governments to development of Solar RE resources.

The performance analysis of West Bengal is presented below as a Case Study to illustrate that lack of commitment to policy and lax implementation environment in States could lead to poor performance.

Case Study I
Poor implementation of Solar Power programme in West Bengal

West Bengal Green Energy Development Corporation Ltd. (WBGEDCL) approved (September 2009) a work plan to install RE projects of 400 MW, Green Building of five MW, roof top SPV plants of 10 MW and develop evacuation infrastructure of 400 MW, to be achieved by 2015. It involved a total investment of ₹ 4,225 crore.

Government of West Bengal developed (April 2010) a State Action Plan for Climate Change (SAPCC) which identified a solar potential of 16,000 MW.

Subsequently, in June 2012, Government of West Bengal declared its RE policy. In the Policy, estimated potential of each RE sources, except Solar, was mentioned. Regarding solar potential it was stated that the same was under preparation. Significantly, the potential assessed under the SAPCC was not considered in the RE Policy declared in June 2012 and as per assessment made by NIWE (in 2011), the estimated solar potential of West Bengal was 6,260 MW. The RE Policy set out targets for creation of capacity of 100 MW and 500 MW to be achieved by 2017 and 2022, respectively.

During 2007-14, against target of 100 MW solar power, the State could install capacity of two MW only which was 0.03 *per cent* of installed capacity in the State, a negligible achievement.

As per RE Policy, WBGEDCL was to identify Government waste land and the land so identified was to be transferred to WBGEDCL which in turn would be leased to the developers. For projects on private land the developer was to arrange the entire required quantum of land through direct purchase. Audit noticed the following deficiencies in planning and implementation of solar projects in West Bengal:

i) Details of sites identified for setting of RE based projects were not kept in public domain in order to facilitate the developers in assessing the information.

ii) Land could not be acquired by seven developers for setting up 32.5 MW solar projects.

iii) In Bankura district, WBGEDCL identified (September 2012) Government waste land (178 acres) in Mejia block. Department of Power and Non-Conventional Energy Resources (DPNES), WBGEDCL was to carry out the feasibility of grid connectivity and submit proposal on these wastelands. The report was not prepared even after lapse of more than two years.

iv) Audit observed that, since June 2012, WREDA received 11 proposals for solar projects but none were cleared till date (September 2014).

Thus, due to lack of commitment to policy and to business plan, only two MW of the Solar RE capacity could be installed in West Bengal.

4. Audit observations on implementation of schemes for promotion of Solar Power

4.1. Implementation of Demonstration Programme by Indian Renewable Energy Development Agency (IREDA)

4.1.1. Ineligible payment of GBI to Reliance Industries Ltd.

Rajasthan Renewable Energy Corporation Ltd (RRECL) in June 2008 approved a five MW Grid Interactive Solar PV Power Generation Project of Reliance Industries Ltd. (RIL) at District Nagaur, Rajasthan under the Demonstration Scheme. MNRE accorded approval for allowing GBI to RIL through IREDA. As per the terms and conditions of the programme, project developers would not avail Accelerated Depreciation (AD) benefit as per the Income Tax Act 1961. In case of any violation of the conditions, IREDA was to immediately stop releasing the GBI to the project and refer the matter to the Ministry.

The project was commissioned in July, 2010 and a MoU was signed between IREDA and RIL in April, 2011. MNRE directed (June 2013) IREDA to obtain confirmation from all the project developers that Accelerated Depreciation benefit was not availed at their end. MNRE again (August 2013) directed that IREDA should ensure that only 7.69 *per cent* depreciation is

claimed by the project developer in their income tax returns. IREDA observed (July 2013) that RIL was claiming depreciation at a higher rate i.e. 15 *per cent* instead of 7.69 *per cent* in its income tax returns.

Audit observed that RIL had violated the above condition by availing Accelerated Depreciation rendering the project ineligible for claiming GBI under this scheme. In violation of the programme conditions, IREDA disbursed GBI of ₹ 22.49 crore from August 2010 to December 2012 to RIL. IREDA on the request of RIL informed MNRE (November 2013) that the developer had given an undertaking (October 2013) that the claim for rate of depreciation would be revised from 15 *per cent* to 7.69 *per cent* in its income tax returns on or before 31 March 2014 for Assessment year 2011-12 and 2012-13 and requested to consider releasing further payment of ₹ 7.79 crore upto September 2013. MNRE did not respond to the request of RIL and claims of ₹ 18.79 crore (January 2013 to December 2014) were pending.

While confirming the facts, IREDA stated (May 2015) that the request of RIL was forwarded to MNRE in November 2013**.** However, approval of MNRE was not received to this effect and resultantly no GBI had been released. It further stated that in the Demonstration Programme, there was no prescribed rate of depreciation to be claimed by the project developer.

The reply of the IREDA was not tenable as the specified terms and conditions appended with MoU, *inter alia* states that SPV power project developers would not avail Accelerated Depreciation benefit under Section 32 of the Income Tax Act 1961. This fact had not been ensured by MNRE/IREDA before releasing GBI claims which resulted in passing of undue benefit to RIL. The reply of IREDA was also silent about the revision of Income Tax Returns by RIL. Pending the resolution of this issue, the possibility of recovering the GBI of ₹ 22.49 crore paid irregularly remains in abeyance.

MNRE confirmed (July 2015) IREDA's reply and stated that the request of RIL for releasing further payment was not considered due to non compliance by RIL.

4.1.2. Excess recovery of service charges by IREDA

The terms and conditions of GBI-Demonstration Solar scheme stipulated that a maximum of one *per cent* of the total funds released by IREDA in a year to project developers as GBI, would be allowed as administrative charges for implementation of the program subject to a maximum of ₹ 5 lakh per project per year. This also needed reconciliation while making future releases.

It was however observed that IREDA deducted one *per cent* of each disbursement of GBI even beyond the limit of ₹ 5 lakh per annum per project in case of three projects to the extent of ₹27.39 lakh. The details of year-wise project wise service charges deducted by IREDA are given in **Annexure VIII**.

During the meeting (December 2013) between MNRE and IREDA it was decided that in cases where IREDA had claimed administrative charges more than ₹ 5 lakh per project per year of operation in the past, requisite adjustments were to be made from the future releases. Out of excess service charges amounting to ₹ 27.39 lakh in respect of three projects during the

period from 2011-12 to 2013-14, ₹ 18.28 lakh remained unadjusted by IREDA (September 2014).

MNRE stated (July 2015) that the amount of excess service charge claimed by IREDA has now been reconciled and adjusted in respect of two developers, the excess charges claimed against M/s RIL could not be adjusted. The reply of MNRE is not tenable as the whole amount could have been adjusted while releasing the claims to IREDA.

4.2. Implementation of RPSSGP by IREDA

JNNSM RPSSGP was announced in June 2010. During the period 2007-14, 78 projects were registered by IREDA in its capacity as programme administrator of the scheme. Of the 78 projects, six were dropped after registration due to non-commissioning of the projects on time and one case was kept in abeyance as the case is under investigation by Central Bureau of Investigation (CBI). Of the 71 projects implemented, in three projects GBI was not released due to non-furnishing of complete documents and in one case document were not furnished for claiming GBI till date (September 2014) by the project proponent. Thus, GBI under the scheme had been released to 67 projects. Out of 71 projects, Audit examined 17 projects. The detailed audit findings are given below:

4.2.1. Delay in passing the GBI claims

The RPSSGP guidelines state that if there was shortage of funds, the program administrator would arrange a standby facility to release the funds on time. However, it was observed that IREDA did not avail the facility of alternative funds from commercial banks to ensure timely release of funds to developers.

In four out of 17 selected projects it was observed that IREDA had not released GBI claims within the specified period of 15 days and had passed the claims with a delay ranging between 68 to 405[14] days.

MNRE stated (July 2015) that delay in release of GBI was due to delay in receipt of claim documents/ clarifications from utilities. The reply is not tenable as IREDA was not processing the claims on monthly basis as envisaged in the Scheme but it processed the claims as and when the funds were received from MNRE.

4.2.2. Pendency of claims under RPSSGP scheme

MNRE started releasing funds for GBI in instalments[15] to IREDA. Audit observed that GBI claims (March 2014) amounting to ₹ 84.50 crore were lying pending for payment due to non receipt of funds from MNRE. Further claims of ₹ 24.78 crore were yet to be processed by IREDA.

MNRE stated (July 2015) that the claims were to be processed by IREDA upon receipt of complete documents as per the scheme guidelines. The reply is not tenable because MNRE/IREDA should ensure that the claims are passed in time.

[14] M/s PCS Premier (405 days delay), M/s Saimeg Infrastructure Pvt. Ltd (383 days delay), M/s RV Akash Ganga Infrastructure Ltd (324 days delay) and M/s Soma Enterprises Ltd (68 days delay).

[15] It released ₹ 15 crore (March 2011), ₹ 40 crore (August 2012) and ₹ 100 crore (July 2013).

4.3. Net metering

Net metering was important to make the RPSSGP scheme successful. The advantage of net metering was that payment had to be made only for the difference between the power supplied by the utility and the power produced by the solar panels and there was no need to store the surplus energy in batteries for later use. It would also allow consumers to directly contribute to enhancing the RE capacity of the country.

Audit observed that while Regulatory framework for electricity generation was a State subject, MNRE could have issued guidelines for reference by the States, as an enabling environment for solar technology penetration in the country at a decentralized level. As of May 2015, 19 States/UTs[16] had formulated a net metering policy. In the absence of recommended guidelines, different States had adopted different models in implementing net metering. Audit findings in this regard are given below:

Andhra Pradesh

The State Government introduced net metering in the State in March 2013. But the issues not addressed in the policy were:

- Difference between higher cost of solar generation and applicable retail tariff.
- Provision for restrictive capacity on overall/local grid penetration to address technical, safety and security issues arising out of possible reverse flow of electricity in local grids as the current distribution system was not geared to accommodate reverse power flows in the distribution network.
- Energy accounting and commercial settlements as per the time of day tariff regimes.

Chhattisgarh

In the State, a total 4,640 Solar Power Plants (SPPs) in residences, commercial establishments, hostels, Community Health Centre/Primary Health Centre etc (off- grid and decentralized) were installed, with capacity ranging from one kW to 1,000 kW. The total generation capacity was about 21,238 kW. However, no SPP was connected to grid for export of surplus power to Distribution Companies (Discoms). As per CERC regulation, the above SPPs were also eligible for net-metering. Chhattisgarh Renewable Energy Development Agency (CREDA) stated that list of all the SPPs having capacity of more than 50 kW had been provided to Chhattisgarh State Power Distribution Company Limited (CSPDCL) and the grid connectivity was to be done by them.

[16] Andhra Pradesh, Andaman & Nicobar Islands, Chandigarh, Chhattisgarh, Dadra & Nagar Haveli, Daman & Diu, Delhi, Goa, Haryana, Karnataka, Kerala, Lakshadweep, Odisha, Pondicherry, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal.

Karnataka

The Government of Karnataka approved (January 2013) Solar Roof Top Yojana[17] with subsidy of 20 *per cent* in addition to MNRE subsidy of 30 *per cent*. It was proposed to install solar power packs with battery backups at an approximate cost of ₹ 2.70 lakh per kW.

Audit observed that even though it was proposed as grid connected power plant, there was no proposal to introduce net metering concept and the energy generated was to be used for captive consumption. The scheme was not successful as there was poor response from the beneficiaries with only seven applications received.

4.4. Implementation of Migration scheme and JNNSM (excluding RPSSGP) by NVVN

4.4.1. Non encashment of Performance Bank Guarantee

In JNNSM the projects were to be commissioned within 28 months of the date of signing of Power Purchase Agreement (PPA). In case of failure to achieve this milestone, NVVN was to encash the Performance Bank Guarantee (PBG), followed by levying of Liquidated Damages and finally terminating the project.

Audit observed that only one solar thermal plant of 50 MW capacity was commissioned (March 2014) out of seven of 470 MW allotted, but NVVN neither encashed PBG nor levied liquidated damages.

MNRE stated in June 2014 that the projects were permitted to be commissioned by September 2015 with levy of liquidated damages but the project developers filed petition before CERC *inter-alia* seeking extension and restraining NVVN from encashing PBGs and CERC (March 2014) directed NVVN not to encash the PBGs.

4.4.2. Status of land alienated for the Solar projects under Migration and JNNSM

Under JNNSM (Phase I, Batch I), six Solar Thermal (ST) projects having 420 MW capacity had not been commissioned till date (September 2014). Under Migration scheme, two ST project of 20 MW capacity had not been commissioned and one project had been partially commissioned[18] (February 2013).

These non-commissioned/ partially commissioned ST projects were located in Andhra Pradesh (one), Gujarat (one) and Rajasthan (six and one partially commissioned).

Audit observed that the land for the un-commissioned Gujarat project had been directly acquired by the developer (May 2011). In case of Andhra Pradesh project, the land was partially acquired by the developer (April/June2011) and the land to be provided by the State Government was still in the acquisition process.

[17] A scheme for generation of electricity by installing grid connected Solar Photo Voltaic generators on roof top of buildings. It was initially introduced in Bangalore, Mysore, Hubli and Mangalore.

[18] Against the envisaged 10 MW capacity only 2.5 MW had been installed in May 2011.

In Rajasthan, the State policy gave preferential treatment in allotment of land to these developers as this land was being allocated for public purpose. The preferential treatment included allocating Government land at rates lower than the Collector rate and changing the land use status. The records revealed that in Rajasthan, in four[19] ST projects sanctioned under JNNSM (January 2011) and two[20] ST projects sanctioned under Migration scheme (October 2010), a total of 3,404 acres of Government land was leased to the solar power developers at the rate of 10 *per cent* of prevailing Collector rate in districts of Jaisalmer and Jodhpur. The land had been leased[21] by Rajasthan Government for 30 years to these developers and ST projects had not been commissioned till February 2015. This indicated that these developers had created substantial land banks under the Rajasthan Government policy which had not been put to intended use.

Audit also observed that in Demonstration programme, Rajasthan Government leased (September 2008) 375 acres of land to M/s Par Solar for five MW SPV plant which was commissioned in March 2012. For commissioning of one MW SPV project, approximately six acres of land was required. Hence, 345 acres of land was leased in excess of requirement.

MNRE stated (April 2015) that the information on the status of the land where the allotted solar power projects have either not come up or were cancelled, was not available with the Ministry.

4.4.3. Irregularities in operation of Solar Payment Security Account (SPSA)

MNRE introduced (June 2011) Payment Security Scheme for grid connected solar power projects under Phase-I of JNNSM with Gross Budgetary Support not exceeding ₹ 486.05 crore to MNRE. The main objective of the scheme was to facilitate creating a Solar Payment Security Account (SPSA) and other necessary mechanisms as a payment risk mitigation strategy in the event of default by State Utilities/Discoms in making payment to the developer.

The salient features of the scheme were as under:

- The State utilities/Discoms were to open Letter of Credit (LC) for six month equivalent amount which would be backed by an escrow account[22].

- As per the available provisions of the PPA, NVVN was to raise a provisional bill against the State Utilities/Discoms on the last day of the month. The due date of payment would be 30 days from date of billing. If payment was not made by the 30th day, NVVN was to notify a default and encash the amount from LC. In addition to encashing LC, NVVN had the right to divert and sell the bundled power in the spot/short term market.

[19] M/s Rajasthan Sun Technique Energy Pvt Ltd, M/s Corporate Ispat Alloys Ltd, M/s Diwakar Solar Projects Pvt Ltd and M/s KVK Energy Ventures Pvt Ltd.

[20] M/s Entegra Ltd and M/s Dalmia Solar Power Ltd.

[21] Date of acquisition of land for two projects under Migration Scheme was February 2010 and for the four projects under JNNSM was between May and July 2011.

[22] It is a temporary account held by a third party during the process of a transaction between two parties.

- In case, the realized amount from the market was lower than the cost of the bundled power, the difference was to be paid from the SPSA provided under the scheme.

MNRE released ₹ 58.32 crore in three tranches to NVVN upto December 2013 and recognized interest earned as accretion of ₹ 2.30 crore (August 2014). NVVN had been utilizing the funds for releasing payments to Solar Power Developers (SPDs) and recouping the same on realization from Discoms. Till August 2014, NVVN had utilized ₹ 47.14 crore of which ₹ 28 crore were recouped and balance ₹ 19.14 crore were utilised towards charging of trading margin[23], leaving ₹ 41.48 crore[24] as unutilized balance available with NVVN.

Audit examination revealed the following in the operation of SPSA:

i. NVVN entered into PPA with SPDs with back to back Power Sale Agreement (PSA) with Discoms in 10 States[25] (October 2010 to May 2012) to sell bundled power. NVVN did not obtain adequate LC as per the terms of PSAs from Discoms. Against the total amount of ₹ 1,102.09 crore LCs to be obtained as per the terms of PSA, NVVN had obtained LCs of only ₹ 221.94 crore as of August 2014.

ii. The Discoms did not open Escrow Accounts in any of the States. Thus shortfalls in LCs obtained and non-opening of Escrow accounts, reduced the security available with NVVN to recover the defaulted amount from Discoms.

iii. NVVN did not explore the option of diverting and selling the bundled power in spot/ short term market before drawing the money from SPSA as per the guidelines. NVVN did not maintain records of negotiations with third parties including prevailing exchange prices during such periods in a format specified by CERC, which was to be verified by MNRE and the Ministry of Power through a standing committee.

iv. NVVN was to utilize its working capital from day one of the billing up to 60 days, to pay the claims raised by SPDs and NTPC Ltd. SPSA was to be used only in the event of non payment of dues by the Discoms within 60 days from the billing date. SPSA was to be used only as a 'fall back' arrangement when other payment security provisions, such as, the availability of working capital, Letter of Credit linked with an Escrow account, had been exhausted. However, in case of Rajasthan Discoms, LC of only ₹ 21.97 crore was provided by Rajasthan Discoms against the requisite LC of ₹ 481.38 crore as per PSA. This amount was only four time monthly revolving in a month (August 2014) instead of the mandated six months to cover the risk of default in payment. When these Discoms disputed the payment of trading margin[26], instead of encashing available LCs, NVVN utilized ₹ 19.14 crore from SPSA towards unrecovered trading margin from Rajasthan Discoms. This utilization of SPSA was in violation of the provisions of the scheme because NVVN could utilize SPSA only after accessing alternate sources of funds including letter of credit linked with Escrow account.

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[23] Margin earned by the person who has been granted licensee by CERC to undertake inter-State trading in electricity.

[24] (₹ 58.32 crore + ₹ 2.30 crore) – ₹ 47.14 crore + ₹ 28 crore = ₹ 41.48 crore.

[25] Andhra Pradesh, Assam, Chhattisgarh, Karnataka, Maharashtra, Odisha, Punjab, Rajasthan, Uttar Pradesh and West Bengal.

[26] The issue of disputed trading margins is discussed in details at para 4.4.5.

NVVN stated (September 2014) that the Discoms were requested to open Escrow account and Discoms had retained the amount on account of pending issues. MNRE stated (May 2015) that the Discoms had been requested many times to open the Escrow account and LCs with proper amount but they have not done the same because of financial resource crunch and limits not available.

4.4.4. Encashed Bank Guarantee not kept in separate Bank account

As per Migration Scheme the Project Developer was to provide a performance guarantee to NVVN in the form of Bank Guarantee (BG) at the rate of ₹ 50 lakh per MW. This BG was to be encashed by NVVN if the SPV power plants were not commissioned within 12 months and solar thermal in 28 months from the date of signing of PPA. During the course of implementation of the scheme, NVVN encashed total BG of ₹ 147.42 crore[27] from March 2011 to March 2014.

MNRE directed (June 2012) that the money so obtained after encashment of BG be kept separately in maximum interest bearing account. It further directed (December 2012) that NVVN may use the funds as working capital for (i) coverage of litigation charges and (ii) releasing payments to SPDs towards settlement of their claims, with the condition that NVVN will recoup the funds by its receipts from Discoms and the total amount will remain the same (i.e. the amount realized from encashment of BGs).

Out of ₹ 147.42 crore, NVVN utilized ₹ 97.79 crore for non-payment of dues by Discoms under JNNSM scheme and ₹ 1.30 crore for legal expenses.

Audit observed that NVVN did not keep the above money in a separate account as directed by MNRE (June 2012) and it cannot be assured in audit that money was not used as working capital.

NVVN (September 2014) stated that there was no direction from MNRE to open the separate account for this money and that it was keeping its accounting separate from NVVNs business money/revenue. Reply of NVVN was not tenable, as the order of MNRE (June 2012), clearly stated that the money should be kept separately in maximum interest bearing account which had not been done by NVVN.

4.4.5. Non-quantification of trading margin

A trading margin is earned by person/ entity who had been granted license by Central Electricity Regulatory Commission (CERC) to undertake inter-State trading in electricity. CERC (Fixation of Trading Margin) Regulations 2010, stated that, "the licensee shall not charge trading margin exceeding seven paise per kWh in case the sale price exceeded rupees three per kWh and four paise per kWh where the sale price was less than or equal to rupees three per kWh."

MNRE fixed (June 2013) the trading margin of seven paise per kWh on the power sold by NVVN to State Utilities/Discoms from JNNSM Phase-I projects.

[27] ₹ 17.50 crore in six projects under Migration Scheme, ₹ 116.18 crore in 19 project of Batch I, ₹ 2.66 crore in one project of Batch II of JNNSM and LD of ₹ 11.08 crore in three projects.

NVVN signed PSA with three[28] Rajasthan Discoms and with Grid Corporation of Odisha Limited (GRIDCO) in January 2011 for the sale of bundled power. Audit observed that though the CERC's regulations for fixation of trading margin were already notified (January 2010), NVVN did not incorporate the rate of trading margin in PSA signed from October 2010 to May 2012. Instead there was only a provision to charge trading margins in the PSAs, but the rate at which NVVN would charge trading margin was not stipulated in the PSA.

Consequently, Discoms disputed the trading margin of seven paise per kWh fixed by MNRE and charged by NVVN, stating that any subsequent memorandum through which rate of trading margin is unilaterally imposed on the procurer after signing of PSA defeats the very sanctity of PSA. This ambiguity in the PSA resulted in a disputed claim of ₹ 25.07[29] crore.

NVVN (22 September 2014) stated that it was envisaged that the Discoms would pay to NVVN trading margin i.e. CERC cap trading margin as mentioned in the expression of interest against which quotes were received from the Discoms and this matter was being pursued with the Discoms. NVVN's reply was not acceptable as the fact remains that although charging of trading margin was mentioned in expression of interest but the PSA, which was a legal binding document between NVVN and Discoms, it was silent on the rate of trading margin.

NVVN further stated (July 2015) that it had recovered outstanding ₹ 19.14 crore on account of trading margin and other dues from the funds provided under the Payment Security Scheme. However, this recovery made by NVVN was not in line with the terms and conditions of the Payment Security Scheme as discussed in para 4.4.3 (iv).

4.4.6. Non synchronization of supply of thermal power with solar power

NVVN and Discoms executed PSA (January 2011) setting out the terms and conditions for the sale of bundled power[30] up to the agreed contracted capacity. Audit observed instances in which the supply of solar power started from the commissioning of SPV project without simultaneous commencement of supply thermal power from NTPC Ltd. (NTPC) as required under the bundling arrangement. Consequently, the power supplied during initial period was billed at average rate of solar power which was higher than the bundled rate. As the PSA was for bundled power, the Discoms did not accept the claims raised by NVVN at average rate of solar power as detailed below:-

i. **Rajasthan**: In 45 projects delay ranging between 11 days to 160 days was noticed in allocation of NTPC-thermal power resulting in non-supply of bundled power to the Rajasthan Discoms. Consequently, these Discoms did not accept claim of ₹ 26 crore which was still outstanding (March 2014).The details of delay in supply of bundled power in JNNSM is given in the **Annexure IX**.

ii. **Odisha**: The supply of NVVN thermal power started after 84 days of commissioning of SPV project. The power supplied during initial period from 7 February 2012 to 30

[28] Ajmer Vidyut Vitaran Nigam Limited, Jaipur Vidyut Vitaran Nigam Limited and Jodhpur Vidyut Vitaran Nigam Limited.
[29] Rajasthan (₹ 24.77 crore) and Odisha (₹ 0.30 crore).
[30] Solar component + equivalent thermal component from unallocated quota of NTPC.

April 2012 from SPV project commissioned in Odisha was admitted by GRIDCO at ₹ 5.154 per kWh at the bundled energy rate though NVVN raised the bill at average solar power rate of ₹ 12.35 per kWh, resulting in outstanding dues of ₹ 1.11 crore.

Thus, inability to synchronize supply of thermal power with solar power resulted in disputed claim of ₹ 27.11 crore as the same was not in accordance with provisions of PSA.

NVVN (September 2014) stated that the implementation of the allocation and scheduling of NTPC thermal power was done by Regional Power committees /Regional Load Dispatch Centres on submission of commissioning certificates issued by SNAs. The scheduling of power inter-state, co-ordination was to be done by NVVN with the distribution companies.

The simultaneous flow of solar power in the grid with the equivalent thermal power does not happen due to the system procedures requirements carried out by State/Central authorities. In view of above, simultaneous supply of solar power and NTPC Power from beginning for bundling was not contemplated which has been claimed by Rajasthan Discoms and GRIDCO.

NVVN's reply is not acceptable because "bundling" mechanism was devised to lower the average cost of power and such delays and billings are not only in contravention of the PSA but skew the costing structure for NVVN and impose a burden on Discoms.

4.4.7. Non availability of Long Term Access (LTA) to inter-State transmission system

NVVN requested (November 2012) the Ministry of Power for allocation of power from the unallocated power of coal based stations of NTPC for bundling the same with Solar Power in anticipation of commissioning of 295 MW Solar power projects (Phase-I, Batch-II) in Rajasthan by February 2013, under JNNSM.

The Ministry of Power allocated (12 February 2013) equivalent (295 MW) thermal power for bundling with the solar power. Out of 295 MW bundled power, 85 MW was to be supplied within Rajasthan and remaining 210 MW bundled power was to be supplied to other States.

However, since PGCIL did not permit LTA to inter-State transmission system of 210 MW solar power which was allocated to other States. This 210 MW power was reallocated (1 April 2013) to Rajasthan till the receipt of LTA with the prior approval of Rajasthan Discoms Power Procurement Centre (RDPPC) (19 March 2013).

Audit observed that RDPPC withdrew its consent (30 May 2013) for temporary allocation of additional 210 MW power from 1 July 2013, citing the reason that there was reduction in requirement of power in the State. Despite this NVVN continued power supply to Rajasthan till the granting of LTA on 12 August 2013.

However, in view of prior intimation of withdrawal of consent, RDPPC decided to make only partial payments for the above energy supplied for the said period (1 July 2013 to 15 August 2013).

Thus, non-availability of LTA for evacuating solar power outside Rajasthan resulted in disputed claim of ₹ 66 crore. More importantly, this also indicated that there was no proper

coordination between NVVN, Discoms and PGCIL, due to which NVVN could not obtain LTA for evacuation of solar power outside Rajasthan as planned.

NVVN stated (19 September 2014) that the procedure to obtain LTA of 210 MW started on 14 February 2013 and LTA was signed on 8 July 2013. While the inter–state scheduling of solar power was commenced by Regional Load Dispatch Centre (RLDC) from 16 Aug 2013 after persuasion by NVVN, bundled power remained within Rajasthan from 1 July 2013 to 15 Aug 2013.

5. Other Audit findings

Gujarat

5.1. Incorrect tariff fixation – Central Excise and Custom exemptions not considered

The Gujarat Government Solar policy 2009 proposed that the energy generated from a solar power project would be sold to the distribution licensees in the State at a levelised per unit tariff for the period of 25 years. Gujarat Electricity Regulatory Commission (GERC) in exercise of power conferred under Electricity Act 2003 issued tariff order (29 January 2010) for procurement of power by the distribution licensees and others from Solar Power Generators (SPG) for 25 years which determined the levelised tariff[31] of ₹ 12 per kWh and ₹ nine per kWh for SPV and Solar Thermal project, respectively.

MNRE vide office memorandum dated 3 June 2010 issued procedure for issue of the certificate for exemption of Excise Duty, on items manufactured for Solar Thermal and SPV power generation projects. The SERCs were required to factor in these exemptions while determining the tariffs.

Audit observed that 47 developers sought excise duty exemption for an amount of ₹ 83.77 crore and customs duty exemption amounting to ₹ 104.53 crore. Gujarat Energy Development Agency (GEDA) forwarded the information to MNRE but no data regarding exact amount of exemption actually availed by respective developers was maintained and forwarded to Energy and Petrochemicals Department of the Government of Gujarat and/or GERC for working out its impact on the levelised per unit tariff. In absence of receipt of any data on exemption of duties GERC did not factor in the exemptions and fixed the capital cost as ₹ 16.50 crore per MW for SPV and ₹ 13 crore per MW for Solar Thermal which were on the higher side as compared to the levelised tariffs of ₹ 12 per kWh and ₹ nine per kWh for SPV and Solar Thermal project, respectively. Thus Gujarat Urja Vikas Nigam Ltd. (GUVNL) a State Government company engaged in the business of bulk purchase and sale of electricity continued to pay the higher tariff.

The State Government stated (November 2013) that the GERC had set aside (8 August 2013) a petition (1320 of 2013) for revision in solar tariff filed by GUVNL considering determination of appropriate capital cost, actual equity-capital deployed for servicing at 14 *per cent,* but did not mention the duty exemption parameter. The reply was not

[31] The tariff was worked out taking into account the benefit of Accelerated Depreciation under the Income Tax Act, Rules and the then prevailing applicable duties and taxes including Excise and Customs Duty.

acceptable as the non-consideration of exemptions in the capital cost of the project led to passing of undue benefit on to developers and burdens the consumers of the State.

Rajasthan

5.2. Delays in installation of projects

The State Government sanctioned 177 grid connected solar projects for a capacity of 1,379.67 MW of which 140 power plants with capacity of 725.50 MW (52.59 *per cent*) could be installed by March 2014. Audit analysis of the projects under execution disclosed that the projects were held up due to the following reasons:

Type of hindrance	Details of projects
Non-allotment of land	In a case of 150 MW project under Policy 2011 (open access), land could not be allotted to the power producer and consequently the power producer expressed inability to execute the project. Six projects totalling 55 MW approved through Competitive bidding under Policy 2011 could not be commissioned by the stipulated period of March 2014 due to land not being made available or delay in making available the land for the projects (one project of five MW out of the six was commissioned in August 2014).
Financial difficulties	In respect of another 50 MW project, the lead banker for the project requested MNRE to substitute the existing promoter with the new promoters owing to serious liquidity crunch.
Abandoned projects	In respect of two solar thermal projects of 100 MW each, under JNNSM Batch-I (Letter of Intent issued in December 2010), only part of the foundation work had been carried out and no progress was reported (till March 2014).

5.3. Incorrect tariff fixation under GBI scheme by MNRE

In Rajasthan two projects were sanctioned by MNRE under Demonstration programme, details of which are given in Table 13.

Table 13: Details of two projects under Demonstration programme

Particulars	Name of developer	
	M/s Reliance Ind. Ltd.(RIL)	M/s Par Solar
Date of application to RRECL	4-1-2008	27-11-2007
Capacity approved by RRECL	5 MW	5 MW
Schedule completion date	30-11-2008	30-6-2009
Date of approval by MNRE	30-10-2009	9-12-2009
Capacity approved by MNRE	5 MW	3 MW
Date of actual commissioning	31-3-2011	28-3-2012
GBI approved by MNRE	₹ 11.33 per kWh vide letter dated 31-3-2011	₹ 10.76 per kWh vide letter dated 14-8-2012

The MNRE took a period of 13 to 15 months in sanctioning the projects after recommendations by Rajasthan Renewable Energy Corporation Ltd. (RRECL) which ultimately delayed the establishment of projects. This showed that MNRE itself did not adhere to the guidelines of the programme.

As per MNRE guidelines, the amount of GBI was to be determined after deducting the power purchase rate of PPA from the maximum permissible tariff of ₹ 15 per kWh. Maximum permissible GBI was ₹ 12 per kWh for the projects commissioned up to 31 December 2009 and ₹ 11.40 per kWh for projects commissioned after 31 December 2009. Also, the GBI was to be reduced by 5 *per cent* i.e. (₹ 10.76 per kWh), in case the project was commissioned after 31 December 2009.

MNRE granted extension to both the developers (RIL up to 31 March 2011 and M/s Par Solar up to March 2012) but it did not follow identical policy for both the developers as it allowed reduced GBI of ₹ 10.76 per kWh to M/s Par Solar but in case of RIL, the MNRE allowed GBI of ₹ 11.33 per kWh despite the fact that plant was commissioned on 31 March 2011. This resulted in an additional payment of tariff by ₹ 0.57 per kWh to RIL and creating an additional burden of ₹ 4.55[32] crore during the period of 10 years on the Discoms at the net expected power generation of 79.89 lakh units per annum for a five MW plant.

5.4. Non recovery of development charges

Para 13 of the Rajasthan Solar Energy Policy 2011 provided that for Solar power projects established for sale of solar power to parties other than Discoms of Rajasthan, the power producer shall deposit non-refundable development charges of ₹ 10 lakh per MW to RRECL within one month from the date of issue of 'in-principle clearance'. In case of failure, 'in-principle clearance' shall be cancelled without any notice. During the period of finalisation of new Policy-2011, RRECL registered 25 projects of 500 MW capacities under JNNSM guidelines which were approved by NVVN in November 2010 and PPAs were signed on 15 January 2011. NVVN had also confirmed allocation of 225 MW power to Rajasthan and the remaining 275 MW power was to be sold to States other than Rajasthan.

Audit observed that development charges recoverable under the Policy from 25 projects were not recovered. RRECL submitted (October 2011) a proposal for waiver of development charges to the Energy Department, of the State Government stating that these projects were registered under Policy 2004 which did not have any provision for recovery of development charges. The Energy Department agreed with the proposal. The Finance Department, however, stated (June 2012) that it was a case of amendment/relaxation in the Policy and would require approval of the Cabinet which was not obtained. Hence, issue of recovery of the development charges of ₹ 27.50 crore from the power producers remained unresolved.

5.5. Non recovery of processing fee

As per Rajasthan Solar Energy Policy, 2011, with effect from 19 April 2011, the solar power producer was to deposit a non-refundable processing fee of ₹ 50,000 per at the time of application for the project. Amendments (September 2012) to the policy also stipulated that

[32] ₹ 0.57 x 79.89 lakh kWh per annum x 10 years.

any 'Parent', 'Subsidiary' or 'Ultimate Parent Company' may distribute/transfer the project capacity between them for setting up maximum four projects at any time against one application. Thus, the project capacity and processing fee was non-transferable to another project prior to the amendment (September 2012) in the Policy.

Audit observed that in ten[33] cases RRECL transferred the registration of the projects from one company to another without recovery of the processing fees of ₹ 2.98 crore.

5.6. Non forfeiture of security deposit

Clause 12.2 of Rajasthan Solar Energy Policy 2011 required the power producer to deposit security amount of ₹ five lakh per MW by cash and ₹ 20 lakh per MW in the form of bank guarantee within one month from the date of issue of `in-principle' clearance of the project and in case the power producer failed to commission the power plant in scheduled time, including extension granted, the security deposit and bank guarantee were to be forfeited.

Audit observed that in case of M/s VS Lignite the project was not commissioned by scheduled date (8 February 2014) but the bank guarantee and security deposit of ₹ 2.50 crore was not forfeited.

Tamil Nadu

5.7. TANGEDCO denied permission to sign Power Purchase Agreements

As per Section 63 of the Electricity Act 2003, an Appropriate Commission shall adopt the tariff if such tariff has been determined through transparent process of bidding in accordance with the guidelines issued by the Central Government[34].

Government of Tamil Nadu in its Solar Policy 2012 committed to generate 3,000 MW solar power by the year 2015.

TANGEDCO invited (December 2012) bids from developers for establishing solar power plants of one MW or above capacity totalling 1,000 MW in the State through long term PPAs. Based on the offers received, Letters of Intent (LoI) were issued (April-June 2013) to 52 developers for procurement of a combined capacity of 708 MW of solar power at rates upto ₹ 6.48 per unit for 2013-14, subject to escalation as per terms and conditions of the tender.

When TANGEDCO sought Tamil Nadu Electricity Regulatory Commission's (TNERC) permission for signing PPA with the solar developers who were issued LoI, TNERC declined (September 2014) TANGEDCO's request on the ground that in the absence of guidelines issued by the Central Government, the bidding process adopted by TANGEDCO for

[33] M/s Dhanu Solar Power Pvt Limited (₹ 25 lakh), M/s Reliance Green Power Pvt. Ltd (₹ 150 lakh), M/s Kiran Energy Solar Power Ltd (₹ 12.50 lakh), M/s Field Energy Pvt Ltd (₹ 10 lakh), M/s Global Power Infra Ltd (₹ 25 lakh), five cases (M/s North Delhi Power Ltd, M/s Bhanu Solar Projects Pvt. Ltd, M/s KVK Energy Ventures, M/s Chenab Securities and M/s GMR Rajmundry)(₹ 75 lakh).

[34] Ministry of Power within the GoI was to notify/ approve the guidelines for the bidding process.

procurement of solar power had no legal sanctity for consideration under Section 63 of the Electricity Act 2003.

The solar projects which were expected to be commissioned before April 2014 were thus delayed without any reasonable chance of commissioning in the near future.

5.8. Stalling of tender process

In line with the State Solar Policy, the Government also planned (November 2012) for setting up of Solar Power Parks in different locations of the State for generating 1,000 MW of solar power in five years. The first such park (for 100 MW) was being developed in the Ramnad district, with an investment of around ₹ 920 crore through the Tamil Nadu Industrial Development Corporation in association with a private promoter. Expressions of Interest were also received (February 2013) from various developers for a total of 55 MW. Consequent to the stalling of TANGEDCO's tender process, the development of this project became uncertain as of September 2014.

5.9. Deficient scheme for domestic consumers

The Government of Tamil Nadu announced (April 2013) capital incentive of ₹ 20,000 per kW for 10,000 domestic consumers who installed one kWp[35] solar roof tops and generated power. TEDA proposed (May 2013) installation of a battery less Grid Tie Solar Rooftop Photovoltaic (PV) system of one kW capacity and accordingly, the Government issued (October 2013) orders for implementation of the scheme.

Under the scheme, the beneficiaries were entitled to CFA at 30 *per cent* on the cost of the solar plant limited to the bench mark cost of ₹ one lakh fixed by MNRE and in addition, the State Government would also provide a subsidy of ₹ 20,000 per system. The anticipated generation from each plant was 1,600 units per year and the scheme envisaged coverage of 5,000 beneficiaries in the first year. As of June 2014, TEDA received applications from 1,864 beneficiaries but the system had been installed in only 51 houses (including three houses with net metering).

Audit observed that:

i. The scheme was intended only for the domestic Low Tension (LT) consumers and did not cover other LT consumers like Educational Institutions, Hostels and Commercial establishments.

ii. The scheme provided for a battery less grid - tie system, which would generate power only when there was supply of power from the grid and in the absence of such supply from the grid, the solar PV system would not work.

TEDA stated (June 2014) that a system with battery involved additional cost of procurement and maintenance. The reply was not acceptable as the minimum expectation of a common man going in for a supplementary power generation unit in his premises was to mitigate the

[35] Wp - means Watt peak. It is the maximum amount of power a *solar panel* could produce in perfect conditions.

effect of power cuts. This was evident from the fact that against the anticipated target of 5,000 systems, only 51 had been installed till June 2014.

Uttarakhand

5.10. Solar power plants not connected to grid since May 2011

Uttarakhand Renewable Energy Development Agency (UREDA) installed (March 2004) two Rooftop Solar Power plants of capacity of 25 kW each at Secretariat premises, at a cost of ₹1.29 crore with a production capacity up to 150 units per day. The plants were shifted (May 2011) to Energy Park, Dehradun, and were non-functional because of delay in installation of 100 kVA transformer.

6. Conclusion

The installed capacity of grid interactive solar power in the country at the beginning of the 11th Plan period was `Nil'. During the 11th Five Year Plan period and 12th Five Year Plan (upto 2013-14), 2,656 MW of solar power capacity was added in the country, which was 0.35 *per cent* of the country's solar energy potential. In the 24 States test checked in audit, it was observed that 17 of the 24 States did not set any targets for grid connected solar power generation. There was no installed capacity in 10 of these States. The remaining 14 States had a total installed capacity of 2,413 MW which was only 0.36 *per cent* of the total estimated potential of these States. In the ten States endowed with 78 *per cent* of the national solar potential, the exploited potential varied from zero to 2.56 *per cent*. Gujarat and Rajasthan alone created more than 50 *per cent* of the capacity installed in the country but had exploited only 2.56 *per cent* and 0.51 *per cent* of their respective potential.

MNRE introduced three schemes between 2008 and 2010 for promoting the use of solar energy. There was a shortfall in achieving targets under all the schemes except in Demonstration programme. The major shortfall was in achieving targets in setting up Solar Thermal power plants. Against the target of creating 500 MW of Solar Thermal power capacity, plants of 447.50 MW (approximately 90 *per cent*) had not been commissioned (February 2015).

Government land of 3,404 acres leased at preferential rates to the developers for six Solar Thermal projects in Rajasthan had not been put to intended use so far. In Demonstration Programme, in one case, 345 acres of land had been leased in excess of requirement for a Solar Photovoltaic power plant.

The three schemes launched between 2008 and 2010 for promoting grid linked solar power projects came in quick succession and the GBI assured increased from ₹ 12 to ₹ 12.41 per unit, the tariff assured increased from ₹ 15 to ₹ 17.91 per unit and the period of commitment from 10 years to 25 years, under these schemes.

While the MNRE schemes pegged the GBI at ₹ 12 per unit and tariff at ₹ 17.91 per unit, during the period 2011-12, the Central Electricity Regulatory Commission tariffs fell from ₹ 17.91 to ₹ 10.39 per unit and the rates obtained in the reverse bidding under Jawaharlal

Nehru National Solar Mission were ₹ 10.85 and ₹ 7.49 per unit. The programmes also did not have any scope for revision of GBI periodically to reflect changing costs. This also created an opportunity for the Developers to shift from programmes to seek better benefits.

While Regulatory framework for electricity generation was a State subject, MNRE could have issued guidelines for reference by the States, as an enabling environment for solar technology penetration in the country at a decentralized level. In the absence of such guidelines the States adopted different models for net metering.

There were deficiencies in the implementation of MNRE programmes by IREDA such as irregular payment of GBI to developer, delays in passing GBI claims and also delays by MNRE in releasing funds to IREDA resulting in pendency and settlement of GBI claims.

The Solar Payment Security Account introduced to safeguard solar power developers/ NTPC Vidyut Vyapar Nigam Limited from default in payment by distribution companies was not operated as envisaged. Distribution companies did not provide required Letter of Credits, open escrow accounts and opportunity to sell power on spot were not explored prior to accessing the funds.

Under the `bundling' of power arrangements for lowering the average cost of power, supply of thermal power could not be ensured in time, resulting in NTPC Vidyut Vyapar Nigam Limited billing distribution companies at higher rates and leading to disputed claims. Delays in providing Long Term Access to inter-State transmission system also created disputes between distribution company and NTPC Vidyut Vyapar Nigam Limited.

7. Recommendations

- *MNRE should focus on development of solar energy in the States endowed with high solar energy potential.*
- *MNRE, while formulating schemes that commit the Government to long term liability for incentives like Generation Based Incentives, must ensure that these are kept flexible to match changes in tariffs and costing structure to avoid unwarranted burden on public exchequer or developers.*
- *MNRE must formulate guidelines for net metering so as to provide an enabling environment for solar technology penetration in the country at a decentralized level.*
- *MNRE must ensure that the solar projects are completed as per schedule. In case of delays, the Central/ State Governments must review the status of the public resources like land allotted to the solar power developers and take necessary corrective measures.*
- *MNRE, in coordination with other Central Government agencies, should ensure timely arrangement for making available conventional power for bundling and Long Term Access to inter-State transmission system, for smooth operation of the schemes.*

Chapter - IV

Wind Power

1. Introduction

India is a wind-rich country with quality, harvestable wind potential. Monsoon patterns and geography of India play a major role in the Indian wind climatology structure. Indian geography - a mixture of elevated plateau, hill blocks, passes and coastal plains, aid the monsoons, especially the Southwest monsoon to earn harvestable wind potential. Due to this, States like Andhra Pradesh, Gujarat, Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Tamil Nadu are endowed with rich wind energy potential. Wind power is the fastest growing Renewable Energy (RE) source in India. With an installed capacity of about 21,137 MW as of March 2014, it constitutes 67 *per cent* of the total RE capacity in India.

2. Assessment of Wind Potential

National Institute for Wind Energy[1] (NIWE) in association with Riso DTU, Denmark has developed Numerical Wind Atlas[2] of India at 50 metre (m) and 80 m mast[3] height which was published in April 2010. The Wind Resource Assessment (WRA) programme was an ongoing activity being co-ordinated by the NIWE in association with State Nodal Agencies (SNAs).

2.1. At 50 meters mast height

For estimating potential at 50 m height, the WRA covered 28 States and three Union Territories (UTs) and involved establishment of about 789 Wind Monitoring Stations (WMS). The total wind energy potential at 50 m mast height was estimated at 49,130 MW.

2.2. At 80 meters and 100 meters mast height

NIWE had commissioned 73 numbers of 100 m high meteorological masts with multilevel measurements in seven windy States to validate and fine-tune the 80 m wind Atlas and estimate and validate potential at 100 m height.

MNRE had also formulated (July 2014) a new scheme for implementation of WRA in uncovered/new areas to assess the realistic potential at 100 m level in 500 new stations across the country. It was to be implemented through NIWE in Public-Private Partnership mode, in association with SNAs and private developers, which was yet to start.

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1 Formerly Centre for Wind Energy Technology, Chennai.

2 Numerical wind atlas methodologies have been devised to solve the issue of insufficient wind measurements. One such methodology is the KAMM/WAsP method developed at Riso National Laboratory, Denmark. Karlsruhe Atmospheric Mesoscale Model (KAMM) and Wind Atlas Analysis and Application Program (WAsP) are used to model the effects on the wind flow over India using modeling domains.

3 Height of pole used for wind studies before a wind turbine generator is erected in its place.

2.3. State Nodal Agency initiatives

During the test check of the records of 24 SNAs, Audit observed that some SNAs in collaboration with NIWE attempted to undertake wind resource assessment with varying degree of success. Audit findings in this regard are reported below.

2.3.1. Jharkhand

Jharkhand Renewable Energy Development Agency (JREDA) in consultation with NIWE had identified eight[4] locations for setting up Wind Monitoring Stations (WMS) which were approved by MNRE. Audit observed that NIWE could not assess the wind potential due to: (i) non furnishing of Wind monitoring data continuously by JREDA for one year as required from WMS at three locations[5]; (ii) At Sakhuapani the WMS could not be operated as the mast was placed at a higher level than required height of 50 m; (iii) WMS at Parasnath and Jhumra hills could not be established for want of forest clearances; and (iv) WMS at Kurta and Hadari in Hazaribagh district could not be established as JREDA did not initiate action for setting up of WMS within three months of issue of instruction (June 2014) by NIWE. In this regard JREDA also furnished bank details to NIWE in January 2015, after a delay of four months, for receipt of first installment of funds.

2.3.2. Bihar

Bihar Renewable Energy Development Agency (BREDA) commissioned (February 2009) three[6] WMS for ₹ 4.50 lakh in consultation with NIWE but these were closed in 2010-11 without submission of any report by NIWE. Three[7] other sites were commissioned but no feasibility or data analysis report was given by NIWE. The SNA stated that there was nothing mentioned in the scheme about giving or buying the report.

3. Potential, target and achievements

3.1. Targets and achievements of MNRE

The targets and achievements of MNRE under the 11th Five Year Plan (FYP) and 12th FYP upto 2014 are given in Table 14 below:

[4] Netarhat (Lohardaga) and Pithoria (Simdega) in 2003-04, Sakhuapani (Gumla) and Metramata (Simdega) in 2005-06, Parasnath and Jhumra hills (Giridih) in 2008-09 and Kurta and Hadri in Ichack (Hazaribag) in 2013-14.

[5] Metramata, Netarhat and Pithoria.

[6] Kaimur, Lalganj and Simultala.

[7] Bodh Gaya (K P Nagar), Motihari (Chikni) and Munger (Shankarpur).

Table 14: Targets and achievement under 11th and 12th FYP

S.No.	Year	Target (in MW)	Achievement (in MW)	Excess(+)/ Shortfall(-) (in *per cent*)
11th Five Year Plan Period (2007-12)				
1	2007-08	1,500	1,663	+11
2	2008-09	2,000	1,485	-26
3	2009-10	2,500	1,565	-37
4	2010-11	2,000	2,349	+17
5	2011-12	2,400	3,197	+33
	Total	10,400	10,259	
12th Five Year Plan Period (upto 2014)				
6	2012-13	2,500	1,700	-32
7	2013-14	2,500	2,079	-17
	Total	5,000	3,779	
	Grand Total	**15,400**	**14,038**	

Source: MNRE. However, data on State wise capacity installed between 2007 and 2014 given by MNRE in Table 15 under para 3 is 14,046 MW as compared with 14,038 MW reported as achievement under 11th and 12th FYPs.

3.1.1. Target setting and achievement under 11th FYP

At the commencement of the 11th FYP period, the wind power capacity installed in the county was 7,091 MW. During the 11th FYP period (2007-12) the target of wind power capacity addition was set at 10,400 MW which was 21 *per cent* of the potential at 50 m mast height. Against a target of 10,400 MW, the achievement in wind power capacity addition was 10,259 MW. As a result of the 11th FYP achievement, and to ensure effective exploitation of wind energy resource, the 12th FYP target has been kept at 15,000 MW which was roughly 1.5 times the 11th FYP target.

As can be seen from Table 14, from 2007 to 2014, in four years there was a shortfall in achievement of the target and in three years there was an excess, and overall there was a shortfall of nine *per cent*. The shortfall in achievement of targets set for the first two years of 12th FYP (2012 to 2014) was 24 *per cent*.

MNRE stated (October 2014) that after the withdrawal of Accelerated Depreciation (AD) scheme by the Ministry of Finance w.e.f. April 2012 the capacity addition gradually decreased in this sector. MNRE further stated (July 2015) that the target for 11th FYP period was originally 10,400 MW which was reduced to 9,000 MW at mid-term appraisal stage.

3.1.2. State wise target and achievement

State wise wind potential of India at 80 m and 50 m mast height as assessed by NIWE, and targets fixed for creation of installed capacity between 2007 and 2014 and the installed capacity as on 31 March 2014 is given in Table 15 below:

Table 15: Wind potential, target and installed capacity

(in MW)

S. No.	State/ Union Territory	Estimated potential		Targets fixed (2007-14)	Installed capacity			Installed capacity as a percentage of potential	
		at 50 m[8]	at 80 m[9] (2010)		Prior to 2007	Between 2007-14	As on 31.3.14	50 m	80 m
1	Andaman & Nicobar Islands	2	365	NA	Nil	Nil	Nil	Nil	Nil
2	Andhra Pradesh	5,394	14,497	NF	123	624	747	14	5
3	Arunachal Pradesh	201	236	NF	Nil	Nil	Nil	Nil	Nil
4	Assam	53	112	NF	Nil	Nil	Nil	Nil	Nil
5	Bihar	NE	144	NF	Nil	Nil	Nil	Nil	Nil
6	Chhattisgarh	23	314	NF	Nil	Nil	Nil	Nil	Nil
7	Diu & Daman	NA	4	NA	Nil	Nil	Nil	Nil	Nil
8	Gujarat	10,609	35,071	NF	637	2,818	3,455	33	10
9	Haryana	NA	93	NF	Nil	Nil	Nil	Nil	Nil
10	Himachal Pradesh	20	64	NF	Nil	Nil	Nil	Nil	Nil
11	Jammu & Kashmir	5,311	5,685	NF	Nil	Nil	Nil	Nil	Nil
12	Jharkhand	NE	91	NF	Nil	Nil	Nil	Nil	Nil
13	Karnataka	8,591	13,593	2,969	822	1,497	2,319	27	17
14	Kerala	790	837	NF	2	33	35	4	4
15	Lakshadweep	16	16	NA	Nil	Nil	Nil	Nil	Nil
16	Madhya Pradesh	920	2,931	3,259	56	367	423	46	14
17	Maharashtra	5,439	5,961	2,100	1,487	2,610	4,097	75	68
18	Manipur	7	56	NA	Nil	Nil	Nil	Nil	Nil
19	Meghalaya	44	82	NF	Nil	Nil	Nil	Nil	Nil
20	Mizoram	NA	NA	NA	NA	NA	NA	NA	NA
21	Nagaland	3	16	NF	Nil	Nil	Nil	Nil	Nil
22	Odisha	910	1,384	NF	Nil	Nil	Nil	Nil	Nil
23	Puducherry	NA	120	NA	Nil	Nil	Nil	Nil	Nil
24	Punjab	NA	NA	NF	Nil	Nil	Nil	Nil	Nil
25	Rajasthan	5,005	5,050	1,400	470	2,316	2,786	56	46
26	Sikkim	98	98	NF	Nil	Nil	Nil	Nil	Nil
27	Tamil Nadu	5,374	14,152	2,400	3,494	3,777	7,271	135	51
28	Uttar Pradesh	137	1,260	NF	Nil	Nil	Nil	Nil	Nil
29	Uttarakhand	161	534	2	Nil	Nil	Nil	Nil	Nil
30	West Bengal	22	22	75	Nil	Nil	Nil	Nil	Nil
31	Others	NA	NA	NA	NA	4	4	NA	NA
	Total	**49,130**	**1,02,788**	**12,205**	**7,091**	**14,046**	**21,137**	**43**	**20**

NA – Not Available; NE- Not Estimated, NF- Not Fixed
Source: MNRE.

[8] The 50 m map was prepared and published in April 2010 after validation.
[9] At 80 m, the estimated potential is to be validated through field measurements.

It is evident from Table 15 above that against an estimated potential of 49,130 MW at 50 m mast height and 1,02,788 MW at 80 m mast height, the installed capacity was 21,137 MW[10] which was 43 *per cent* of the potential at 50 m height and 21 *per cent* of potential at 80 m height. MNRE did not have details of the mast heights at which the capacities had been installed, for better analysis of the extent to which potential had been exploited.

Based on analysis of the data at Table 14 and 15, the following observations are made:

i. Data of targets and achievement, both State-wise and under 11th and 12th FYP, was collected from MNRE. However, discrepancies in the two sets of data were noted. As per State-wise breakup (Table 15), the target for the period 2007-14 for each States aggregated to 12,205 MW whereas for the 11th FYP period and from 2012 to 2014 under the 12th FYP (Table 14) the target was 15,400 MW. Similarly, achievement as per Table 15 for the period 2007-14 was 14,046 MW whereas as per Table 14 it was 14,038 MW, a nominal difference of eight MW.

ii. MNRE did not provide any record based on which FYP targets were set and State wise breakups of the targets. No records were shown to Audit that inputs have been taken from the States in setting these targets. As can be seen from Table 15 above, 17 States (of which three States[11] alone had over 50 *per cent* of the wind energy potential[12], had not fixed any targets during the period 2007-14. Moreover, there was a discrepancy of 3,195 MW in the State-wise targets and FYP targets for the same period (refer point i above). From these observations it appeared that the targets had been routinely set by MNRE without proper planning, analysis, involvement of and communication with the States.

    MNRE stated (May 2015) that it does not fix State wise targets, rather it had a single national target. It further stated that few States based on their own performance, kept annual targets which were same or different from the national targets and this happened because of the fact that Wind Power Projects (WPP) were taken up with private sector investment. Ministry's reply needs to be viewed in the context that MNRE and the States with rich potential of wind energy should work in tandem to ensure significant exploitation of potential for meeting national goals.

iii. At the stage of framing targets for 11th FYP, the wind resource assessment was available at only 50 m mast height and the target set was 21 *per cent* of capacity. By 2010, the India wind Atlas estimated the potential at 80 m mast height at 1,02,788 MW and also the technology to exploit the wind energy at this height was available in the country. It was observed in audit, that the targets set for capacity addition in 12th FYP were a modest 15 *per cent* of potential, which was not adequate to translate Government intent and priority in promoting renewable energy sources as a significant component of the energy mix of the country and a necessity for ensuring its energy security and adhering to

[10] However, as per the records furnished by individual SNAs, the installed capacity totaled to 20,564 MW. The difference was largely in the installed capacity in Madhya Pradesh as recorded in MNRE i.e. 424 MW whereas as per the SNA records, it was only 52 MW.

[11] Andhra Pradesh, Gujarat and Jammu & Kashmir.

[12] At 80 m mast height.

the targets set for 2020 in the NAPCC regarding proportion of RE sources in the electricity consumed in the country.

MNRE stated (May 2015) that the targets were not kept only in view of potential availability. Annual targets were set depending upon feasibility of exploitation of the available potential in a particular year depending upon policy environment and market conditions for bringing private sector investments.

MNRE's reply highlights the need for strategic planning if significant progress had to be made in the Renewable Energy sector since there will always be competing needs and the Government must prioritise this sector both in policy formulation and development strategy.

3.2. MNRE programmes for promotion of wind energy

MNRE from time to time brought out different programmes to promote development of wind energy in the country. The incentives were in form of Generation Based Incentive (GBI) or Accelerated Depreciation (AD) under the Income Tax Act 1961. The programmes and the audit finding on the implementation of each are given below:

3.2.1. Demonstration project

i. MNRE (December 2006) launched Demonstration project for State Governments, for promotion of grid interactive power projects. Capacity of each eligible project was to be greater than 500 kW; not more than one *per cent* of technical potential of State or six MW whichever was less; and in the States where commercial activity had not taken off.

   Under this scheme an aggregate capacity of 71 MW was installed at 33 locations in nine States through State Governments/ SNAs or State Electricity Boards. After December 2006 no new project had been established. However, it was observed that in four[13] States more than six MW was commissioned contrary to eligibility criteria.

ii. MNRE (July 2008) launched the Demonstration programme for the independent power producers with minimum installed capacity of five MW. The scheme was not applicable for captive consumption, third party sale, merchant[14] plants etc.

   Under this scheme, four[15] companies installed 48.9 MW capacity in three States[16]. The GBI of ₹ 27.52 crore had been released by MNRE to IREDA till March 2014 under this scheme and all the UCs had been received.

[13] Gujarat (17.30 MW), Karnataka (7.10 MW), Maharashtra (8.40 MW) and Tamil Nadu (19.40 MW).
[14] A merchant power plant is funded by investors and sells electricity in the competitive wholesale power market.
[15] M/s Generacion Eolica India Ltd, M/s Green Infra Wind Energy Ltd, M/s CLP India Pvt Ltd and M/s Simran Wind Power Pvt Ltd.
[16] Gujarat, Karnataka and Tamil Nadu.

3.2.2. Generation Based Incentive (GBI)

i. MNRE launched GBI scheme (GBI-I) (December 2009) for the 11th FYP with the objective of enhancing generation of electricity from grid connected wind power projects and to encourage investment by project proponents who would not avail of Accelerated Depreciation under the IT Act for making investments in wind power projects.

ii. MNRE further extended (September 2013) retrospectively from April 2012 the scheme (GBI-II) for continuation of GBI during for the 12th FYP period with the same objectives.

Audit observed that under the GBI-I scheme, 167 projects of 2,230 MW capacity were registered. Under GBI-II scheme, 176 projects of 2,749.40 MW had been registered till September 2014.

3.2.3. Accelerated Depreciation (AD)

The installation of commercial wind power projects along with energy from other RE resources had been promoted by MNRE since the early 1990s through fiscal incentives also which included Accelerated Depreciation (AD) under the Income Tax Act 1961. Under the AD provision investors were allowed to claim 80 *per cent* of the gross block as depreciation in the first year of installation of a project. This substantially reduced their stated income for income tax purposes during the year, thereby deferring income tax payout. This provision was attractive to companies, investors and captive users because of the tax planning opportunity it provided and simultaneously encouraged the development of the wind power projects. The scheme was discontinued from April 2012 and re-introduced in April 2014. As per data provided by IREDA the total capacity addition made under AD scheme till March 2014 was 15,818[17] MW.

3.2.3.1. Affect of discontinuation of AD and GBI

Both the schemes i.e. GBI and AD, were discontinued from April 2012. GBI was discontinued because it was only for the 11th FYP period and MNRE could not ensure that it seamlessly continued in the 12th FYP. It was re-introduced (September 2013) retrospectively from April 2012. AD provision was also not continued in 2012-13 and 2013-14 due to reservations expressed by Central Board of Direct Taxes, Ministry of Finance (MoF).

In order to analyse the impact of discontinuation of the incentives for one and half years (GBI) and two years (AD), Audit attempted to collect data of projects installed under each category from MNRE. MNRE could not provide list of projects commissioned under AD and GBI mode to Audit. It stated that the benefit of AD was given to the developers under the provisions of the Income Tax Act, 1961 and MNRE had no details of the projects installed under AD scheme. Consequently, Audit obtained list of projects installed under GBI scheme from IREDA and the capacity installed through AD was calculated by deducting the capacity installed under GBI from the total installed capacity data provided by MNRE. The data is given in Table 16 below:

[17] Based on calculation discussed in para 3.2.3.1.

Table 16: Year wise capacity addition under the AD Scheme

(in MW)

Year	Total Capacity	Through GBI	Through AD[18]
Pre 2009	10,239	120	10,119
2009-10	1,565	138	1,427
2010-11	2,349	603	1,746
2011-12	3,197	1,490	1,707
2012-13	1,700	1,398	302
2013-14	2,079	1,562	517
Total	**21,129**	**5,311**	**15,818**

Source: MNRE and IREDA. However, data on capacity installed given by MNRE in Table 15 under para 3 is 21,137 MW as compared with 21,129 MW reported as achievement under 11th and 12th FYPs.

As can be seen from Table 16, between 2009-10 and 2011-12, the capacity addition increased considerably both under GBI and AD category. AD was the preferred category, whereas GBI was also catching up. In the year 2011-12, the capacity addition crossed 3,000 MW.

Post withdrawal of GBI and AD, the capacity addition in this sector was only 3,779 MW (2,960 MW through GBI and 819 MW through AD) during 2012-14, against a target of 5,000 MW. Hence, there is a strong indication that the break in incentive due to policy reversal in 2012-14 did adversely affect capacity addition.

MNRE (July 2013) moved a Cabinet note seeking reintroduction of both GBI as well AD incentives for the wind energy sector. Central Board of Direct Taxes (CBDT) under Ministry of Finance (MoF) objected to AD scheme. The Department of Revenue, MoF, expressed reservations on the proposal to re-introduce AD on the ground of revenue foregone and also the AD benefit being front loaded in the first year. They also expressed apprehension regarding double benefit, both under AD and GBI, being availed by some developers even though they were mutually exclusive schemes. MNRE had pointed out that benefit of AD was being provided to all other RE sources and in many other sectors also, and therefore it would be unfair to discriminate against wind energy sector. MNRE also pointed out that there was a provision in the GBI scheme that the wind power developers should be registered with IREDA, they would have to prove that they are not taking benefits of AD and IREDA would build safeguards in the implementation process to avoid misuse of incentives. But these were not implemented for want of notification from the Department of Revenue.

Audit found that:

i. As per study[19] conducted (February 2012) by MNRE, out of the target of 15,000 MW for the 12th FYP, 6,000 MW would have come from AD route. The taxes[20] foregone by the Government, on NPV[21] basis, due to no investment because of absence of AD was

[18] In the years 2012-14, there was no capacity addition under AD. The capacity shown may pertain to captive users, third party sale, GBI etc. GBI was restored in September 2013 with retrospective effect from April 2012 and the developers who installed wind power plants during this period are opting for GBI.

[19] CRISIL Risk and Infrastructure Solutions Ltd.

[20] Minimum Alternate Tax, Central Sales Tax and Service Tax.

[21] Net Present Value.

₹ 6,741 crore and the income tax deferment, on NPV basis would have been ₹ 5,606 crore. Hence, there would have been benefit of revenue to the Government to the tune of ₹ 1,135 crore. Also, the financial liability of GBI would decrease from ₹ 16,354 crore to ₹ 11,164 crore. Still, AD was withdrawn at the behest of CBDT, MoF.

ii. Further on the issue of misuse of the GBI and AD scheme, Audit found that the list of developers claiming GBI was forwarded by MNRE to CBDT in January 2013 for their verification to rule out the suspicion of double benefit being availed. Audit enquired from CBDT of its action and findings on the list of developers. CBDT stated (April 2014) that the field offices were asked to verify the claims and one firm had claimed additional depreciation for the Assessment Year 2011-12 and later on the assessee revised the return. It further stated that no other discrepancy was reported relating to availing of GBI and AD in a mutually exclusive manner.

iii. It was also observed that after expressing reservations on the reintroduction of AD in 2013, MoF reintroduced AD benefit for the wind energy developers in the Finance Bill 2014. Audit sought the documents justifying reintroduction of AD after it had once been rejected, from CBDT (December 2014). CBDT stated (April 2015) that the proposal of introducing certain safeguards to address the concerns was not found acceptable and it was felt that monitoring of such a scheme would not be feasible.

The fact remains that the AD scheme was reintroduced September 2014 onward after a gap of over two years, CBDT's concerns notwithstanding. Also, the AD benefit was being provided to all other RE sources and in many other sectors, and was withdrawn only for wind energy sector.

MNRE stated (July 2015) that IREDA has taken adequate safeguards to ensure that GBI is provided to only those developers who do not avail AD benefit by checking their Income Tax returns.

3.2.3.2. Proposed checks for AD by MNRE not taken into consideration by the Ministry of Finance

Audit examination revealed that in order to make AD more transparent and to address MoF concern of the misuse of AD, MNRE had proposed the following checks:

- All the developers should be registered with IREDA, and the AD would be allowed in tax assessment by MoF only after certificate from IREDA that GBI had not been claimed.
- The ownership of the wind turbine cannot be transferred within three years of commissioning.
- The capacity utilization factor of the AD projects should be minimum of 15 *per cent* per year for a minimum of three years.
- AD would be made available for a maximum capex of wind power project which will be linked with CERC norms.

MoF did not take these into considerations and withdrew the AD scheme (March 2012). Also, MoF/CBDT had not issued any notification, to include these checks, while re-introducing the AD scheme (September 2014).

Audit scrutiny in Maharashtra revealed instances when the developers had been paid GBI without ensuring production of required certificate to the effect the Accelerated Depreciation benefit had not been availed of. The details are given in the box below.

Excess payment to wind generator without Accelerated Depreciation certificate

In Maharashtra, as per Energy Purchase Agreement (EPA) executed with the developer a certificate from Chartered Accountant /IT Department had to be submitted within two years from the date of Commercial Operation (COD) that the AD has not been availed.

Audit observed that that wind generators of Satara, Pune, and Nandurbar (March 2012) had not submitted the certificate for AD to Maharashtra State Electricity Distribution Company Limited (MSEDCL) even after two years from the date of COD.

Even in the absence of the certificate, payment was made by MSEDCL at higher rate in respect of 595 million units purchased during April 2010 to March 2014 resulting in possible excess payment of ₹ 78.31 crore.

MSEDCL stated (December 2014) that this was being verified for taking necessary action as per EPA.

MNRE (April/May 2015) did not comment on the issue and stated that inputs from MSEDCL through Maharashtra Energy Development Agency were awaited. The fact remains that the AD was reintroduced in 2014, the reservations notwithstanding, but the safeguards proposed are yet to be notified.

3.2.4. Lack of competitive bidding for allotment of wind energy projects

Wind energy constitutes around 67 *per cent* of installed RE capacity in the country. Audit observed that

i. There was no competition in the wind energy sector either with respect to tariff fixation (unlike JNNSM under solar energy) or with respect to allocation of sites to the developers (as in the case of SHP).

   MNRE stated (May 2015) that in solar energy, the cost per MW came down substantially due to realistic estimate in India and also due to cost reduction internationally during the last few years. In case of wind energy, the cost corrections have already taken place in the last 20 years. It further stated that wind being relatively more variable in nature, competitive bidding route may not lead to better results because it may not be possible to correctly estimate the generation and grid availability at a particular site. MNRE reply should be considered in the context of the need to address problems linked with infirm nature of wind energy in terms of accurate forecasting, maintaining grid discipline and adequate evacuation infrastructure which are plaguing the sector. These issues have been discussed in para 4.4.

ii. The guidelines issued by MNRE in June 2008 on wind measurement involving private sector stipulated that private developers should establish wind farms on lands categorised as wind farmable site within three years[22] of issue of No Objection Certificate (NOC) by the respective SNA. The guidelines further stipulated that in cases where no development takes place even after the prescribed period of three/five years, the SNA would be at liberty to invite bids for setting up wind power projects from others. When such sites are declared open for others, all data of the site would be treated as part of NIWE knowledge bank and would be given in the normal list of potential stations by NIWE. Audit observed that out of 572 stations in which private promoters conducted measurement, 32 stations were identified as potential sites for setting up wind farms. As these sites had not been developed within the extended time frame of five years, NIWE should have included them in the normal list of potential stations as stipulated in the Ministry's guidelines. This deprived potential developers of the opportunity for planning and establishing wind farm. NIWE stated (May 2013) that such sites would be listed after discussion with the concerned SNAs and MNRE.

4. State wise analysis

4.1. Potential and installed capacity

Based on the wind energy potential assessed in the 31 States/UTs listed in the Table 15 above, Audit identified that four[23] States were endowed with 75 *per cent* of the wind energy potential in the country at 80 m mast height and six[24] States with 22 *per cent* of the wind potential. Together, these ten States were endowed with 97 *per cent* of the country's wind potential. In order to tap the wind energy, it was necessary to focus on developing the resource in these States.

Table 17: Estimated potential and installed capacity (Grid connected) for the States endowed with 97 *per cent* of the country's wind energy potential, as of March 2014

(in MW)

S. No.	State	Estimated potential at 80 m height	Installed capacity	Percent installed
High[25] potential States with 75 *per cent* wind energy potential				
1	Gujarat	35,071	3,455	10
2	Andhra Pradesh	14,497	747	5
3	Tamil Nadu	14,152	7,271	51
4	Karnataka	13,593	2,319	17
	Total	**77,313**	**13,792**	**18**

[22] The period of three years could be extended upto five years in cases of circumstances beyond the control of the developer.
[23] Andhra Pradesh, Gujarat, Karnataka and Tamil Nadu.
[24] Jammu & Kashmir, Madhya Pradesh, Maharashtra, Odisha, Rajasthan and Uttar Pradesh.
[25] States with estimated potential higher than 10,000 MW.

S. No.	State	Estimated potential at 80 m height	Installed capacity	Percent installed
Medium[26] potential States with 22 *per cent* wind energy potential				
5	Maharashtra	5,961	4,097	68
6	Jammu & Kashmir	5,685	Nil	Nil
7	Rajasthan	5,050	2,786	46
8	Madhya Pradesh	2,931	423	14
9	Odisha	1,384	Nil	Nil
10	Uttar Pradesh	1,260	Nil	Nil
	Total	**22,271**	**7,306**	**33**

Source: MNRE

i. The installed capacity in these ten States varied from zero to 68 *per cent* of the potential. Maharashtra had the highest exploitation of the wind energy potential at 68 *per cent* followed by Tamil Nadu at 51 *per cent* and Rajasthan at 46 *per cent*. Jammu & Kashmir, Odisha and Uttar Pradesh had not exploited the potential at all. More significantly, of the four high potential States, three i.e. Gujarat, Andhra Pradesh and Karnataka had very low rates of exploitation of their wind energy potential, ranging from five to 17 *per cent*. Thus, unless MNRE and the State Governments of these high potential States prioritise exploitation and development of the wind energy, the impact of the progress made in the sector will remain insignificant.

ii. While the overarching policy and incentives offered by Government of India to promote wind energy across these States remained common, the comparative and varied development of wind energy in these States was dependent on factors such as State policies, evacuation infrastructure, tariff fixed by the State Electricity Regulatory Commission, Plant Load Factor (PLF) generated because of wind speeds, enforcement of Renewable Purchase Obligation (RPO)/ Renewable Energy Certificate (REC) etc. An analysis of the conditions prevailing in these ten high potential States is discussed below:

4.2. Policy, Planning and implementation

In order to give impetus to development of a particular activity, it is important that the Government policy on the activity be clearly articulated. This should then be followed up with proper planning, target setting and monitoring of implementation. The State wise findings in this regards are given below:

[26] States with estimated potential between 10,000 MW and 1,000 MW.

Andhra Pradesh

The new Wind Policy 2008 was favorable to the developers. But, NREDCAP[27], the nodal agency had only one officer looking after renewable sources of energy, with limited support and no access to specialists. Lack of reliable information, even to the regulators, on different parameters affecting energy tariffs also had its impact on tariff determination.

MNRE stated (July 2015) that APERC has issued the preferential generic levelised tariff for 25 years for wind power generation projects in the State on 31 March 2015.

Gujarat

The State had the maximum estimated wind energy potential at 35,071 MW. So far it had installed capacity of 3,455 MW which was the third highest in the country. However, in terms of percentage of the potential, the installed capacity was 10 *per cent* of the estimated potential. While the State Government did frame a wind energy policy in 2007 and revised it in 2013, it did not set any targets for creation of capacity between 2007-14. This is indicative of comparatively lower priority and focus of the State Government in developing this source of energy. Being the highest potential State, it was imperative that it lead in terms of exploitation of potential capacity to meaningfully contribute towards meeting the Nation's commitment to Renewable Energy.

MNRE stated (July 2015) that the State had been consistently providing investor friendly wind power policies to facilitate setting up of wind power projects in the State with seven *per cent* RPO for the year 2015-16 which reiterate the commitment of the State Government towards promotion of wind power in the State.

Karnataka

Against a target of creating installed capacity of 2,969 MW in 2007-14, only 1,497 MW was created due to difficulties in getting statutory clearances. It was seen in audit that 18 wind projects allotted for a total 475 MW were pending for clearances. Three projects totaling 33 MW were pending for allocation of Revenue land and 15 projects totaling 442 MW were pending for clearance from the Forest Department. This was despite the fact that the State RE Policy 2009-14 envisaged that Karnataka Renewable Energy Development Limited (KREDL) would obtain all statutory clearances from different departments beforehand and offer such lands for Renewable Energy Project development. KREDL was to pursue with the departments and co-ordinate approvals and clearances within 90 days from all departments / agencies and 120 days in case of Forest clearance.

Jammu & Kashmir, Odisha and Uttar Pradesh

These three States set little priority in developing wind energy potential, as was indicated by the absence of both a Government policy and targets, and failed to exploit this resource.

Madhya Pradesh

The State could achieve only 367 MW capacity creation against a target of 3,259 MW during 2007-14. No specific reasons for such substantial under achievement were found on record.

[27] New and Renewable Energy Corporation of Andhra Pradesh Ltd.

Maharashtra
The State leads the high potential States in its performance in terms of percentage of potential exploited (68 *per cent*) and ranks second in terms of capacity creation. While it did not formulate a separate policy for wind energy, a combination of targets, attractive tariffs[28] and adequate evacuation infrastructure contributed to the commendable performance.
Rajasthan
The Wind Energy Policy of 2012, which envisaged selection of power producers on basis of competitive bidding, was stayed by the Rajasthan High Court. Thereafter, Government of Rajasthan amended (March 2014) the policy and allowed preferential tariff determined by the Rajasthan Electricity Regulatory Commission (RERC) for the years 2013-14 to 2015-16 but during the year 2013-14 only 98.80 MW could be added.
Tamil Nadu
About 60 *per cent* of small wind turbines (<400 kW) that had been installed before the year 2000 were operating with PLF ranging from 10 to 15 *per cent*, whereas the new technology wind turbines could operate at a PLF range of 27 to 32 *per cent* on the same sites. There was no policy for repowering of these old turbines which resulted in fall in efficiency of these windmills over the years. The issue has been discussed in detail in para 5.

MNRE stated (May 2015) that the inputs from State Agencies were awaited. It further stated that the State specific achievements were not only dependent on Central Government incentives and these were mainly dependent upon wind regime, State government policies, grid infrastructure availability and investor-friendliness of the State and private sector investment but the reply is silent on planning, target setting and monitoring of implementation of the scheme.

4.3. Tariff

4.3.1. Comparison between CERC and SERC tariffs

CERC (Terms and Conditions for Tariff determination from RE Sources) Regulations 2012, provide for terms and conditions and the procedure for determination of tariff for RE generating stations. The Regulations enjoin upon CERC to determine the generic tariff on the basis of the *suo-motu* petition, for RE technologies for which norms have been provided in the RE Tariff Regulations.

CERC had subsequently issued generic *suo-motu* tariff orders applicable for RE projects commissioned during first, second and third year of the control period (i.e. 2012-13, 2013-14 and 2014-15). The tariff was fixed by CERC on the basis of power generation capacity, capital cost, debt-equity, depreciation, operation & maintenance expenses etc.

Zonal tariff are fixed by CERC for wind energy, based on the Capacity Utilization Factor (CUF) depending on the wind zone as per NIWE. The zone wise tariff fixed by CERC is given in Table 18.

[28] Refer para 4.3.1 and 4.3.2.

Table 18: Zone wise tariff fixed by CERC

Wind Zone	Wind Density (in Watt/ sqm)	CUF (in *per cent*)	2012-13		2013-14	
			Levelised Tariff (₹/kWh)	Levelised Tariff after adjusting AD benefits (₹/kWh)	Levelised Tariff (₹/kWh)	Levelised Tariff after adjusting AD benefits (₹/kWh)
Zone 1	Upto 200	20	5.96	5.36	6.29	5.80
Zone 2	201-250	22	5.42	4.87	5.72	5.27
Zone 3	251-300	25	4.77	4.29	5.03	4.64
Zone 4	301-400	30	3.97	3.57	4.19	3.86
Zone 5	Above 400	32	3.73	3.35	3.93	3.62

In the States, the tariff for the wind power projects are fixed by the SERC based on the factors such as capital cost, return on investment, debt equity ratio, interest on loan, depreciation, operation and maintenance charges, CUF, sharing of CDM benefits, subsidy given by Central/ State Government, useful life etc.

Table 19 gives the details of tariff fixed in the ten high potential States by their respective SERC's.

Table 19: Tariff related details in ten States with highest wind energy potential.

S. No.	State	Potential exploited	Tariff (₹ per Unit)	CUF (in *per cent*)	Installable Potential (in *per cent*)			
					Zone 1	Zone 2	Zone 3	Zone 4
1	Andhra Pradesh	5	4.70	24.50	92	6	2	0
2	Gujarat	10	4.15	23	92	8	0	0
3	Jammu & Kashmir	Nil	Not fixed	Not fixed	9	25	0	66
4	Karnataka	17	4.20	26.50	97	1	2	0
5	Maharashtra	68	Zonal[29]	22	98	2	0	0
6	Madhya Pradesh	14	5.92	22.50	100	0	0	0
7	Odisha	Nil	5.31	-	100	0	0	0
8	Rajasthan	46	5.72[30] & 5.44	21 & 20	100	0	0	0
9	Tamil Nadu	51	3.51	27.50	100	0	0	0
10	Uttar Pradesh	Nil	4.02	-	100	0	0	0

On principle, tariff decreases as the CUF increases i.e. tariff was highest for Zone 1 and lowest for Zone 4. Table 19 shows that States like Andhra Pradesh, Gujarat, Karnataka, Kerala, Tamil Nadu and Uttar Pradesh had most of their wind potential in wind Zone 1, but they had fixed tariff much lower than the CERC tariff for the Zone. States like Maharashtra, Madhya Pradesh and Rajasthan have relatively high tariff to compensate project developers

[29] Zone 1 - ₹ 5.81, Zone 2 - ₹ 5.05, Zone 3 - ₹ 4.31, and Zone 4 - ₹ 3.88.
[30] For Barmer, Jaisalmer and Jodhpur.

for low CUF, making it attractive. Maharashtra and Rajasthan were the only States to fix zone wise tariff as per CERC norms.

MNRE stated (July 2015) that the tariff fixation was done by the State Energy Regulatory Commissions (SERCs). In many cases the State Regulatory Commission does not fix tariff as per the CERC Guidelines due to various reasons including financial health of Discoms.

4.3.2. Revision of tariff

Table 20: Status of revision of tariff in ten States with highest wind energy potential.

S.No.	State	Tariff (₹ per Unit)	Revision of Tariff (2007-14)
1	Andhra Pradesh	4.70	Tariff revised in 2008-09 and 2011-12
2	Gujarat	4.15	Tariff revised in 2008-09 and 2011-12
3	Jammu & Kashmir	Not fixed	Not fixed.
4	Karnataka	4.20	Not revised since 2008-09
5	Maharashtra	Zonal[31] ranging from 5.81 to 3.88	Regularly revised zone wise every year
6	Madhya Pradesh	5.92	Regularly revised every year
7	Odisha	5.31	Not revised since 2010-11
8	Rajasthan	5.72[32] & 5.44	Regularly revised since 2008-09
9	Tamil Nadu	3.51	Regularly revised since 2009-10
10	Uttar Pradesh	4.02	Regularly revised since 2008-09

Audit observed that CERC had been regularly revising the indicative tariff fixed by it for the wind energy projects. But most of the States as given in the table above had not revised the tariff. States like Andhra Pradesh, Gujarat, Karnataka, Odisha, Tamil Nadu and Uttar Pradesh have not revised the tariff regularly. On the other hand it was observed that Maharashtra has regularly revised the zone wise tariff.

MNRE while accepting the audit observation stated (May 2015) that State Regulatory Bodies are not revising the tariff as per the CERC guidelines on regular basis and this was one of the short-comings of the wind sector.

4.3.3. Non execution of Energy Purchase Agreement (EPA) with generators

In Maharashtra, as per Citizens' Charter of Maharashtra State Energy Distribution Corporation Ltd (MSEDCL) the EPA had to be executed within a period of 15 days after receipt of the proposal from the Generators.

MSEDCL received (July 2013 to May 2014) proposals from 106 wind energy generators for execution of EPA. However, MSEDCL had not executed EPA, resulting in delay ranging from 26 to 334 days from the date of receipt of proposed EPA (June 2014).

[31] Zone 1 - ₹ 5.81, Zone 2 - ₹ 5.05, Zone 3 - ₹ 4.31, and Zone 4 - ₹ 3.88.
[32] For Barmer, Jaisalmer and Jodhpur.

Audit observed that six wind projects pertaining to Satara and Sangli Circles had generated 52.99 MUs from the date of commissioning and fed the same into MSEDCL grid upto 31 May 2014. However, MSEDCL had not paid an amount of ₹ 30.79[33] crore to the generating companies for the energy supplied.

MSEDCL stated (Dec 2014) that due to pendency of litigations, the signing of EPAs was delayed during 2013-14. The fact remains that MSEDCL has not adhered to the terms of the Citizens' Charter issued by itself under approval of Maharashtra Energy Regulatory Commission (MERC). MNRE stated (July 2015) that the reply from States was awaited.

4.4. Evacuation

4.4.1. Background

Central Electricity Authority (CEA) has envisaged a capacity addition from RE sources during the 12th FYP to be about 32,000 MW which was likely to come up in eight States i.e. Andhra Pradesh, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Maharashtra, Rajasthan and Tamil Nadu and out of which 30,000 MW was expected to come from solar and wind energy.

Gujarat, Tamil Nadu and Rajasthan had substantial percentages 18 *per cent*, 40.5 *per cent* and 26 *per cent* of the RE in their total installed capacity respectively, predominant of which was wind and solar. The other States with substantial RE capacity were Maharashtra and Karnataka.

The interstate and inter regional transmission infrastructure was being developed and it was expected that all the five electrical regions of India would be synchronously connected by 2014. The transmission system costing about ₹ 32,000 crore had been planned to cater the needs of about 32,000 MW RE capacity addition program for the 12th FYP (2012-17). These systems include both intra state and interstate transmission system of 132 kV, 220 kV, 400 kV and 765 kV voltage levels. Presently, the Southern grid is not synchronized fully with the National Grid to evacuate wind power to other States or to other regions.

The transmission planning in the country was done through a coordinated process with the participation of CEA, Central Transmission Utility (POWERGRID) and the State Transmission Utilities.

The all India grid was divided into 28 control areas interconnected with each other through interstate transmission links and high capacity corridors. Each State had its own generation sources in addition to the shared generation resources called interstate generating stations.

4.4.2. Green Energy corridor

A report `Transmission Plan for Envisaged Renewable Capacity'[34] of PGCIL was released (September 2012) to evolve intra/ inter State transmission system for strengthening adoption/ transfer of RE power within State/ outside State called the Green Energy Corridor.

[33] 52.99 MUs x ₹ 5.81/unit.

[34] Prepared after consultation with MNRE/ Ministry of Power / Planning Commission/ CERC/ CEA/ Forum of Regulators

The report also included proposals regarding other real time monitoring and control infrastructures required for supply balancing mechanism to address intermittency and variability aspects of RE generation, estimated capex requirement, financing strategy etc. Ministry of Power conveyed (February 2014) its approval for implementation of Inter State Transmission Schemes (ISTS), setting of RE Monitoring Centers and control infrastructure by PGCIL for Green Energy Corridor. PGCIL had conveyed (October 2014) that Green Energy Corridor-ISTS was to be commissioned progressively from 2017.

4.4.3. Deficient transmission infrastructure in Tamil Nadu

Tamil Nadu has the largest installed capacity based on wind energy at 7,271 MW. Tamil Nadu Energy Regulatory Commission (TNERC) in its tariff order (May 2006) ordered creation of enough transmission infrastructures in the critical areas of wind energy generation on urgent basis.

It was observed that neither Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)[35] nor Tamil Nadu Transmission Corporation Limited (TANTRANSCO)[36] were able to create adequate transmission infrastructure facilities or utilise the existing facilities effectively. During high wind season, the transmission lines were congested leading to problems of voltage stability and power quality. There was no common spinning reserve[37] maintained with other States in the region to fully utilize the heavy wind generation.

Audit further observed:

i. That there was no long-term transmission planning process to incorporate transmission and evacuation requirements of wind energy. Wind energy projects had low gestation periods which led to rapid increase of installed capacity over the years, there was no matching creation of grid infrastructure resulting in bottlenecks in evacuation of the generated energy.

ii. Examination of substation facilities for evacuation of wind power that existed in 2008-09 and the additional capacity that was created upto 2013-14 indicated that as on 31 March 2014, against the installed capacity of 7,271 MW, TANGEDCO had transmission facility for only 6,085.96 MW leaving a shortfall of 1,185.04 MW.

iii. To evacuate the entire energy from the wind energy generating areas of Tirunelveli, Udumalpet and Theni in the southern parts of the State to the distant load centres in northern parts of the State, establishment of 400 kV substations was essential. A backbone transmission network from Kayathar in the Tirunelveli area to Ottiyambakkam (Sholinganallur) near Chennai in the northern part of the State for a route length of 709 km estimated to cost ₹ 2,200 crore was proposed for implementation during the 12th FYP period. The work was scheduled to be completed by 2014 to help evacuation of power during the 2014 season. It was however observed that as of June 2014, the work had not been completed. The

[35] Responsible for energy distribution.
[36] Responsible for creating evacuation facility.
[37] The spinning reserve is the extra generating capacity that is available by increasing the power output of generators that are already connected to the power system.

allied substation works at Kanarpatti was also pending. The works were under various stages of completion.

MNRE stated (May 2015) that in some cases, the utility was not able to provide timely evacuation facilities for new projects as they have financial constraints to augment the grid and that the States were trying to improve the situation. The reply was indicative of the fact that there were bottlenecks on transmission and evacuation requirements of wind energy.

The impact of inadequate infrastructure on development of the wind energy in various States is given in box below:

Projects pending for want of evacuation infrastructure

In Andhra Pradesh 118 projects of 3,972.67 MW had been sanctioned till 31 March 2014. Audit observed that 63 projects with a capacity of 3,074.50 MW are pending for want of power evacuation facility[38]. Some of the projects are pending since November 2000. State transmission utilities have sought funds to the extent of ₹ 3,058.46 crore from MNRE which are yet to be sanctioned by MNRE.

MNRE stated (July 2015) that Transmission Corporation of Andhra Pradesh Limited (APTRANSCO) had taken up strengthening of transmission infrastructure in two phases for evacuation of 3,150 MW capacity with estimated cost of ₹ 3,373 crores in Ananthapur, Kurnool and YSR Kadapa Districts, where maximum potential was available, by installing three 400 kV and nine 220 kV sub stations and proposals were submitted by APTRANSCO for sanction of 40 *per cent* matching grant under National Clean Energy Fund.

Power backed down

In Tamil Nadu the quantum of wind power backed down was 6,018.43 MUs during 2007-2014, the maximum backing down being in 2012-13 (1,155.27 MUs) and 2013-14 (3,419.85 MUs). This resulted in loss of revenue to the extent of ₹ 2,040.25 crore[39] during the period.

MNRE stated (July 2015) that due to variable nature of wind energy and lack of scheduling and forecasting mechanism, wind power projects are, sometimes, backed down. State Governments are bringing regulations for scheduling and forecasting. NIWE with VORTEX of Spain, in association with Indian Wind Power Association (IWPA) and TANGEDCO was working on a pilot project for scheduling and forecasting. However the fact remained there was loss of power to be fed into the grid and the revenue could not be made good.

Under achievement of generation due to lesser evacuation capacity

In Maharashtra transmission facilities for evacuation of 255 MW were approved (July 2006) for M/s Suzlon Energy Limited at Ghatnandre, Dist Sangli. However, due to unresolved Right of Way and problems in evacuation, the Company issued final connectivity (November 2013) only to the extent of 231.50 MW rendering 23.50 MW of identified potential wasteful. This resulted in unachieved generation of 13.724 MUs and consequent loss of revenue of ₹ 7.97[40] crore to the RE sector in the State.

[38] Out of 63 projects, 24 projects were held up due to non allotment of revenue land also.
[39] Calculated at the 20 years average tariff of ₹ 3.39 per unit as per TNERC's wind energy tariff order of 2009.
[40] ₹ 5.81 x 23.50 MW x 1,000 x 24 x 365 x 4 months/12 months x 20 *per cent* CUF.

Applications pending for issue of grid connectivity

In Maharashtra, the State Transmission Utility had to dispose of the applications for grid connectivity within 45 days from the date of receipt of application. Audit observed that 74 applications for grid connectivity involving 4,304[41] MW were pending with Maharashtra State Electricity Transmission Company Limited (MSETCL) (March 2014) from March 2012 onwards. In addition, in respect of seven projects involving 1,025 MW, though the company had received MEDA's recommendation letter, the cases were pending for want of applications from the developers.

4.4.4. Reimbursement of evacuation expenditure

The Maharashtra Government declared (October 2008) that the RE developer shall be eligible for refund of expenditure on evacuation infrastructure[42]. Audit observed that

i. 16 eligible applications of 397 MW for ₹ 55.08 crore were pending for reimbursement of evacuation expenditure from MSETCL. MSEDCL had also not reimbursed ₹ 17.16 crore to developers in Satara, Pune Rural and Sangli circles.

   In reply, MSEDCL stated (Dec 2014) that if reimbursement was made, then the same shall have to be included in the tariff petition and the common consumers would have to suffer the ultimate burden. The reply was not tenable as the action of MSEDCL was not in keeping with Government Policy and reimbursement of cost of creating evacuation infrastructure would have reduced the capital cost of the producer.

ii. Expenditure on power evacuation in respect of 1,110 wind energy project commissioned and operationalised between 2007 and 2014 had not been reimbursed to the project owners. It was also observed that no expenditure was incurred on construction of approach roads to these 1,110 projects, which was also confirmed by the departmental officials during the joint physical verification of all selected projects.

iii. MSETCL had also approved payment of centage charges[43] amounting to ₹ 7.80 crore, as a component of capital expenditure, which was not eligible for reimbursement.

   MSETCL stated (July 2014) that centages form part of developer's capital expenditure. Reply was not acceptable as the entire capital expenditure was covered in the item wise audited statement of amount spent by the developers.

iv. Test check of records in MSEDCL revealed that at the time of approving the estimates for the cost of the evacuation lines to be constructed by the respective Generator/ Developer, different methods of arriving at the approved cost were employed by different Circles/ Division offices:

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[41] Solar 1,348 MW, Bagasse 288 MW, SHP 17.50 MW, Wind 2,650.50 MW.

[42] The RE developer shall be eligible for refund of actual expenditure on evacuation infrastructure or the sanctioned estimate approved by MSEDCL/MSETCL or the amount as specified in the policy, whichever is lower after one year from the date of commissioning of evacuation arrangement; the expenditure to be shared equally by SNA and MSEDCL/MSETCL

[43] At the rate of 10.75 *per cent*. Centage charges are prescribed for approval of layouts and sub-division of sites.

- In Satara and Pune Circles only material and labour elements were considered for approving the estimates.

- In Dhule and Nandurbar circles, the estimates included an additional five *per cent* for transportation cost (Dhule) and 10 *per cent* Lattitude[44] charge (Nandurbar). In Nandurbar circle, additional cost elements such as Service Tax, insurance, contractors' profit, contractors' supervision, contingencies, head office supervision, escalation etc. were also included in the estimate amount.

- Supervision charges were calculated at the rate of 15 *per* cent of labour charges in Nandurbar whereas it was calculated at the rate of 1.3 *per cent* of material and labour charges in other circles.

MSEDCL stated (Dec 2014) that necessary instructions had been issued for framing the estimates as per MSEDCL standard procedure.

v. The reimbursement of 50 *per cent* of the eligible amount of evacuation expenditure in five annual installments had to commence after one year from the date of commissioning of the evacuation facility. In MSETCL, there were delays in reimbursement ranging from one to six years in 10 cases.

4.4.5. Synchronisation of generation and maintenance of grid discipline

4.4.5.1. Accurate prediction of wind power

The variability of RE power can be addressed through improved forecasting techniques, which are still evolving. When the percentage of RE becomes significant, special attention needs to be paid to accurately forecast their output.

i. RE Management Centers not set up in SLDCs:

To enable accurate forecasting and scheduling, RE Management Centers were expected to be set up in the State Load Dispatch Centers (SLDCs). It was observed (September 2014) that, no such centre had been set up in the States.

ii. Non-scientific methods for calculation of wind power

Wind power was scheduled by averaging the previous two days availability and no scientific methods were used to arrive at correct wind forecast for the day ahead.

4.4.5.2. Maintenance of grid discipline

CERC amended the Indian Electricity Grid Code (IEGC) in April 2010 to allow flexibility in scheduling and despatch of wind energy. The new grid code of CERC mandated that all new renewable energy power sources of 10 MW and above and connected to the grid at 33 kV and above should schedule power generation and provide a forecast to the system operator. The code provided that a +/- 30 *per cent* variation between scheduled and actual

[44] Charges levied by MSEDCL.

power injection would not attract any penalty for the wind developer[45]. Any variation beyond +/- 30 *per cent* would be to the account of the developers. Therefore, good short-term[46] forecasting facilities of renewable energy, especially for wind power, using modern tools were necessary to reduce forecasting errors and reduce the impact of Unscheduled Interchange (UI) penalties.

The peak wind season in Tamil Nadu was from June to September. During this period, wind energy contributed about 30-35 *per cent* of the energy consumption in the State. Chart 4 below indicates month-wise wind generation in the State during 2013-14[47]:

Chart 4:Month wise wind energy generation during 2013-14

As seen above, the generation pattern of wind power was infirm varying from about 2,200 MW (high-wind season) to about 118 MW (low-wind season), and even during high wind season, the generation, at times tapered down to 320 MW or less from a high of 2,170 MW within a day. Due to wide variations in wind generation within short periods, the grid got affected due to voltage control and transient stability. The variable generation led to overloading of transformers and main transmission lines which required high capacity of strengthening of transmission network. As the conventional hydro source available in Tamil Nadu to compensate the wind generation loss was very limited, the vagaries of wind generation had serious bearing on the availability and supply of power in Tamil Nadu. Because of the constraints in transmission system and to contain the frequency within the bandwidth as per the Indian Grid Code, TANGEDCO had to either back down wind generation during excess generation or in cases of drop in wind generation resort to either overdrawal of power from the regional grid or resorted to unplanned load shedding. The detail has been reported in para 4.4.3.

It was observed that, in Tamil Nadu, there were individual generators with capacities of 250 kW also. Sub-regulation 23 of regulation 6.5 of the new Grid code provided that for capacity below 10 MW and for old wind farms, scheduling of wind energy could be mutually decided between the wind generator and the transmission or distribution utility as the case may be if there was no existing agreement to the contrary. Since forecasting and scheduling by all wind generators was required to ensure better operational decision making and ensure secure grid operation, implementation of the new mechanism in Tamil Nadu could be

[45] With host States taking all the Unscheduled Interchange (UI) liabilities through Renewable Regulatory Fund.
[46] Day-ahead and three hour ahead.
[47] Southern Regional Power Committee's monthly progress report for 2013-14.

carried out only by mutual agreement. As of September 2014, there had been no agreement between the wind developers and the State utility to this effect. Even though the code focused on the problems faced by the States having huge infirm power, since it was applicable only in respect of the new generators who are coming into the grid, there was not much benefit for TANTRANSCO as the State has almost reached saturation level in wind capacity at 50 m mast height. TANTRANSCO was yet (September 2014) to set up Renewable Energy Management Centres in the State Load Despatch Centre which would have enabled accurate forecasting and scheduling.

5. Repowering of the wind power projects

Repowering could lead to better utilization of wind-rich sites through the installation of latest technology wind turbine models available and improve the capacity utilization factor to 25-30 *per cent*[48]. Also, the total cost of repowering a site was 20 *per cent* lower than a Greenfield[49] installation. Moreover, the process does not require any permits or approvals.

The return on investment could be considerably improved by repowering of old wind sites-through an increase in energy generation, higher tariff and the REC mechanism. In addition, repowering would reduce the noise produced by turbine operations and facilitate grid integration as the modern turbines comply with grid code standards as well as demonstrate improved performance under erratic grid conditions.

Over 4,600 turbines rated below 500 kW and operational for more than 10/12 years were ideal for repowering. These turbines have an aggregate capacity of 1.6 Giga Watt, which is over 9 *per cent* of the total installed capacity and located at sites with excellent wind conditions. Most of the turbines were installed a decade ago under power purchase agreements that were signed for 20 to 25 years. Old projects aggregating 500-1,000 MW could be repowered with high levels of success.

MNRE while agreeing with the issue of repowering the wind power projects raised by Audit stated in October 2014 that many wind turbines installed in the earlier years have completed up to 15 years out of the theoretical life of 20 years of turbines. It further stated that due to the advancement in technology, higher hub heights and larger rotor diameters, there was a good scope of repowering the old wind turbines of few kW size into MW size. The Ministry also stated that it had not conducted any study to arrive at the figure.

MNRE further clarified that some major issues like signing of new PPAs, permission from adjoining project owner, use of land, requirement of micro-sitting[50] (in Tamil Nadu), ownership of land and multiple owner of project are involved in repowering the wind projects and it has not yet issued any scheme on repowering of wind power projects.

[48] Almost two to three times the current plant load factor (PLF) of old turbines
[49] Structures in an area where no previous facilities exist.
[50] Wind farm micro sitting- a method which could calculate the wind farm velocity.

6. Other audit findings on implementation of wind energy projects in States

Andhra Pradesh

6.1. Government land not returned after reduction in capacity

NREDCAP entered (May 1994) into a MoU with a wind energy developer (M/s Andhra Sugars Ltd.) to set up wind mill of 10 MW at Ramagiri in Ananthpur and alienated 73.86 acres of land to the developer. The developer executed the works for 2.025 MW and did not develop capacity of 7.975 MW. As per MNRE norms 15.54 acre of government land should have been returned, which had not been done.

Rajasthan

6.2. Non-recovery of extension fees

Clause 15.3 of the Policy for promoting Generation of Electricity through Non-Conventional Energy Sources 2004 of Rajasthan, provides that Wind Energy Projects should be completed within six to 24 months from the date of allocation of capacity by Rajasthan Renewable Energy Corporation Limited (RRECL). Extension would be granted for prescribed period along with extension fees payable.

Audit observed that in three projects of M/s Enercon (India) Limited, the extension fees of ₹2.90 crore was not recovered by RRECL.

6.3. Non recovery of processing fee on re-registration

Clause 15.1 and 15.2 of the Policy for promoting Generation of Electricity through Non-Conventional Energy Sources 2004 of Rajasthan stipulated that the Developer/Power producer would deposit a refundable amount at ₹ five lakh per MW with RRECL as security deposit within 30 days from the date of capacity allocation and if the security amount was not deposited within the time specified, the approval of the State Level Empowered Committee (SLEC) shall stand withdrawn and priority shall be accorded to the next applicant. For re-submission of the case to SLEC for project approval, the applicant will have to re-register the case, along with the processing fee, within the next 30 days, failing which the land allotted shall also stand cancelled.

Audit observed that in five[51] cases processing fees amounting to ₹ 1.04 crore was not recovered on re-registration.

6.4. Non obtaining/non-forfeiture of Security Deposit

Clause 15.1 & 15.2 of Non Conventional Energy Sources Policy 2004 stipulated that in case of wind energy projects the Developer/Power producer would deposit a refundable amount

[51] M/s Enercon India Ltd, M/s Vish Wind Infrastructure (two cases), M/s Gujarat Fluorochemical and M/s Veer Energy Infrastructure.

at ₹5.00 lakh per MW with the Company as security deposit within 30 days from the date of capacity allocation towards completion of the project in the prescribed time frame.

Audit observed that in one[52] case a 16 MW capacity was not commissioned by the developer but the bank guarantee for ₹ 80 lakh was not encashed by RRECL.

7. Conclusion

Wind power was the fastest growing renewable energy resource in India, constituting 67 *per cent* of the total RE capacity. MNRE had assessed the potential for wind energy at 50 m mast height. Assessment of capacity at 80 m height was in progress and that at 100 m height was yet to be explored.

Against an estimated potential of 1,02,788 MW at 80 m mast height, the installed capacity was 21,137 MW[53] which was 21 *per cent* of potential at 80 m height.

At the beginning of the 11th Five Year Plan period, total installed capacity of wind power was 7,091 MW. During the 11th Five Year Plan period, against target of 10,400 MW, capacity of 10,259 MW was achieved. In the first two years of the 12th Five Year Plan period, against a target of 5,000 MW, 3,779 MW was achieved. Thus, there was overall shortfall of nine *per cent* in achievement of targets as of 2014. This was despite the fact that the targets set were modest in comparison to the assessed wind energy potential as well as technological competence available in the country. It appeared that the targets had been routinely set by MNRE without proper planning, analysis, involvement of and communication with the States.

The installed capacity in the high potential States varied from zero to 68 *per* cent of the potential. Maharashtra had the highest exploitation of the wind energy potential at 68 *per cent*. The remaining States had exploited only five to 51 *per cent* of their potential. Three States did not have any installed wind power capacity.

MNRE could not ensure seamless transition of GBI and AD schemes in the 12th Five Year Plan. The growth in wind energy sector was hampered by the resultant uncertainties in the policy framework. The safeguards proposed for ensuring that developers did not avail benefit, simultaneously under GBI and AD schemes, were not introduced.

There was no competition in the wind energy sector either with respect to tariff fixation or with respect to allocation of sites to the developers. Thirty two stations identified as potential sites allotted to private developers for setting up wind farms had not been developed within the extended time frame of five years. These stations were not included in National Institute of Wind Energy's normal list of potential stations as stipulated in MNRE's guidelines. This deprived potential developers who could be looking for such sites for establishing wind farms of the opportunity to develop projects.

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[52] M/s Vish Wind Infrastructure Limited.

[53] However, as per the records furnished by individual SNAs, the installed capacity totaled upto 20,564 MW. The difference was largely in the installed capacity in Madhya Pradesh as recorded in MNRE i.e. 424 MW whereas as per the SNA records, it was only 52 MW.

There were problems in evacuation of wind power generated by the States due to non-availability of sufficient transmission infrastructure, non-synchronization of generation and grid management in the event of unexpected fluctuations. Lack of adequate infrastructure and scientific techniques to predict wind power also created problems in maintaining grid discipline.

Though MNRE acknowledged the importance of re-powering of old wind turbines, no action had been taken in this regard.

8. Recommendations

- *MNRE should focus on development of wind energy in the States endowed with high wind energy potential.*
- *MNRE may work towards development of adequate transmission and distribution infrastructure, both intra-State and inter-State, to meet the needs of large scale evacuation of wind power and grid stabilization through scientific forecasting techniques.*
- *MNRE may look into the issue of repowering the old wind turbines and formulate a policy for optimal utilization of existing capacities and their enhancement.*

Chapter - V

Small Hydro Power

1. Introduction

MNRE has been vested with the responsibility of developing Small Hydro Power (SHP) projects up to 25 MW capacities. SHP projects can play a critical role in improving the overall energy scenario of the country and, in particular, for remote and inaccessible areas. Most of the potential is in the Himalayan States as river-based projects and in other States on irrigation canals. MNRE's aim was to install about 7,000 MW by the end of 12th Five Year Plan (FYP) i.e. 2017.

2. Potential, Target and Achievement

MNRE had identified[1] and created a database of 6,474 potential sites with an aggregate capacity of 19,749 MW. The State Governments also assessed the potential in their respective States. The independent Power Producers could also identify the potential and install projects.

2.1. Targets and achievements

The installed capacity of grid interactive SHP projects in the country at the beginning of the 11th FYP was 1,976 MW. The targets and achievements of MNRE under the 11th Five Year Plan (FYP) and 12th FYP upto 2013-14 were as given in Table 21 below:

Table 21: Targets and achievement under 11th and 12th FYP

S. No.	Year	Target (in MW)	Achievement (in MW)	Excess(+)/ Shortfall(-) (in *per cent*)	CFA released (In ₹ crore)
11th Five Year Plan Period (2007-12)					
1	2007-08	200	205	2	49
2	2008-09	250	249	0	72
3	2009-10	300	305	2	100
4	2010-11	300	307	2	152
5	2011-12	350	353	1	154
	Total	1,400	1,419	1	527
12th Five Year Plan Period (upto 2014)					
6	2012-13	350	237	-32	159
7	2013-14	300	171	-43	123
	Total	650	408	-37	282
	Grand Total	**2,050**	**1,827**	**-11**	**809**

Source: MNRE

[1] With the assistance of Alternate Hydro Energy Centre (AHEC), Roorkee.

During 2007-12, MNRE was able to achieve its target. However, during 2012-14 there was a shortfall of around 38 *per cent*.

As of March 2014, of the identified 6,474 potential sites for SHP projects of 19,749 MW, only 997 projects (3,803 MW) were completed and 254 projects (895 MW) were under implementation i.e. only 19 *per cent* of total potential sites had been exploited. MNRE had planned to install 7,000 MW by the end of 12th FYP (upto 2017). Based on analysis of the target and achievement, the following observations are made:

i. MNRE had achieved 3,803 MW[2] as on 31 March 2014, which was 58 *per cent* of target set to be achieved by the end of 2017.

ii. There had been a substantial shortfall in achieved targets in the first two years of the 12th FYP. The capacity addition in these two years i.e. 2012-14 had only been 408 MW. This implies that MNRE will be required to make a concerted effort to add another 3,197 MW capacity approximately, starting from conceptualization to commissioning, in the coming three years to meet its 12th FYP targets.

2.2. Small Hydro policy of Government of India (GoI)

MNRE, from time to time, formulated SHP policy. Prior to 2009-10 the policy was part of combined RE policy of MNRE. The exclusive SHP policy came in November 2009. The policy was revised in July 2014.

The GoI had also launched the schemes of PM's Special Package for Arunachal Pradesh and Ladakh Renewable Energy Initiative targeting development of local SHP and solar resources to meet the energy needs of the region. Audit findings on these programmes are discussed in Chapter X and XI, respectively, of this report.

2.3. State wise potential and cumulative achievement

The State wise detail of estimated potential and cumulative installed capacity is given in **Annexure X**. From the annexure, it can be observed that of the 29 States/UTs endowed with SHP potential, Andaman and Nicobar Islands and Haryana reported highest potential exploitation at 66 and 64 *per cent*, respectively. However, since the potential in these states was marginal, the contribution to aggregated installed capacity by these States was a meager 75 MW at eight sites. The highest capacity addition was made in Karnataka at 1,032 MW, which was also the State with highest potential.

For better analysis and appreciation of performance, Audit identified that six States were endowed with 61 *per cent* of the SHP potential in the country and five States with 20 *per cent* of the SHP potential. Together, these eleven States were endowed with 81 *per cent* of the country's SHP potential. The details are brought out in the following Table 22 with the data of these 11 States.

[2] Including 895 MW not yet commissioned

Table 22: Estimated potential, targets and achievement (Grid connected) for the States endowed with 81 *per cent* of country's SHP potential, as of March 2014

(in MW)

S. No.	State	Estimated potential	As per SNA		Installed capacity	*Per cent* installed
			Target fixed	Achievement		
High[3] potential States with 61 *per cent* of the SHP potential						
1	Karnataka	4,141	600*	742	1,032	25
2	Himachal Pradesh	2,398	2,473	438	639	27
3	Uttarakhand	1,708	NA	14	175	10
4	Jammu & Kashmir	1,431	Not fixed	144	148	10
5	Arunachal Pradesh	1,341	79.85	28	104	8
6	Chhattisgarh	1,107	NA	27	52	5
	Total	**12,126**			**2,150**	**18**
Medium[4] potential States with 20 *per cent* of the SHP potential						
7	Andhra Pradesh[5]	978	NA	127	221	23
8	Madhya Pradesh	820	266.50	NA	86	11
9	Maharashtra	794	40[#]	41	327	41
10	Kerala	704	Nil	163	158	22
11	Tamil Nadu	660	Nil	107	123	19
	Total	**3,956**			**915**	**23**

* Only 2009-14, [#]2010-11 to 2013-14

An analysis of these eleven States indicates that:

i. Though cumulatively the high potential category States contributed more toward capacity installed in absolute values i.e. 2,150 MW as compared with medium potential category States with 915 MW, the latter performed better in terms of percentage of potential exploited i.e. 23 *per cent* as compared with 18 *per cent*;

ii. In the high potential category States, Himachal Pradesh and Karnataka had exploited 27 and 25 *per cent* of their potential as compared with five to 10 *per cent* exploitation by the other four States in this category;

iii. In the medium potential category, Maharashtra stood out with highest contribution both in terms of capacity creation and potential exploited followed closely by Andhra Pradesh, Kerala and Tamil Nadu. Madhya Pradesh, though endowed with considerable potential, lagged behind in exploiting it.

It is therefore important that MNRE and respective Governments of these States prioritize development of hydro potential in the next three years in order to achieve the 12th FYP targets.

[3] States with estimated potential higher than 1,000 MW.
[4] States with estimated potential between 1,000 MW and 600 MW.
[5] Figures refer to the position before bifurcation into separate States of Andhra Pradesh and Telangana.

Audit's findings of the reasons for low capacity creation in some of these States, based on examination of records are given below**:**

Arunachal Pradesh

Memoranda of Agreement were entered with private developers and the State Government for setting up 52 Small/Mini/Micro Hydro Power projects with a capacity of 714.40 MW (upto 25 MW) between 2007-08 and 2014-15. However, none of the projects have been commissioned yet. These were still in the preliminary stages due to various reasons, like pending forest and environment clearances and public hearings, etc.

Chhattisgarh

Chhattisgarh State Renewable Energy Development Agency (CREDA) sanctioned 50 SHP projects of 612.25 MW and identified (2010) about 70 potential sites for development of SHP/Mini Hydro Power (MHP) projects of 2,997 kW but none had been commissioned till December 2014 because of delay in obtaining No Objection Certificate (NOC), local issues and non-execution of Power Purchase Agreement (PPA).

Himachal Pradesh

i. Hydro Power Policy 2006 of the State Government stipulated the timeline for preparation of feasibility report and Detailed Project Report (DPR) submission as 24 months from the date of issue of consent letter / MoU. Himachal Pradesh Energy Development Agency (Himurja) issued 37 consent letters in June and July 2009 but even after five years the Independent Power Producers (IPPs) have not submitted the DPRs. Himurja had levied extension fee of ₹ 1.79 crore (up to December 2013) on 37 IPPs of which only six IPPs had paid full extension fee of ₹ 0.25 crore, 25 IPPs paid partly (₹ 0.33 crore) and six IPPs did not pay at all. Himurja cancelled two[6] projects, 14 were recommended for cancellation and 15 were given show cause notice.

ii. Himurja submitted 88 DPRs between April 2003 and March 2013 for total capacity creation of 278.76 MW to the Department of Energy (DoE) for technical approval but none had been approved so far (August 2014).

iii. IPPs had not submitted the feasibility study report of 78 projects (total capacity 217.87 MW) allotted between February 2008 and March 2013.

Himurja stated (February2015) that matter had been taken with the State Government for extension beyond the period mentioned in the policy. In respect of the non serious IPPs who have neither responded to show cause notice nor deposited any extension fee, the project allotted to them had been recommended for cancellation. The reply is not tenable as Himurja took a long time to act and the projects have still not been cancelled.

Karnataka

The State Government, keeping in view the environmental issues, restricted the mini hydro projects to five MWs and only run-of-the-river projects were encouraged in Western Ghats Districts/Forest areas. Audit observed that 167 allotments made for establishing Mini Hydro projects in the State were held up due to non clearance from the Forest Department.

[6] Dehar-III one MW, Jiya one MW.

The State Government informed (November 2014) that obtaining clearances in this ecologically sensitive region was a major hurdle for implementation of projects and achieving targets.

Uttarakhand

i. The State Government approved (February 2006) 250 kW SHP project at Gauri Chhina (Pauri) for ₹ 2.24 crore with a Central Financial Assistance (CFA) of ₹ 0.93 crore. Scrutiny of records revealed that even after a lapse of seven years from the date of work order (April 2007), only 15 *per cent* of the work was completed at an expenditure of ₹ 0.69 crore. The construction work was discontinued in October 2013. There was also a delay of two years in transfer of forest land. However, Uttarakhand Renewable Energy Development Agency (UREDA) had given assurance to MNRE at the time of seeking CFA that no forest land was involved at the site of the project. Further, there was lack of interest of the firm[7] towards completion of work. The State Government accepted the facts (January 2015).

ii. Gangori SHP (4 X 200 kW) project was commissioned in March 1987 but the project was lying closed since 1990. After the formation of Uttarakhand, the project was transferred to Uttarakhand Jal Vidyut Nigam Ltd (UJVNL) without the land records. UJVNL prepared a proposal (September 2003) for Renovation, Modernization and Upgradation (RMU) of Gangori SHP project of ₹ 1.91 crore. DPR of the project was approved by UJVNL in December 2007, after delay of four years. Due to agitation by the local villagers claiming compensation for the land, which could not be refuted in absence of proper land deeds, it was decided in February 2014 to abandon the project. Expenditure of ₹ 1.60 crore incurred till then was rendered wasteful. The State Government accepted the facts (January 2015).

iii. Scrutiny of 31 SHP projects sanctioned during 2007-14 revealed that 13 projects, to be constructed on public community participation mode, were not only delayed but had not been completed till date (June 2014) due to lack of interest and poor co-ordination of sharing partners which resulted in blocking of funds of ₹ 6.51 crore. The State Government accepted the facts.

The above cases illustrate that there was an urgent need to resolve the hindrances confronting the planning, approval and implementation of projects.

3. Implementation of the SHP Scheme

The SHP scheme was implemented through the State Government Departments, State Electricity Board, State Nodal Agencies (SNAs), private developers, individual entrepreneurs, Non Governmental Organisations (NGOs), Financial Institutions/ banks etc. There were delays and problems in according technical approvals to Detailed Project Reports, allotment of projects, acquiring land for setting up projects and obtaining forest and environmental clearances, several projects could not be taken up and completed in time. The detailed audit findings are given below:

[7] M/s Standard Electronics Instruments Corporation, Roorkee.

3.1. Identification of new potential sites and preparation of plan and DPR

MNRE provided financial support for the overall estimation of potential of SHP projects in the States, identification of new potential SHP sites and for preparation of plan for systematic SHP development in the States.

3.1.1. Few feasibility studies and site identification done by the States

Identification of sites and assessing potential for SHP projects was a critical planning activity. Audit separately enquired from the selected 24 States of feasibility studies and site identification done in each State. Of the 24 selected States only three set targets for conducting feasibility studies between 2007-14 as shown in the Table 23 below:

Table 23: Targets for conducting feasibility studies and achievement

State	Target	No. of studies conducted	No of sites identified
Himachal Pradesh	78	78	Nil*
Nagaland	24	24	13
Uttarakhand	23	23	52

*IPPs had not submitted feasibility/non feasibility report.

This indicates that very few States undertook the process of site identification in a planned manner by setting targets and monitoring against them, beyond the exercise done by MNRE.

MNRE stated (July 2015) that it had no role in this process. The expressions of interest/proposals/bids from private developers are invited by the State Government. MNRE should have ensured that the States take up feasibility studies and identification of sites as MNRE was responsible for developing SHP projects upto 25 MW. Identification of new potential sites and systematic detailed survey and investigation of all identified potential sites was a primary and critical component for SHP development.

3.1.2. Delays and problems in the DPRs prepared by the States

Apart from the three States mentioned above, some States also conducted feasibility studies, though no targets for such studies were set. Due to delays and problems in according technical approvals to Detailed Project Reports, allotment of projects, acquiring land for setting up projects and obtaining forest and environmental clearances, several projects could not be taken up and completed in time. Audit findings on the status and quality of feasibility studies are presented below:

Chhattisgarh

CREDA awarded DPR work (May 2005) to M/s Savitri Power Projects Ltd, Hyderabad for ₹ 2.52 lakh along with the project at an estimated project cost of ₹ 7.28 crore. However, the application of the firm requesting for release of assistance for preparing DPR was pending with MNRE for eight years. MNRE stated (July 2015) that CREDA had not taken the prior approval/sanction for DPR work, hence the CFA was not considered.

Himachal Pradesh

The potential sites were identified on the basis of preliminary reconnaissance only and no system existed to assess power potential accurately to obviate the chances of enhancement of capacity or cancellation of projects due to non-feasibility at a later stage.

Audit scrutiny (July 2014) revealed that because of above there was a variation of 40 to 1,300 *per cent* in the capacity allotted to the various SHP projects (136.50 MW) and the actual capacity addition (407 MW) in SHP projects.

Tamil Nadu

As per notification dated 11 December 2009 of the MNRE, Tamil Nadu Generation and Distribution Corporation (TANGEDCO) was entitled to receive subsidy for preparation of DPRs for the identified SHP projects, as also capital subsidy for setting up the projects. Though TANGEDCO had claimed the eligible subsidy in 2010 and followed it up with several reminders with MNRE, it was yet to receive the eligible amount of ₹ 25.90 crore. MNRE stated (July 2015) that TANGEDCO had not taken the prior approval/sanction for DPR and also work awarded the on single tender basis which was violation of provision of guideline, hence the CFA was not considered.

Uttar Pradesh

MNRE has identified 251 sites and estimated potential of 460.75 MW in Uttar Pradesh whereas the State Government had identified only 57 sites and potential of 167 MW for installation of SHP projects. Out of the 57 sites, pre- feasibility report and DPR in case of only 11 sites had been prepared in 2004-05.

3.2 Delays in allotment of projects

Audit observed instances when allotment of projects where DPRs had been prepared was inordinately delayed, hampering the exploitation of potential. These instances are reported below:

Himachal Pradesh

Himurja prepared DPRs for 16 projects (total installed capacity 63.05 MW) at a cost of ₹ 88.71 lakh for which MNRE sanctioned CFA of ₹ 72 lakh during 2010-11. It took up the matter with the State Government for execution of the projects. However, the State Government allowed Himurja to set up only three projects[8] (14.5 MW) on BOT (Built Operate and Transfer) basis and the remaining 13 projects were yet to be allotted though a period of more than three years had elapsed since the preparation of DPRs. The three projects allotted to Himurja had also not been taken up for execution so far (March 2014).

[8] Lower Sumej, Tauhak and Kareri.

Punjab

Punjab Energy Development Agency (PEDA) allotted (between August 1999 and January 2010) 19 MHP sites having power potential of 17.13 MW on Built, Operate and Own (BOO) basis to six private developers, to be developed within two years of allotment. Audit noticed that the developers did not take any steps to perform their obligations after signing Implementation Agreements (IAs) with PEDA even after getting extension ranging between 450 and 1,391 days. Resultantly, PEDA terminated all the agreements between June 2009 and October 2013 and encashed performance bank guarantee of ₹ 49 lakh. Audit further noticed that out of these 19 cancelled MHP sites, seven MHP sites with power potential of 9.40 MW only were re-allotted during March 2010 to October 2013 and 12 MHP sites with power potential of 7.73 MW were not allotted even after a lapse of eight to 60 months. PEDA stated that efforts were being made to harness the potential.

Uttar Pradesh

Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA) invited bids for 11 projects in December 2010 and January 2013 but only one project (Walipura, Bulandsahar) had been allotted so far (November 2014). Proposal for another two were pending with MNRE. Considering that Uttar Pradesh was an electricity deficit State there was need for greater efforts to harness the small hydro energy.

3.3 Problems in Land acquisition and Forest and Environmental clearances

In 24 selected States Audit observed that a number of SHPs were held up for problems in acquiring land or getting forest clearances. While the impact of problems in getting clearances on projects in Karnataka and Uttarakhand has been reported in para 2.3, other such instances that came to the notice of Audit are reported below:

Bihar

Audit observed that MNRE released CFA of ₹ 1.31 crore to three[9] SHP projects during 1995-96. All the three projects were held up for want of forest clearances. Neither Bihar State Hydroelectric Power Corporation limited (BSHPCL) nor MNRE monitored the projects. BSHPCL could not furnish the details of fund utilised and work executed. As per the terms and condition of the MNRE sanction, the BSHPCL was liable to return the CFA along with interest of ₹ 3.20 crore.

Meghalaya

MNRE sanctioned (March 2001) ₹ 7.39 crore for revival of abandoned Sonapani SHP project. Meghalaya State Electricity Board (MeSEB) could take the possession of land, free from all encumbrances only in October 2009. Similarly Lakroh SHP project was sanctioned (March 2001) by MNRE for ₹ 11.76 crore. MeSEB could acquire the required land only in January 2008 after a delay of more than six years. The projects had not been commissioned so far (September 2014).

[9] Lower Ghagri ₹ 40 lakh, Sadani ₹ 90 lakh and Netharhat ₹ 1 lakh.

MNRE stated (July 2015) that the Techno-Economic Clearances were provided by the State Government and will advise all the State Government to expedite the pre-requisite clearances.

3.4 Delay in completion of projects – time and cost overruns attributable to implementing agencies

As per guidelines of MNRE, the projects should be completed within five years of release of first installment for run-of-the-river project and three years for canal based projects. Approved projects could not be completed due to negligence of contractors, midway changes in design, etc. resulting in significant time and cost overruns. The detailed audit findings are highlighted below:

Assam

Lungnit SHP project was approved (March 2000) by MNRE. The State Government approached the Ministry of Environment and Forests (MoEF) for forest clearance in February 2004, after a delay of four years. MoEF accorded the clearance in December 2004. The estimated cost of the project was ₹ 55.61 crore and the contracted value was ₹ 47.08 crore. Till November 2014 expenditure of ₹ 11.11 crore had been incurred but the project was still in initial stages only. The project was delayed due to the negligence of the contractor to whom a mobilization advance of ₹ 4.32 crore was released. The contract was terminated in August 2012 without recovering ₹ 3.93 crore. The contract had not been re-awarded as yet (December 2014).

Bihar

BSHPCL was sanctioned 23 projects by MNRE during the period 2005-12. Only eight projects were completed and remaining 15 under construction projects were yet to be completed despite lapse of time ranging between 37 to 88 months from the date of release of first installment of subsidy and after incurring an expenditure of ₹ 128.19 crore, including MNRE subsidy of ₹ 19.15 crore. The last installment of ₹ 2.95 crore for eight projects was not released by the MNRE due to non submission of completion report, Utilisation Certificate (UC), audited accounts etc. Four projects[10] could not be started due to non-availability of forest land. No reply was furnished by BSHPCL.

Audit scrutiny further revealed that each of the eight completed projects was delayed. The delays ranged between 41 to 59 months from date of release of first installment in three canal based projects[11] and between nine to 68 months in all eight commissioned projects. The cost overrun in these eight projects was ₹ 48.06 crore.

Mizoram

MNRE approved (October 2011) five MW SHP projects for ₹ 56.93 crore. The project which was necessary for North Eastern Rural Development Blocks of Mizoram especially for Ngopa, Khawzawl and S. Khawbung having 114 villages located in the remotest corner bordering Myanmar was to be completed within 36 months. But, monthly progress

[10] Dhobaha SHP, Sadani SHP, Lower Ghaghri SHP and Netarhat SHP.
[11] Arwal, Belsar and Sewari.

report as of June 2014 revealed that the progress of work was very slow. Zoram Energy Development Agency (ZEDA) in its reply (January 2015) stated that the delay was due to late tender process, non inclusion of items of work like bailey bridge, transmission lines in the contractor's package and non release of mobilization advance by the State Government.

Punjab

As per Project Implementation Schedule, 19 projects were to be commissioned within 16 months[12] from the date of Implementation Agreement (IA). Audit noticed that out of 12 projects at 19 sites of 11.05 MW, commissioned between 2009-14, only one[13] project was commissioned within scheduled time and the remaining 11 projects were commissioned with delays ranging between three and 86 months.

Further, out of 19 projects (at 20 sites) under execution with power potential of 28.94 MW allotted (between April 1998 and October 2013) by PEDA to private developers as of March 2014, IAs were signed for 16 projects between August 2001 and October 2012. Out of these 16 projects, commissioning of nine projects with power potential of 18.05 MW were inordinately delayed by 16 to 135 months (position as of March 2014) beyond the prescribed time period. Remaining three projects allotted between December 2009 and October 2013 were at DPR stage and IAs were not signed as yet (October 2014).

Tamil Nadu

Test check in audit of seven[14] completed/ongoing SHP projects revealed that in all the seven projects, there were slippages in time schedule ranging between 49 and 87 months with consequential cost overrun of ₹ 448.75 crore. Even after commissioning, the Perunchani and Periyar Vaigai Projects suffered frequent forced outages due to mechanical problems, causing loss of generation. The delays in commissioning together with the outages caused loss of generation equivalent to 455.42 MUs during the period 2007-2014. The factors contributing to the increase in cost of the projects were delays in awarding of contracts, midway changes in design, increase in cost of materials and equipment etc.

From the above findings it was evident that poor planning and implementation led to low exploitation of SHP resources in the country, apart from time and cost overruns.

4. Deficiencies in operation and maintenance of the projects

4.1 Non/under performance of commissioned projects

The success of the SHP programme lay not only in commissioning projects but also in ensuring that these were properly run and maintained after commissioning. During test check in audit in five States, 60 projects[15] were found shut down or under repairs and

[12] 485 days.
[13] Terkiana head works.
[14] Perunchani Mini Hydel, Periyar Vaigai Small Hydro (PV-I to IV) and Bhavani Barrage Small Hydro (BB-I and II)
[15] Arunachal Pradesh (47 projects), Bihar (one project), Himachal Pradesh (five projects), Punjab (four projects), and Mizoram (three projects).

maintenance or working below capacity due to low discharge of water, leading to loss of power generation and revenue. Individual cases of interest that were noticed during audit are reported below:

Arunachal Pradesh

Department of Hydro Power Development (DHPD)

i. Between 2007 and 2014, the installed capacity under DHPD increased from 34.095 MW to 61.810 MW but the percentage of electricity generation decreased from 17.48 *per cent* (2007-08) to 9.91 *per cent* (2013-14). Due to low generation, the power loss was 3,018.23 MU. This was because DHPD did not operate/under-operated 19 SHP projects since their commissioning, due to non-availability of sufficient operating staff (seven projects), low discharge of water (eight projects), non-repair/replacement of defective Electrical & Mechanical equipment and non-availability of sufficient transmission and distribution lines (two projects), fixing of unsuitable head (one project) and non-commissioning (one project), resulting in unfruitful expenditure of ₹ 33.70 crore, besides depriving 171 villages of electricity.

ii. In addition, DHPD started (January 2011) Renovation & Modernization (R&M) of 15 SHP projects to be completed by November 2012. But even after incurring an expenditure of ₹ 43.29 crore[16] the work has not been completed (September 2014) as the State Government only released ₹ 4.94 crore out of committed share of ₹ 32.46 crore leaving a balance of ₹ 27.52 crore. DHPD stated that the R&M projects were rescheduled to be completed by March 2015, subject to release of funds from MNRE.

iii. In respect of Rina SHP project it was observed that due to low discharge of water and non-availability of sufficient transmission capacity, DHPD generated 9.30 MUs of power against the targeted generation of 63.06 MUs, resulting in loss of generation of 53.76 MUs during 2008-14.

iv. Both machines of Units I & II of Bramdhongchung - I SHP (100 kW) project were not working (July 2013) due to turbine problems and the machines were taken out and kept in the power house.

Arunachal Pradesh Energy Development Agency (APEDA)

v. In respect of 11 test-checked SHP projects (485 kW) of APEDA, generation was very low, where APEDA lost generation of 3.09 MUs. Reasons for the shortfall were not on record.

vi. 11 SHP projects, with a capacity of 275 kW and constructed at a cost of ₹ 4.17 crore, were rendered non-operative after working for 18 to 72 months due to availability of local grid connection to the villages. Neither the State Government nor APEDA re-deployed the energy systems to other needy places nor connected the plants to the local grid for continuous operation. Besides, the plant and machinery would become unusable due to wear and tear, rust, etc.

[16] CFA of ₹ 10.77 crore, State share ₹ 4.94 crore and Prime Minister's Package of ₹ 27.58 crore.

Bihar

i. One unit of 1.5 MW Triveni Link Canal project (1.5X2 MW) at Valmikina (Bihar) installed in February 2009 was shut down since May 2013 due to inadequate repair and maintenance.

ii. BSHPCL generated only 56.70 MUs (20 *per cent*) of energy during the period 2013-14 as against design energy of 278 MUs for SHP projects.

Himachal Pradesh

Himachal Pradesh Electricity Regulatory Commission (November 2013) specified capacity utilisation factor of 55 *per cent* for SHP projects for the purpose of tariff determination. Test check (August 2014) of five SHP projects[17] revealed that against a target of 172.48 MUs during the period 2007-14, the projects could generate only 83.40 MUs leading to a loss of ₹ 26.28 crore[18].

Punjab

Mention was made in paragraph 3.14.7 of the Audit Report No. 4 of 2009-10, Government of Punjab regarding less[19] generation of power from four MHP projects having total capacity of 3.9 MW[20] during 2005-2010. Audit further noticed that generation of power from these MHP projects during the year 2010-11 was 0.44 MUs only against the annual target of 10 MUs and the Operation and Maintenance (O&M) contractor stopped generation in all four MHP projects from May 2010. On failure of the contractor to execute the contract as per provisions, Punjab State Power Corporation Limited (PSPCL) sent (April 2011) the Bank guarantee (BG) of ₹ 25 lakh for encashment to the Bank, but the same could not be done because the serial number of the stamp paper of the BG did not match with its copy in the Bank. The possession of these MHP projects was taken over from the contractor (March 2012) but PSPCL noticed that major components of the plants were missing from the sites. Arbitrator awarded (14 August 2012) finally a claim of ₹ 6.28 crore in favour of PSPCL which was not recovered from the contractor as of February 2015.

Mizoram

i. Serlui-B project should have generated 178.72 MU in four years but it only generated 104.33 MUs leading to loss in revenue of ₹ 22.31[21] crore. ZEDA in its reply (January 2015) attributed the low generation to occurrence of non repairable defects in third unit after trial run. It further stated due to the absence of provision for third party inspection in original project, this had not been conducted.

ii. Out of 11 hydro power stations in Mizoram, Turivang power station (300 kW) was not operating since long. As per DPR the remaining projects should have operated at 70 *per cent* load factor for seven months every year. Audit observed that during 2007-14 against the required generation of 565.35 MUs, the SHP projects only generated 211.547 MUs. ZEDA stated (January 2015) that the generation was

[17] Lingti, Rukti, Nogli, Aloe and Kothi
[18] 89.08 MU x ₹ 2.95 (tariff) = ₹ 26.28 crore.
[19] During 2005-10, only 28.2 MUs were generated against the projected 50 MUs (10 MUs per year).
[20] Nidampur (0.80 MW), Rohti (0.80 MW), Thuhi (0.80 MW) and Daudhar (1.50 MW).
[21] 74.39 MU x ₹ 3.00(tariff) = ₹ 22.31 crore.

affected as many of the SHP projects are more than 20 years old and one SHP project at Tuipanglui was damaged due to cloud burst. Further, it stated paucity of fund for operation and maintenance, resulting in low generation.

iii. Serlui-A, one MW SHP project in Mizoram was commissioned in 1984. MNRE sanctioned (March 2004) R&M for ₹ 1.91 crore, which was completed (September 2007) and the project was re-commissioned (July 2008) at a cost of ₹ 2.57 crore. Audit observed that as against desired generation of 3.53 MUs annually, the SHP project generated only 2.34 MUs annually during 2008-14. ZEDA in its reply (January 2015) assigned the reasons for low generation as poor hydrology in the area but remained silent on non reparability of machines as observed by the Original Equipment Manufacturer (OEM). Audit observed that ZEDA ignored the fact of poor hydrology, age of the project (over 20 years old) and observation made by the OEM, and carried out repair and modernization work. Thus the expenditure incurred on the project proved to be infructuous.

The above findings indicate that there were a large number of projects that had been commissioned and reported as a part of installed capacity in the country, but were either not functioning or functioning sub-optimally.

4.2 Non collection of consumption charges

As per Agreements with contractors, Arunachal Pradesh Energy Development Agency (APEDA) was required to form Village Energy Management Committees (VEMCs), for operation and maintenance of SHP projects, with beneficiaries as members. However, APEDA formed only 12 VEMCs for 74 SHP projects commissioned between January 2005 and February 2014. In the absence of VEMCs, APEDA incurred an expenditure of ₹ 82.30 lakh for operation, maintenance and repair of damaged works etc; on its own. Besides, APEDA did not collect consumption charges of ₹ 1.73 crore from beneficiaries for supply of 6.30 MUs of energy.

4.3 Generation and Evacuation of power

Adequate infrastructure and PPAs are a prerequisite for ensuring the successful functioning of projects. As per guideline of MNRE the project developer had to enter into PPAs with the State Utility before submitting application for financial support from MNRE. Audit examination revealed deficiencies in Himachal Pradesh on both arrangements as reported below:

i. Electricity generation of SHP (Beas Kund nine MW) project commissioned in June 2012, was blocked (7.5 MUs) during 2012-14 due to inadequate evacuation infrastructure. This resulted in loss of energy to the extent of ₹ 2.21 crore[22].

ii. PPA in respect of one SHP (Binwa IV) project with installed capacity of four MW, commissioned in July 2013 had not been signed with distribution licensee so far (August 2014).

[22] 7.5 MU X ₹ 2.95 (tariff) = ₹ 2.21 crore.

5. Other audit findings

5.1 Unwarranted financial accommodation of developers

5.1.1 Non levy and recovery of Liquidated damages, environmental dues, capacity enhancement, commitment fees, etc.

Audit observed certain instances of unwarranted financial accommodation of the developers by the State Agencies, in contravention of applicable terms and conditions of the award of contract. These are reported below:

Himachal Pradesh

i. Hydro Power Policy of the State stipulated that if the capacity of the project below five MW was enhanced the IPP would have to pay additional premium and additional free power as applicable for projects above five MW. Audit noticed (July 2014) that capacity addition charges/upfront premium of ₹ 3.90 crore was not deposited by four developers[23] for capacity enhancement. These projects were allotted initially for total 6.60 MW during 2005-07 which was later enhanced to 45.60 MW. Neither IAs had been signed nor upfront premium/capacity addition charges deposited even after lapse of more than seven to nine years.

ii. Further the Hydro Power Policy 2006 provided that 1.5 *per cent* of the final cost of the projects above five MW and one per cent of the final cost up to five MW would be contributed towards Local Area Development Fund (LADF) for Environmental Management Plan, Catchment Area Treatment Plan, Compensatory Afforestation etc. Audit observed (September 2014) that four IPPs were commissioned between January 2008 and May 2013 but LADF of ₹ 4.87 crore [24] was not deposited by them.

Madhya Pradesh

Eleven developers in Madhya Pradesh had originally applied to Narmada Valley Development Authority/ Water Resource Department and were migrated to the new policy (November 2011). Three[25] developers did not pay commitment fee of ₹ one lakh per MW after migration to the new policy. None of the developers paid project performance guarantee of ₹ one lakh per MW aggregating to ₹ 2.67 crore. But no action was taken by the SNA. None of the developers executed Hydro Power Development Agreement (HPDA). It was further noticed that no specific project completion and other related activities i.e. DPR etc were prepared by any developer.

Maharashtra

MEDA did not levy Liquidated Damages amounting to ₹ 3.59 crore in respect of seven[26] projects, where the projects were commissioned with delays ranging from 360 days to 1,320 days and all RE benefits had been released to these developers.

[23] Parbati project 12 MW - ₹ 1.09 crore, Sharmi project 9.60 MW-₹0.71 crore, Hurla-I project 9.40 MW - ₹ 0.84 crore and Kurpan-III project 14.60 MW- ₹ 1.26 crore.

[24] M/s Kapli Mohan & Associates Hydro Power Pvt. Ltd: Beas Kund 9 MW-₹ 1.14 crore; Om Hydro Power Ltd: Neogal 15 MW-₹ 0.77 crore; Rangaraju Ware Housing Pvt Ltd: Sumej 14 MW-₹ 1.08 crore; Patikari Hydro Electric Project Ltd: Patikari 16 MW-₹ 1.88 crore.

[25] Hata (4 MW), Danwa (5 MW) and Pancpani (4.5 MW).

[26] Veer Nira Left Bank Canal, Sonawade, Kolhapur Kumbhi, Chitri, Gadre Marine Export, Kasari and Dhom Balkawadi.

5.1.2 Excess payments for evacuation arrangements and tariff

Audit observed following instances of excess payments to developers.

Bihar

Loss of revenue

In 2009, on a tariff petition filed by BSHPCL, BERC[27] fixed provisional tariff of ₹ 2.49 per kWh as the annual accounts were in arrear since 2001-02 and also directed BSHPCL to update its accounts and get them audited. In April 2010, BSHPCL filed petition for revision in tariff to ₹3.72 per kWh which was rejected by BERC in June 2010 because BSHPCL could not submit audited annual accounts from 2001-02 onwards, and the provisional tariff continued to be applicable (December 2014). This led to loss of revenue of ₹ 21.98 crore, during the period 2011-14. Further, Audit observed that the CERC rate for SHP was ₹ 4.00, ₹ 3.65, ₹ 3.84, ₹ 4.16 and ₹ 4.40 per unit during the period 2009-14 which was substantially higher than the rate allowed to BSHPCL. No reply was furnished by BSHPCL.

Maharashtra

Excess payment towards evacuation arrangement

The State Government stipulated (July 2010) that MEDA will reimburse 50 *per cent* of the expenditure on evacuation at the rate ₹ 11 lakh per km, limited to actual expenditure or ₹ 1.10 crore, whichever is lower. Audit scrutiny revealed that MEDA reimbursed ₹ 2.53 crore as against ₹ 0.64 crore admissible in respect of five[28] projects having capacity upto five MW.

Punjab

Extra payment due to delay

PEDA(Punjab) allotted (November 1997) five[29] MHP projects of 5.05 MW to M/s Triveni[30] Engineering and Industries Limited for which Implementation Agreement (IA) was signed (November 2001) and the PPA was to be signed within 90 days from the IA, but the PPA was signed in November 2008. Due to delay in signing of the PPA, Punjab State Power Corporation Limited had to purchase power at higher rates ranging between ₹ 3.81 and ₹ 4.04 per unit during 2009-14 instead of ₹ 3.66 per unit (fixed) as per New and Renewable Sources of Energy Policy 2001[31]. The developer sold 1,039.112 lakh units during 2009-14 on which PSPCL had to make an extra payment of ₹ 3.59 crore.

5.1.3 Payment of higher CFA

In Himachal Pradesh it was observed that a MoU for the construction of three MW capacity Aloe-I SHP project was signed (March 2001) with M/s Aloe Manali Hydro Power Private

[27] Bihar Electricity Regulatory Commission.
[28] Veer Nira, Sonawade, Kolhpur Kumbhi Lakmapur, Kasari and Tembhu.
[29] Akhara, Gholian, Channuwal, Khanpur and Sudhar on Abohar Canal Branch.
[30] Renamed as Abohar Powergen Limited.
[31] As per NRSE policy, 2001, rate per unit was ₹ 3.01 (base year 2000-01) with five *per cent* annual escalation up to 2004-05 for the projects for which PEDA had already entered into MoU/IA. No escalation was to be paid beyond 2004-05.

Limited with a CFA of ₹ three crore. But at the time of Techno Economic Clearance in January 2002 it was known that the discharge from Allian Nala would get reduced and the plant capacity would be lower and corresponding eligible CFA would be only ₹ one crore. After 2010, the generation capacity of the unit was reduced to 510 kW due to reduction in water discharge after commissioning of Allian- Duhangan Project. This aspect was ignored at the stage of technical clearance for three MW in September 2006, allowing the developer to claim higher CFA.

5.2 Allotment of project to ineligible contractors

As per bidding document of Jammu & Kashmir Energy Development Agency (JAKEDA) the eligibility criteria for contractors were - permanent resident of Jammu & Kashmir; and experience of developing and executing infrastructure projects of aggregate cost not less than ₹ 0.75 crore, of which ₹ 0.25 crore should be for hydro electric related projects, in the last 10 years. Audit observed that work (six projects) was awarded (February 2013) to five[32] ineligible contracts.

5.3 Non maintenance of records of land acquisition

DHPD and APEDA in Arunachal Pradesh did not maintain any evidence of land acquisition for projects. It was stated that in lieu of land compensation, work orders were issued for carrying out civil works. However, details of the extent of land acquired, names of land owners and the number and value of work orders issued were not maintained either by the DHPD or APEDA.

5.4 Poor quality of work executed

As per Schedule of Work, power houses of Sikin Koro and Sinyum Koro SHPs in Arunachal Pradesh were to be constructed with cement concrete. During physical verification of the projects, it was noticed that the power houses were constructed with ordinary material - the walls of power houses were of Corrugated Galvanised Iron Sheets. However, the full amount of ₹ 10.39 lakh was paid to the contractor as per Schedule of Work by the DHPD, which was irregular. DHPD stated (December 2014), that after enquiry, responsibility would be fixed on concerned officers.

6. Monitoring and evaluation

As per MNRE's guideline the implementing agencies would set up reviewing arrangements to closely monitor the implementation of projects. MNRE itself or through third party/consultants may also monitor the implementation and post commissioning of the projects. Implementing agencies were also required to submit monthly generation data to MNRE for ten years after commissioning.

MNRE had conducted third party evaluations for 70 projects installed during the 11th FYP, however, no generation data was available with MNRE.

[32] M/s JK Renewable Energy, M/s SA Power Utilities Pvt Ltd, M/s Gousia Road Construction Company, M/s Sharika Enterprises and M/s A.M. Contractors.

7. Conclusion

About 7,000 MW capacity was targeted for installation through Small Hydro Power projects by the end of the 12th Five Year Plan period i.e. by 2017. Of this 3,395 MW i.e. 48.50 *per cent* had been created by the end of the 11th Five Year Plan period i.e. by 2011-12. During the 12th Five Year Plan period, as of 2013-14, MNRE added another 408 MW only and was running behind its targets by 38 *per cent*. This implied that a significant 3,197 MW capacity would be required to be added in the remaining three years of the 12th Five Year Plan period to be able to meet target for development of Small Hydro Power. In eleven States endowed with 81 *per cent* of the National Small Hydro Power potential, the exploitation varied from five to 41 *per cent* of the potential.

MNRE had identified 6,474 potential sites with aggregate capacity of 19,749 MW in 29 States for setting up Small Hydro Power projects. As of 2013-14, 997 projects with capacity of 3,803 MW were installed. Thus, of the total capacity identified, only 19 *per cent* had been exploited so far. 254 projects (895 MW) were under implementation.

Audit observed delays and problems in conducting feasibility studies for identifying potential sites for setting up Small Hydro Power projects, which was a critical planning activity for development of Small Hydro Power. In Himachal Pradesh 37 consent letters were issued but the Independent Power Producers did not submit any Detailed Project Report even after five years; out of 88 Detailed Project Reports submitted by Himurja to the Department of Energy for technical approval none had been approved and the Independent Power Producers had not submitted feasibility study reports for 78 projects allotted to them.

Further, due to delays and problems in according technical approvals to Detailed Project Reports, allotment of projects, acquiring land for setting up projects and obtaining forest and environmental clearances, several projects could not be taken up and completed in time. In Arunachal Pradesh the State Government had entered into agreement with private developers for setting up 52 Small/Mini/Micro Hydro Power projects of 714.40 MW but none had been commissioned. Similarly, in Chhattisgarh the State Nodal Agency sanctioned 50 Small Hydro Power projects of 612.25 MW but none had been commissioned.

Approved projects could not be completed for various reasons such as negligence of contractors, midway changes in design, etc. This led to significant time and cost overruns. In Bihar 15 projects had not been commissioned even after a delay of 37 to 88 months and incurring an expenditure of ₹ 128 crore.

Audit also observed deficiencies in post-commissioning maintenance of the projects. Test check revealed that 60 projects in five States were shut down, under repair and maintenance or working below capacity, resulting in loss of power generation, revenue losses, unfruitful expenditure on out of order plants, wasteful expenditure on abandoned plants, etc.

There were instances of non-recovery of liquidated damages, environmental dues, commitment fees, diversion of funds, excess payments to developers, non-revision of tariffs, etc. There were also deficiencies in monitoring and evaluation of projects by MNRE and State agencies.

8. Recommendations

- *MNRE must ensure that pre-requisites such as land and statutory clearances are obtained before release of Central Financial Assistance to developers, in order to avoid time and cost overruns.*

- *MNRE should focus on reviewing Small Hydro Power projects that are held up or are under performing, to find solutions to the problems hindering the completion of these projects.*

Chapter - VI

Biomass Power

1. Introduction

Biomass is an important source of RE because it is widely available, carbon-neutral, capable of providing firm energy and generating significant employment in the rural areas. About 32 *per cent* of the total primary energy used in the country is still derived from biomass and more than 70 *per cent* of the country's population depends upon it for its energy needs. Biomass is the most commonly used energy source for several small-scale industries and is used as fuel for independent power plants. Biomass materials used for power generation include sugarcane bagasse and other non bagasse materials like rice husk, straw, cotton stalk, coconut shells, soya bean husk, de-oiled cakes, coffee waste, jute waste, groundnut shells, saw dust etc.

2. Biomass resource assessment

As per MNRE biomass resource assessment conducted between 2002 and 2004, the availability of biomass in India was estimated at about 500 Million Metric Tonnes (MMT) per year. The surplus biomass availability was estimated at about 120-150 MMT per annum covering agricultural and forestry residues, corresponding to a potential of about 18,000 MW. As per MNRE, this potential can be increased significantly by exploring the opportunity of high yield varieties and energy plantations in the wastelands. This apart, about 5,000 MW additional power could be generated through bagasse based cogeneration in the country's 550 sugar mills, if these sugar mills were to adopt technically and economically optimal levels of cogeneration for extracting power from the bagasse produced by them.

2.1. Variation in potential assessment done by MNRE and the States

The installed capacity of grid interactive Biomass power in the country at the beginning of the 11th Plan period was 1,184 MW. It rose to 4,123 MW by March 2014, which was 23 *per cent* of the country's Biomass potential of 17,981 MW. Of the 24 test checked States, 16 undertook Biomass energy potential assessment independent of MNRE. The comparative position of the biomass potential as assessed by MNRE and the State Nodal Agencies (SNAs) is given in Table 24.

Table 24: Biomass power potential as assessed by MNRE and SNAs

(in MW)

S. No.	State	Potential estimated by MNRE	Potential estimated by SNA	Variation
1	Andhra Pradesh	150.20	448.50	-298.30
2	Arunachal Pradesh	Not assessed	Not assessed	Not assessed
3	Assam	165.50	Not assessed	Not assessed
4	Bihar	530.30	Not assessed	Not assessed
5	Chhattisgarh	220.90	1,000	-779.10
6	Gujarat	1,014.10	900	114.10

S. No.	State	Potential estimated by MNRE	Potential estimated by SNA	Variation
7	Haryana	1,261	1,150	111
8	Himachal Pradesh	128	Not assessed	Not assessed
9	Jammu & Kashmir	31.80	Not assessed	Not assessed
10	Jharkhand	66.80	90	-23.20
11	Karnataka	843.40	2,500	-1,656.60
12	Kerala	762.30	1,044	-281.70
13	Madhya Pradesh	1,065.40	Not assessed	Not assessed
14	Maharashtra	1,585	2,281	-696
15	Meghalaya	1.10	165.30	-164.20
16	Mizoram	Not assessed	Not assessed	Not assessed
17	Nagaland	3.10	Not assessed	Not assessed
18	Odisha	147.30	240	-92.70
19	Punjab	2,674.60	1,100	1,574.60
20	Rajasthan	4,595	1,039	3,556
21	Tamil Nadu	863.70	1,671	-807.30
22	Uttar Pradesh	1,477.90	3,757	-2,279.10
23	Uttarakhand	6.60	262.31	-255.71
24	West Bengal	368.30	6,663	-6,294.70

Source: MNRE and SNAs.

Analysis of the data in the above table brings out that:

i. There were variations in the biomass potential assessed by MNRE and the SNAs in 16 States that undertook such study.

ii. The potential assessment was done by MNRE in 2002-04, and no efforts were made by MNRE to reconcile their potential assessment with that of the SNAs so that efforts could be made to concentrate on the States having high potential. In Rajasthan, this difference was more than 3,500 MW.

iii. Eight SNAs had not done any potential assessment, significant among them was the SNA of Madhya Pradesh, which ranked sixth in terms of potential assessed by MNRE.

A comprehensive mapping of biomass resource is required to be carried out in order to estimate the realistic achievable biomass power potential. MNRE had initiated various studies and has undertaken the launch of Bio energy mission in the 12th plan period.

MNRE stated (July 2015) that there was no co-relation between potential assessed by IISc[1] and SNAs. The variation might be due to dynamic nature of crops, year of survey and assumptions used in the survey. However, the reply needs to be viewed in light of the fact that there were large variations indicating that the assumptions used in the survey were not correct and scientific.

[1] Indian Institute of Science, Bangalore.

3. Target and achievements

3.1. Targets and achievement

The targets and achievements of MNRE under the 11th Five Year Plan (FYP) and 12th FYP upto 2014 are given in the following table:

Table 25: Targets and achievement under 11th and 12th FYP

S. No.	Year	Target		Achievement	
11th Five Year Plan Period (2007-12)					
				Bio power@	Bagasse
1	2007-08	250		81	185
2	2008-09	300		97	248
3	2009-10	400		151	297
4	2010-11	455		144	322
5	2011-12	450		153	317.70
	Total	1,855		626	1,369.70
12th Five Year Plan Period (upto 2014)					
		Bio power@	Bagasse		
6	2012-13	105	350	114.70	352.20
7	2013-14	105	300	101.60	310.92
	Total	210	650	216.30	663.12
	Grand Total	**2,715**		**2,875.12**[2]	

Source: MNRE.

@ Other than bagasse

As per MNRE, as against the target of 2,715 MW the capacity created was 2,875.12 MW during 2007-14. In addition to above installed capacity, projects of 1,150 MW capacity were in pipe line (May 2015).

3.2. Variation in achievement as reported by MNRE and SNAs

MNRE had not fixed any State wise targets. Data collected from 24 test checked States of their targets and achievements juxtaposed against the achievements reported by MNRE is given in Table 26.

[2] However, the State wise installed capacity as per MNRE was 4,013.55 MW.

Table 26: Targets and achievements reported by SNAs and MNRE in creation of installed capacity as on 31 March 2014

(in MW)

S. No.	State	As per SNA			As per MNRE	Variation (*per cent*)
		Targets	Achievement	Variation (-) shortfall (percent)	Achievement	
(i)	(ii)	(iii)	(iv)	(v)	(vi)	vii (iv-vi)
1	Andhra Pradesh[3]	No targets	467.98		380.75	87.23 (19)
2	Arunachal Pradesh	No targets	Nil		Nil	Nil
3	Assam	No targets	Nil		Nil	Nil
4	Bihar	10.02	8.12	-1.90 (-19)	43.42	-35.30 (-435)
5	Chhattisgarh	No targets	260		264.90	-4.90 (-2)
6	Gujarat	No targets	31.20		43.90	-12.70 (-41)
7	Haryana	242	60.90	-181.10 (-75)	45.30	15.60 (26)
8	Himachal Pradesh	No targets	Nil		Nil	Nil
9	Jammu & Kashmir	No targets	Nil		Nil	Nil
10	Jharkhand	No targets	Nil		Nil	Nil
11	Karnataka	581	613	32 (6)	603.28	9.72 (2)
12	Kerala	No targets	Nil		Nil	Nil
13	Madhya Pradesh	296.85	12	-284.85 (-96)	26	-14 (-117)
14	Maharashtra	1,605	1,245.45	359.55 (22)	940.40	305.05 (24)
15	Meghalaya	No targets	Nil		Nil	Nil
16	Mizoram	No targets	Nil		Nil	Nil
17	Nagaland	No targets	Nil		Nil	Nil
18	Odisha	No targets	20		20	0
19	Punjab	1,100	105	-995 (-90)	140.50	-35.50 (-34)
20	Rajasthan	322	70	-252 (-90)	101.30	-31.30 (-45)
21	Tamil Nadu	No targets	870		571.30	298.70 (34)
22	Uttar Pradesh	No targets	1,142		776.50	365.50 (32)
23	Uttarakhand	No targets	52		30	22 (42)
24	West Bengal	595	85	-510 (-86)	26	-59 (-69)

Source: MNRE and SNAs.

From the Table 26 it can be seen that

i. Sixteen States had not fixed any targets for exploitation of biomass potential during 2007-14. However, seven of these 16 States still reported capacity creation and in the case of Uttar Pradesh and Tamil Nadu it was substantial.

ii. Of the eight States which had fixed targets for themselves, in six there was shortfall in achieving the targets. The shortfalls were as high as 96 *per cent* in Madhya Pradesh, 86 *per cent* in West Bengal and 90 *per cent* in Punjab and Rajasthan. Karnataka and Maharashtra were able to exceed their targets.

[3] Figures refer to the position before bifurcation into separate States of Andhra Pradesh and Telangana.

iii. There was variation in the achievement reported by MNRE and SNAs. No efforts were made by MNRE to reconcile these differences, even though it is the nodal Ministry for the implementation of biomass programme.

MNRE stated (July 2015) that the variation was due to difference in capacity addition of sugar mills of the States, biomass availability, financial tie up, interest rate, State Government policies and tariff announced by State Electricity Regulatory Commission (SERC). The reply is not tenable as the audit observation is on variation in reporting of targets and achievement by MNRE and States, which should have been reconciled.

3.3. State wise analysis

Based on the biomass energy potential assessed in Table 26, Audit identified that seven States with a potential of over 1,000 MW accounted for nearly 76 *per cent* of the biomass potential in the country. In order to tap the biomass energy it was necessary to focus on these States.

Table 27: Estimated potential and achievement (Grid connected) for the States endowed with 76 *per cent* of country's Biomass potential, as of March 2014

(in MW)

S. No.	State	Potential	Achievement	Exploitation (in *per cent*)
1	Rajasthan	4,595	101.30	2
2	Punjab	2,674.60	140.50	5
3	Maharashtra	1,585	940.40	59
4	Uttar Pradesh	1,477.90	776.50	53
5	Haryana	1,261	45.30	4
6	Madhya Pradesh	1,065.40	26.00	2
7	Gujarat	1,014.10	43.90	4
	Total	**13,673**	**2,073.90**	**15**

Source: MNRE.

These States were able to exploit only 15 *per cent* of their estimated potential. The installed capacity varied from two to 59 *per* cent of the potential assessed by MNRE in these States. Maharashtra had the highest exploitation of biomass potential followed by Uttar Pradesh.

More significantly still, of these seven States, five i.e. Gujarat, Haryana, Madhya Pradesh, Punjab and Rajasthan had very low rates of exploitation of biomass potential ranging from two to five *per cent*. MNRE and the State Governments of these high potential States need to prioritise exploitation and development of the biomass energy in these areas.

MNRE stated (July 2015) that the State wise targets were not fixed and the projects were set up by private developers.

3.4. Policies of MNRE for promotion of Biomass Energy

MNRE promoted grid interactive biomass power and bagasse cogeneration in sugar mills. MNRE was also promoting biomass cogeneration based power plants for producing electricity using locally available surplus biomass resources such as small wood chips, rice husk, arhar stalks, cotton stalks and other agro-residues to meet the unmet demand of electricity. MNRE's support to developers was given in the form of Central Financial Assistance (CFA) determined on the parameters like gas pressure, type of project and category of the State.

The proposals for biomass projects were sent directly by the developer to MNRE and not through the SNAs. It was vetted at the Ministry and CFA released directly to the developers. The concerned SNAs and MNRE were to closely monitor the execution of the project and ensure their timely completion.

Out of 24 test checked States it was found that only three States i.e. Rajasthan, Maharashtra and Madhya Pradesh had framed their biomass policy.

4. Non maintenance of records by the States

In the 24 States selected for Audit, it was observed that no data of the projects executed was maintained in the States of Bihar, Jharkhand, Madhya Pradesh, Maharashtra, Rajasthan, Uttarakhand and Uttar Pradesh. According to the database provided by West Bengal Renewable Energy Development Agency (WBREDA) in West Bengal, 145 plants of different capacity (total capacity 61.207 MW) based on biomass were commissioned in the State between 2001 and 2014. Audit scrutiny revealed that out of 145 plants installed, location of 24 plants was not available with the WBREDA and files in connection with 21 plants were only available with WBREDA. The CFA was released directly by MNRE to the developer and no agency was monitoring the operations of the plants. WBREDA had not maintained any data of power generated from biomass plants, in absence of which the status of plants could not be ascertained in audit.

5. Implementation

Subject to scope limitation reported in Para 8 of Chapter I of this report, the audit findings based on examination of 19 files of bagasse cogeneration and 17 files of non-bagasse projects produced to Audit are given below.

5.1. Biomass Bagasse Cogeneration

5.1.1. Plants not installed even after taking first advance installment of CFA

It was observed in audit that four projects were not commissioned after release of first advance installment of CFA as detailed in Table 28.

Table 28: projects were not commissioned after release of first advance installment of CFA

(₹ in crore)

S. No.	Name of Project and Capacity(In MW)	Capacity (in MW)	Date of sanction	CFA sanctioned	CFA released	Balance CFA
1	Boot Model Cogen Project in 12 Cooperative Sugar Mills by TANGEDCO, Tamil Nadu	116	28.03.2012	58.25	29.12	29.13
2	Kukadi S.S.K. , Ahmednagar, Maharashtra	6.62	08.12.2011	1.32	0.66	0.66
3	Bhima S.S.K.,Daund Pune, Maharashtra	11.40	08.09.2012	2.08	1.04	1.04
4	Kumbhi Kasari S.S.K. Ltd., Kolhapur, Maharashtra	NA	15.03.2014	3.60	1.80	1.80
	Total			**65.25**	**32.62**	**32.63**

Note: NA – Not Available.

The first installment of CFA was to be released only after placing of order of equipment and after furnishing the details of the equity and promoters share etc. by the developer. However, in these cases first installment was released in advance without obtaining the required documents.

MNRE stated (July 2015) that performance assessment of the projects at serial number 2 and 3 was under way for release of final installment of CFA. Regarding project at serial number 4, it stated that the performance assessment had been completed in March 2014 and the final release of CFA was under way. Further the project at serial number 1 was under progress. However, the fact remains that the first installment was released without complying with the requirements of the guidelines.

5.1.2. CFA released by MNRE without following scheme guidelines and verifying facts

Maharashtra State Cooperative Bank Ltd (MSCBL) forwarded to MNRE (September 2010) application for grant of capital subsidy to M/s Vasantrao Dada Patil SSK. Ltd Vithewadi, Nasik, Maharashtra for a 17 MW (11 MW surplus power over and above the captive consumption) Bagasse Cogeneration power project. MNRE sanctioned (December 2010) the capital subsidy of ₹ 6.60 crore and released 50 *per cent* of the capital subsidy to MSCBL.

Audit scrutiny revealed the following deficiencies:

i. Fifty *per cent* CFA was to be released after successful commissioning and performance testing of the project which *inter alia* implied operation of the project for three months including at least 72 hours continuous operation at minimum 80 *per cent* of rated capacity. Audit observed that CFA of ₹ 3.30 crore was released without certificate of performance testing by the designated agency. Interestingly, the balance CFA was neither demanded by Financial Institutions (FI)/ sugar mill nor was it looked into by MNRE.

ii. The developer was to provide month wise generation data on half yearly basis to MNRE but MNRE never asked the developer to furnish the same.

iii. It was also revealed that during the crushing season 2007-09 the sugar mill's licensed crushing capacity was 2,500 Tonnes Crushed per Day (TCD). The cane crushed daily was between 2,560 TCD to 3,000 TCD and number of days cane crushed in these years was 239 in 2007-08, 111 in 2008-09 and 153 in the year 2009-10. It is pertinent to mention here that per day cane crushed was on a decreasing trend which indicate changing crop pattern. In this context, MNRE assumption of 3,500 TCD per day for calculating surplus power indicates distortion of facts towards higher side for calculating surplus power.

MNRE stated (July 2015) that the commercial operation of the cogeneration plant was started in February 2012 but due to scarcity of water, the performance test was postponed, and the SNA had been asked to monitor and submit the status report.

5.1.3. Delay in implementation of cogeneration plants in co-operative sugar mills

Based on the approval (February 2008) of Tamil Nadu Government for setting up of cogeneration plants in co-operative and public sector sugar mills in the State, TANGEDCO executed (February 2010) an agreement with M/s Walchandnagar Industries to establish 12 cogeneration plants in the sugar mills on Engineering, Procurement and Commissioning (EPC) basis. The estimated cost of the project, with a total capacity of 183 MW, was ₹ 1,241.15 crore. As per the scheme, the sugar mills would make the sites available to Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO) for setting up the cogeneration plants. TANGEDCO would raise upto 90 *per cent* of the funds required for the project through institutional loans and the balance would be met by the sugarcane growers of the respective mills. The plants after commissioning would be run by the sugar mills and the surplus power over and above the captive consumption would be exported to the TANGEDCO grid. MNRE released ₹ 29.12 crore, being 50 *per cent* of the capital subsidy, for the project during 2012-13 with the balance subsidy to be disbursed only after commissioning.

Though the 12 plants were scheduled to be commissioned in September 2011 as per the scheme, the project suffered due to delays committed by the EPC contractor in mobilization of men and materials, non-synchronisation of materials and erection activities, lapse of excise exemption certificate resulting in six months delay on account of revalidation etc. Consequently, the project suffered time over run (36 months as of September 2014) and was expected to be completed only by March 2015.

Due to the delay in commissioning of the plants, power generation capacity of 183 MW including exportable power of 123 MW did not accrue to the State during the years 2012-13 and 2013-14 as envisaged.

MNRE (July 2015) accepted the audit observations and stated that the delay was due to non performance of contractual obligations by the owners and non availability of sand for completion of civil works. The reply is not correct as these issues should have been settled mutually in advance at planning stage.

5.2. Biomass power generation

The MNRE guidelines (December 2006, August 2008 and April 2010) for grid interactive power generation projects required the developers to provide data on electricity generation on a six monthly basis for a period of 10 years (5 years for the projects sanctioned after 1 April 2010) after commencement of commercial generation by the plant.

Audit scrutiny of the 12[4] cases at MNRE, revealed that none of the developers had furnished the generation data to MNRE after the commencement of commercial generation of electricity. In absence of generation data, the current status of the projects, whether they are in working condition or closed could not be ascertained in audit.

MNRE stated (July 2015) that emphasis was laid on SNAs to provide generation data on quarterly basis and the data was recorded by the State Utilities. However, the fact remained that the developers did not furnish their generation data to MNRE as per the requirements of the scheme guidelines.

6. Findings from audit of State Nodal Agencies

Audit observed instances of non traceable biomass plants, inoperative plants, plants working at lower capacities, plants installed with different specifications than approved and plants using non-permitted fuels. None of the developers had furnished the generation data to MNRE after the commencement of commercial generation of electricity. The cases are highlighted below:

6.1. Missing Biomass plants

Test check of records of SNAs and physical verification by Audit team revealed the following:

Andhra Pradesh
Audit team conducted Physical Verification of the biomass plant of M/s. Sainath Power at Bandarupalli village, Warangal District along with NREDCAP[5] representative and found that there was no power plant in the village which was endorsed by the Gram Sarpanch.
Bihar
Test check by Audit revealed that one biomass plant of 32 kW at Churahi, West Champaran was not in existence.

[4] M/s Shri Dyaneshwar SSK Ltd, Dnyaneshwarnagar Ahmedabad, Gujarat, M/s Amreli Power Project Ltd, Village Amereli, Gujarat, M/s Junagadh Power Project Pvt Ltd Khokhareda Village Vanthali, Taluk Junagarh, Gujarat, M/s Maharishi Shankarrao Mohite SSK Ltd, Solapur, Maharashtra, M/s Yashwant Rao Mohite Krishna SSK Ltd, Satara, Maharashtra, M/s Purna SSK, Hingali, Maharashtra, M/s Samarth SSK Ankushnagar, Jalna, Maharashtra, M/s Bhimashankar Sahakari Sakhar Karkhana (SSK) Ltd, Dattatryangar Pargaon Awasari Pune, Maharashtra, M/s Someshwar SSK Ltd, Baramati, Pune, Maharashtra, M/s Chambal Power Ltd, Village Rangur, Kota, Rajasthan, M/s Dee Development Engineers Pvt Ltd Village Gadda Dhob, Abhor, Firozepur, Punjab, M/s ETA Power Generation Pvt Ltd, Sattur, Virudhungar, Tamil Nadu.

[5] New and Renewable Energy Development Corporation of Andhra Pradesh Ltd.

6.2. Biomass plants not working or working at lesser capacity

Test check of records of SNAs for assessing the actual working of the plants that had received CFA revealed the following:

Andhra Pradesh

MNRE sanctioned CFA of ₹ 7.02 lakh and Indian Renewable Energy Development Agency (IREDA) sanctioned loan of ₹ 131.90 lakh for one MW plant at Siddipet, Medak to Harsha Power Projects (P) Ltd. The plant was commissioned (March 1999) but stopped generation (August 2000) due to ban on third party sales of the power produced by Andhra Pradesh Electricity Regulatory Commission (APERC) and malfunctioning of generator sets installed.

Bihar

Test check of records of 28 projects, which had availed CFA, revealed that 10 projects were closed and in one project, the developer had sold the plant after five years of commissioning without prior permission of MNRE.

Haryana

Four plants[6] for which CFA of ₹ 1.40 crore was released were not working since installation. MNRE stated (May 2015) that CFA was released after verification of generation data for three months by SNA. MNRE further stated that two plants (M/s REI Agro Limited and M/s Satyam Industries Pvt. Ltd) were not operational because of financial issues with the banks and the other two plants (M/s RP Basmati Rice Ltd and M/s Kayem Foods Industries Pvt. Ltd) were closed due to maintenance problems.

Karnataka

Eleven projects totaling 83 MW had been commissioned upto 2005-06 and four projects for 20 MW had been commissioned thereafter. Out of the 11 projects commissioned upto 2005-06, five projects had stopped working and another three were working only intermittently. The reason for not working was attributed to un-remunerative tariff.

Maharashtra

M/s Ind Bharat Energies Limited was to generate 126.72 MUs per year but the actual generation was only 11.86 to 45.74 *per cent* during 2009-14 due to non-availability of biomass.

Mizoram

Two biomass gasifier power plants with 200 kW capacity commissioned (March 2003) for ₹79.10 lakh were not operating since middle of 2003 and a large number of essential parts were missing. Zoram Energy Development Agency (January 2015) stated the machines remained idle for long period due to lack of manpower.

[6] M/s RP Basmati Rice Ltd, Karnal; M/s REI Agro Ltd, Rewari; M/s Kayem Food Industries Ltd, Panipat and M/s Satyam Ind. Pvt. Ltd, Pardhana, Panipat.

Punjab

During 2007-12, M/s Rana Sugars Limited, Amritsar, a grid connected bagasse based project, generated 947.204 lakh units, of which, it exported 781.452 lakh units to the grid valued at ₹ 28.59 crore, but it did not supply any power during 2012-14 in spite of the commitment in the PPA for supply of 10.20 MW power to Punjab State Power Corporation Ltd (PSPCL) every year and there was no penalty clause in the PPA for such default. PSPCL stated (February 2015) that the project stopped generation due to litigation/ pending resolution of dispute regarding re-determination of tariff.

Rajasthan

MNRE released (January 2013) a CFA of ₹ 40 lakh to M/s Sharda Solvent Limited, Mundla power plant which was not in operation since September 2011. From the log book of the plant, it was observed that MNRE officials did not verify the operations.

MNRE stated (May 2015) that the plant was in working condition as it had released the CFA after verification of three months generation by SNA. The reply is not tenable because the log books of the plant did not depict the working of plant.

6.3. Biomass plant not installed or not installed as per specification approved

Test check of records of SNAs revealed inconsistencies in the capacities installed in the following cases.

Bihar

i. MNRE sanctioned (November 2006) six plants with capacity of 50 to 100 kW for ₹ 2.01 crore with CFA of ₹ 57.80 lakh but only four plants of lesser capacity were installed. Bihar Renewable Energy Development Agency (BREDA) did not take any action against the firm/developer. MNRE stated (May 2015) that it had not released the entire funds to BREDA but only 70 *per cent* CFA was released and that BREDA had been requested to verify the installations and release only eligible CFA. The reply is not tenable because the project was sanctioned in 2006 and MNRE had not ensured the finalization of the project till date.

ii. MNRE sanctioned (February 2007) one unit of 120 kW biomass gasifier with 100 *per cent* producer gas engine at Garkha, Saran for ₹ 0.70 crore including CFA of ₹ 18.12 lakh, of which ₹ 12.60 lakh had been released to the developer. Audit observed that dual fuel mode biomass gasifier engine was installed which could be run on non permitted fuels. But no action was taken by BREDA.

Chhattisgarh

Fourteen developers were given permission (2006 to 2011) to install biomass plants, with a capacity 128 MW, but even after lapse of more than 3-8 years only one project of 15 MW was commissioned.

Rajasthan

i. In a 15 MW plant (January 2009) of M/s Orient Green Power Company only eight MW was installed because of delay in providing evacuation infrastructure and the remaining capacity allocation was cancelled. The excess 50 acres land allotted for seven MW was not returned by the developer to the State Government.

ii. M/s Transtech Green Power Private Limited registered (March 2011) a project for six MW capacity but failed to finalise land**,** power evacuation plan and availability of water within four months of registration. RRECL did not cancel the project.

West Bengal

MNRE sanctioned (December 2008) a plant at Chikisabrati Udyog for ₹ 13.68 crore, which was installed (December 2009) but not commissioned because they were not able to sell their entire power to the grid.

6.4. Biomass plants using non-permitted fuel after availing CFA

One of the parameters for determining the amount of CFA to be released was the fuel proposed to be used. In Andhra Pradesh audit scrutiny revealed three instances where the power producers were not using the approved RE fuel for generation.

i. MNRE sanctioned (October 2005) a 20 MW plant to M/s NCS Sugars Ltd with CFA of ₹ 78.65 lakh and the fuel to be used was bagasse, cane trash and cane tops only. Audit observed that the plant was using non-permitted fuel.

ii. In respect of M/s Nava Bharat Ventures Ltd, in a 20 MW plant, the developer started using coal instead of bagasse.

iii. A plant of 5.5 MW of M/s. Sri Rayalaseema Green Energy Ltd., commissioned (February 2001), was not using rice husk, ground nut and farm waste as fuel instead used woody biomass derived from exempted and non exempted species after paying penalties to the Forest Department.

Thus, the project set up to work on RE were actually not complying with the basic conditions.

MNRE stated (July 2015) that the issue of utilization of non renewable fuel by the projects was not reported by SNAs to the Ministry. However, the fact remained the MNRE was not monitoring the projects.

7. Conclusion

MNRE assessed the total potential from biomass to be 17,981 MW. During the 11th FYP period, a target of capacity creation of 1,855 MW through Biomass was set against which MNRE achieved 1,995.70 MW. In the first two years of the 12th Five Year Plan, MNRE set a target of 860 MW against which 879.42 MW was achieved. As such, overall target for the period 2007-08 to 2013-14 were achieved. MNRE had not fixed any State wise targets for Biomass power.

State wise analysis showed that most of the States did not set targets for biomass capacity. Of the eight States that did set targets, the same were achieved in two States only, with the remaining States showing a deficit of 19 to 96 *per cent*. Seven States having 76 *per cent* of the country's potential in biomass energy were able to exploit only 15 *per cent* of their estimated potential. Further, 21 States did not frame a biomass policy for promotion for biomass energy.

Audit scrutiny of implementation of biomass projects showed cases of project not installed even after release of assistance, irregular release of assistance by MNRE, inoperative plants, plants working at lower capacities, plants installed with different specifications than what was approved and plants working on coal rather than bagasse. Audit also observed instances of biomass plants not being traceable at the places where they were reported to be installed.

Audit observed that none of the developers had furnished the generation data to MNRE/ State Nodal Agency after the commencement of commercial generation of electricity.

8. Recommendations

- *MNRE must ensure that the Central Financial Assistance is released only after compliance with conditions and thereafter the implementation of the sanctioned biomass projects should be closely monitored.*

- *MNRE must review the power generation from the sanctioned biomass projects to ensure that these are operating as per specifications and use approved RE fuel.*

Section III –

Off-Grid Renewable Power

Chapter - VII

Solar Photovoltaic Systems

1. Introduction

Since 2005-06 MNRE had been providing Central Financial Assistance (CFA) to the implementing organisations[1] for deployment of off-grid[2] Solar Photovoltaic (SPV) systems such as Solar Home Lighting Systems (SHLSs), Solar Street Lighting Systems (SSLSs), standalone Solar Power Plants (SPPs), Solar Lanterns (SLs), Solar Water Heating Systems (SWHSs) and Solar Water Pumps (SWPs) etc. Various off-grid SPV systems up to a maximum capacity of 100 kW per site and off-grid and decentralized solar thermal applications, were also eligible for CFA. Mini-grids for rural electrification up to a maximum capacity of 250 kW per site were also supported. The main objectives were to promote the use of SPV systems, reduce the consumption of kerosene for lighting purposes, improve the quality of life in rural areas and provide an alternate for meeting rural lighting/energy requirements. In January 2010, the Government of India (GoI) launched the Jawaharlal Nehru National Solar Mission (JNNSM) which aimed at 2,000 MW by 2022 and merged all the previous schemes into the mission.

The solar off-grid policy of MNRE was demand driven and open to each implementing organization. The locations[3] were to be identified by the State/ Accredited Channel Partners/Beneficiary. The selection of locations was the prerogative of the State Nodal Agency (SNA)/ Channel Partners. The projects were to be approved by MNRE.

2. Targets and achievements

2.1. Mismatch between MNRE targets and targets set under JNNSM

The targets of MNRE and those set under JNNSM are given in Table 29.

Table 29: MNRE and JNNSM targets

(in MW)

Year	MNRE Target	Target under JNNSM	Achievement
2007-08	0	Not Applicable	4
2008-09	0	Not Applicable	3
2009-10	5	Not Applicable	9
2010-11	32	Phase I	11
2011-12	20	200	16

[1] The programme was implemented through SNAs/ State Nodal Departments (SNDs)/Corporations, PSU Banks, IREDA, and Akshaya Urja Shops. The Scheme was also being implemented through various Channel Partners like Renewable Energy Service Providing Companies; Financial Institutions including microfinance institutions acting as Aggregators; Financial Integrators, System Integrators and Programme Administrators. Akshaya Urja Shops are shops for sale of solar energy products and to provide easy after sales repair services.

[2] Distributed/decentralized renewable power (solar) system for isolated communities and areas which are not likely to be electrified in near future from grid connectivity

[3] Site/Village/Community/Institution.

Year	MNRE Target	Target under JNNSM	Achievement
2012-13	30		34
2013-14	40	Phase II (2013-17) 800	50
Total	**127**	**1,000**	**127**

Source: MNRE.

JNNSM envisaged incremental targets - Phase I (2010-13): 200 MW, Phase II (2013-17): 800 MW and Phase III (2017-22): 1,000 MW. However, the year wise targets of MNRE were not aligned with JNNSM targets. For Phase I, MNRE target of 82 MW was 59 *per cent* below JNNSM target, and achievement was only 61 MW i.e. 31 *per cent* of JNNSM target.

For the Phase II, JNNSM target was 800 MW (from 2013-17) but achievement in the first year (2013-14) was only 50 MW. MNRE was unable to elaborate its plan to achieve the target of 800 MW in Phase II, within the next three years, with 750 MW capacity yet to be installed.

MNRE stated (July 2015) that the sanctioned projects take 24 to 36 months to complete. Hence, installation targets are different from the sanctioned targets. Further, for Phase-II the sanctioned target had been revised to 500 MW.

The reply is not tenable because in JNNSM the target was installation of 2,000 MW by 2022. Also, the Phase I target (200 MW) of JNNSM was not achieved by MNRE over the three year period 2011-14 (100 MW).

2.2. Achievement of physical targets by the States

In order to determine the extent to which targets were achieved, Audit collected the data in each category of the SPV systems (in numbers) from the State Nodal Agencies (SNAs) of the 24 States sampled.

The State wise details of targets and achievements are given in **Annexure XI**. Analysis of achievement of physical targets in *percentage* terms in 24 States selected in Audit is summarized in Table 30 below.

Table 30: Achievement of States for various off-grid programmes

(in numbers)

SPV system	Number of States without targets	Number of States with					
		100 to 90 *per cent* achievement	90 to 75 *per cent* achievement	75 to 50 *per cent* achievement	50 to 25 *per cent* achievement	Less than 25 *per cent* achievement	Nil achievement
SL	12	8	2	-	-	1	1
SHLS	6	8	3	2	3	1	1
SSLS	5	10	4	1	3	-	1
SWP	16	3	1	1	1	1	1
SPP	6	8	-	5	3	2	-
SWHS	5	3	1	4	7	4	-

Source: SNAs.

Note: Solar Home Lighting System (SHLS), Solar Street Lighting System (SSLS), Solar Power Plant (SPP), Solar Lantern (SL) and Solar Water Pump (SWP).

Audit observed that:

i. Chhattisgarh, Karnataka, Mizoram, Nagaland, Odisha and Punjab did not fix any targets for some of the off-grid programmes. In Chhattisgarh, Mizoram and Nagaland though no targets had been set, various off-grid programmes were running.

ii. Arunachal Pradesh, Bihar, Himachal Pradesh, Maharashtra, Meghalaya, Rajasthan and Uttarakhand were able to achieve more than 90 *per cent* of the targets fixed by them for various off-grid programmes.

iii. In Assam and Tamil Nadu, the achievement was less than 25 *per cent* for some of the off-grid programmes.

MNRE stated (July 2015) that solar mission was demand driven and project based and Ministry cannot enforce any targets for the States. The reply needs to be viewed in the context that JNNSM does set a target, which can be achieved only through State agencies.

2.3. Approval Mechanism

As per JNNSM guidelines, MNRE had to constitute a Project Appraisal Committee (PAC) to approve projects within 45 days of receiving the project proposal. This committee was to provide approval as also review progress. Deficiency, if any, had to be communicated in writing to the Proposer/Channel Partner within 30 days. The Committee would then, on receipt of clear proposal approve it. The entire approval process was to be Information Technology (IT) enabled.

Audit observed that the projects were not approved by MNRE within 45 days of date of the submission of the application. MNRE approved the projects based on the availability of the funds. No application was accepted by MNRE in the year 2013-14 as it had applications pending from previous years. PAC also did not review the progress of the projects. The approval process was not IT enabled.

MNRE stated (July 2015) that PAC could not approve the projects as Phase II of JNNSM was approved on 26 May 2015 and now approval process is IT enabled.

3. Financial Management of SPV off-grid programme

During the years 2007-14, MNRE released CFA of ₹ 864 crore to the 24 sampled States for SPV projects, States contributed ₹ 707 crore and ₹ 114 crore was received from other sources. State wise details of the 24 sampled States are at **Annexure XII**. Audit noticed instances of non submission of Utilization Certificates, excess claim of Central Financial Assistance and diversion of Central Financial Assistance. The detailed audit findings are given below:

3.1. Non submission of Utilisation Certificates (UCs)

As per Rule 212 of General Financial Rules (GFR), UCs should be submitted by the organization receiving funds within 12 months of the closure of the financial year. MNRE

should monitor the submission of UCs and if the UC was not received within the specified time, the grantee organization should be black listed. As per Principal Pay and Accounts Officer of MNRE, UCs worth ₹ 198 crore were pending (August 2014).MNRE did not review these cases of pending UCs to see whether the works had been done as per sanction and the reasons for non submission of UCs. The State wise audit findings are given below:

Assam

i. Assam Energy Development Agency (AEDA) carried out awareness activities through Akshay Urja Diwas, seminars, exhibitions, conferences, debates, competitions, media campaigns etc. during 2007-12, and ₹ 0.36 crore were released by MNRE for these activities. An expenditure of ₹ 0.33 crore was incurred, UCs for ₹ 0.14 crore were available with AEDA, of which UC for ₹ 0.04 crore had not been sent to MNRE, and UCs for ₹ 0.19 crore were not available, rendering expenditure of ₹ 0.19 crore doubtful.

ii. MNRE sanctioned (September 2008) ₹ 0.53 crore for installation of solar systems to be completed by September 2009. The work was completed in September 2010. AEDA sent UCs to MNRE in September 2009, one year before actual completion of the work.

Jammu & Kashmir

UCs, in respect of SWHSs sanctioned during 2009-12, were submitted to MNRE after a delay ranging from nine to 28 months. UCs submitted (January 2013) in respect of installation of 46 SWHSs sanctioned by MNRE during February 2011 confirmed that all the 46 SWHSs had been installed and commissioned. Records, however, showed that six SWHSs were not installed/ commissioned at the time of submission of UCs, of which three SWHSs had not been installed even as of August 2014.

Punjab

For implementation of Integrated Rural Energy Programme (IREP) during 2006-07, MNRE released (January 2007) ₹ 0.73 crore to the State Government, which in turn released ₹ 1.46 crore, including its share of ₹ 0.73 crore, to Punjab Energy Development Agency (PEDA) in November 2008 (after a delay of 23 months). Audit noticed that the scheme was not implemented and PEDA while refunding ₹ 0.01 crore submitted (December 2009) UCs of ₹ 0.72 crore to MNRE showing the amount as spent on salaries and development of Information Technology infrastructure etc. during 2006-07, which was irregular.

3.2. Excess claim of CFA

Audit observed that in Tamil Nadu a project for installation of a 100 kW solar system was approved by MNRE to be completed by February 2012. The project was commissioned on 24 February 2012 at an actual cost of ₹ 1.80 crore. Audit observed that the project cost was certified by Tamil Nadu Energy Development Agency (TEDA) as ₹ 2.35 crore while claiming the balance CFA from MNRE, though the beneficiary had submitted details of expenditure for the project as ₹ 1.80 crore only. On 18 April 2013, it was seen that solar systems of 40 kW was installed. There was no mention about the installation of the balance 60 kW. The

status of the project whether ongoing or abandoned/stopped, was also not clear as of June 2014.

MNRE stated (July 2015) that the settlement of claim was based on the audited Statement of Expenditure and completion certificate given by the agency after inspection. Reply is not acceptable as the status of project was not submitted to MNRE and excess claim of CFA was not checked by MNRE.

3.3. Diversion of CFA

Audit observed that in Chhattisgarh MNRE sanctioned capital subsidy of ₹ 2.22 crore in 2012-13 for installation of domestic SWHSs with collector area of 7,000 sqm and released ₹ 1.55 crore as first installment. Audit observed that an amount of ₹ 0.53 crore (1,706 sqm collector area) was diverted for installation of SWHSs in commercial/ Industrial/ institutions etc. Chhattisgarh Renewable Energy Development Agency (CREDA) stated (December 2014) that the systems were installed in various sectors like industries, hospitals and educational institutions etc., within the overall targets. The reply was not tenable as the sanction was only for domestic purposes and the changes in purpose were not approved by MNRE.

4. Implementation of off-grid programme

Implementation of the off-grid programme was examined in audit at two stages i.e. execution and monitoring. There were cases of irregularities in distribution of solar devices, delay in distribution, irregular purchases of solar devices, deficiencies in award of works for Solar Power Plants, irregular payments and delays in completion of projects. Cases of excess recovery of beneficiary share were also noticed. Findings of each stage are given below.

4.1. Execution

MNRE released CFA to the State Governments for procurement of solar appliances and their distribution to beneficiaries with certain terms and conditions. However, Audit observed that in some States, SNAs did not follow the terms and conditions stipulated in the Ministry's sanction for distribution of solar appliances/devices to beneficiaries.

4.1.1. Irregularities in distribution of solar devices

Based on test audit, some instances of irregularities in distribution of solar devices were noticed. The State wise audit findings are given below:

Bihar

In Bettiah district, 90 SLs were shown as distributed during 2006-07 but details of total number of SLs received from Bihar Renewable Energy Development Agency (BREDA) were not on record of Deputy Development Commissioner (DDC) and the recipients signature were also not on record. It was also observed that six SLs were irregularly distributed among the DDC (two), BREDA (one), technician (one) and signatures of recipients of remaining two SLs were not on record.

Meghalaya

i. MNRE sanctioned (February 2006) 20,000 SLs for un-electrified villages. Meghalaya Non-Conventional and Rural Energy development Agency (MNREDA) purchased (April 2008) 12,000 SLs and could distribute (October 2011) only 3,318 with under recovery of beneficiary share of ₹ 0.15 crore (actual beneficiary share ₹ 0.56 crore). MNREDA decided (November 2012) to distribute the remaining 8,682 SLs free of cost in schools but by that time the batteries had expired, which had to be replaced for ₹ 0.53 crore. The school children to whom these lanterns were given were not from un-electrified villages. UCs sent to MNRE indicated that 20,000 SLs had been distributed to the beneficiaries instead of 12,000 SLs actually distributed.

ii. MNRE sanctioned (October 2006) 8,000 SLs to be distributed, free of cost, to girl child studying in Class IX and X. Audit observed that only 5,600 lanterns were purchased and these were given to beneficiaries for ₹ 1,465 per lantern instead of free of cost.

Uttarakhand

Scrutiny of records (July 2014) revealed that Uttarakhand Renewable Energy Development Agency (UREDA) collected ₹ 0.69 crore more from 80,859 beneficiaries for distributing SLs to them, claiming the collection as service charges. This was irregular since service charges were to be released by MNRE at the rate of three *per cent* of CFA and not to be borne by beneficiaries. The State Government accepted the facts.

West Bengal

Out of 1,000 lanterns procured, WBREDA could produce a list of six institutions to whom 258 lanterns were handed over, no record of the balance 742 lanterns was furnished to Audit.

4.1.2. Non distribution/delay in distribution of solar appliances

Audit observed that in certain States there were instances of solar appliances either not being distributed to beneficiaries or delay in distribution of solar appliances. The State wise audit findings are given below:

Arunachal Pradesh

MNRE released (January 2014) ₹ 0.25 crore to APEDA for procurement and distribution of solar energy education kits to Government school students. APEDA procured 500 solar energy education kits in April 2014 at a cost of ₹ 0.25 crore but these were yet (September 2014) to be distributed. APEDA accepted the facts.

Bihar

i. Under the Tharu community development programme, a total of 4,000 SLs were to be provided to 3,846 members (November 2013). Audit scrutiny revealed that only 3,556 SLs were distributed and 444 SLs worth ₹ 0.06 crore remained un-distributed. Delay in distribution might result in discharge of batteries kept in unused conditions.

ii. BREDA (2009-10) delayed distribution of 2,000 SLs in 38 districts. There was delay of five to eleven months in the distribution of the material supplied by the supplier to districts. Further, the lanterns were distributed with a delay of two to 11 months by the Deputy Development Commissioner (DDC) after receipt from the supplier because of which not only the capacity of batteries decreased, the beneficiaries also remained deprived of the benefit of the scheme.

iii. Audit scrutiny of records revealed that 59 SLs and six SHLSs supplied (May 2007) to the DDC Saran got destroyed (December 2007) in a fire in the godown. As per BREDA directives, these should have been immediately distributed to the beneficiaries.

Jammu & Kashmir

i. MNRE sanctioned (February 2013) 10,000 SHLSs for ₹ 11 crore for various villages in Kishtwar, Dodha District. Audit observed that the SHLSs had not even been procured by Jammu and Kashmir Energy Development Agency (JAKEDA) as of August 2014. MNRE stated (May/July 2015) that orders had been placed and the project had been extended upto September 2015 for completion.

ii. MNRE sanctioned (March 2010) assistance of ₹ 1.81 crore for distribution of 15,150 SLs in the Gujjar and Bakerwal basties of the State. Test check of records of Anantnag District, revealed that of the 4,384 SLs received in 2011, 803 had not been distributed and the batteries were exhausted. MNRE stated (May 2015) that SNA completed distribution of SLs and submitted audited SoE. However, MNRE did not furnish documents evidencing distribution of SLs.

Punjab

MNRE sanctioned (March 2011) 2,680 SHLSs in 147 villages of Gurdaspur, Ferozepur, Tarn Taran and Amritsar districts for ₹ 5.36 crore. PEDA placed (May 2011) order for supply of 1,000 SHLSs. The contractor[4] could supply only 500 SHLSs for which a payment of ₹ 0.90 crore was made, and these were also below MNRE specifications.

In Abohar 30 SHLSs worth ₹ 0.05 crore were destroyed in a fire. Audit observed that these had been kept in an ordinary rented house and had not been distributed even after 13 months of procurement.

4.1.3. Delay in completion of projects

Projects were sanctioned by MNRE based on the proposal received from SNAs/ other agencies. Audit observed that there were delays in completion of projects. The State wise audit findings are given below:

Assam

i. MNRE sanctioned 11 SPV projects during October 2006 - March 2013 to AEDA for ₹ 23.29 crore. Out of 11 projects, five were completed with delay of seven months to two years, while six had not been completed (July 2014) even after delays of eight to 25 months. Delay in completion of works was due to considerable time taken in initial processing and issuing the notice inviting tenders, with delays ranging from four to 21

[4] M/s R.R Solar System, Ahmedabad.

months from date of receipt of sanction orders from MNRE. An amount of ₹ 16.14 crore remained blocked out of ₹ 23.29 crore sanctioned between October 2006 to March 2013. MNRE accepted the facts (May 2015).

ii. MNRE sanctioned (August 2012) installation of SPV power plants (28kW) at various locations in the State for ₹ 0.69 crore to be completed by April 2013. The work was awarded (February 2014) to M/s National Small Industries Corporation (NSIC) which further sub contracted the work to M/s Mac Power system against the general terms and conditions of contract. The work to be completed by April 2013 was still under progress (November 2014).

MNRE stated (July 2015) that progress of work was slow because of local problems and there was no financial burden on either MNRE or the State Government. The reply is not acceptable as the projects were delayed.

iii. MNRE sanctioned two projects (September 2010) for development of solar cities in Guwahati and Jorhat for ₹ 0.45 crore and ₹ 0.49 crore respectively. The Master Plan was to be prepared by September 2011 and the other three activities[5] were to be carried out during the following five years. It was observed that while the Master Plan prepared by Jorhat Municipal Board (JMB) was sent to MNRE during September 2011, the Master Plan prepared by Guwahati Municipal Corporation (GMC) was sent in March 2013, after a delay of 18 months. The Master Plan of Guwahati was approved by MNRE in January 2014.

RE proposals for Jorhat valuing ₹ 1.96 crore were sent to MNRE in December 2012, which were yet to be approved. As for Guwahati, the same had not been sent (June 2014). Further, the MNRE released ₹ 0.15 crore (March 2012) and ₹ 0.05 crore (March 2013) for setting up of Solar Cell and promotional activities for Jorhat and Guwahati, respectively. No further progress in the matter was on record.

iv. The work of installation of RE systems in Raj Bhawan was sanctioned in November 2011, to be completed by November 2013. However, tender was invited (September 2013) after a delay of 23 months, and the work was awarded in February 2014. MNRE had censured the concerned agency for the abnormal delay in work, stressing that the financial support would be completely withdrawn for delay beyond 36 months from date of original sanction. The work was under progress (November 2014).

v. The work of installation of Solar Plants of 240 kW at 11 locations (Assam State Secretariat – 100 kW; Guwahati High Court – 50 kW; and Dibrugarh Public Health Engineering Department (PHED) – 90 kW) was sanctioned in March 2013 to be completed by November 2013. AEDA invited an expression of interest on behalf of Dibrugarh PHED in December 2013, the tender was invited in January 2014 and the work was awarded in February 2014 to National Small Industrial Corporation (NSIC). NSIC in turn sublet the work to M/s Mac Power Systems.

In relation to other two locations (viz. State Secretariat and High Court) the work was yet to be awarded (July 2014). The tender for Assam Secretariat was invited in June 2014 and was at the tender evaluation stage. Delay in inviting tenders was attributed to changing of the nodal agency multiple times by the State Government.

[5] Implementation, Setting up of Solar Cell and Promotional activities

Bihar

i. BREDA received a sum of ₹ 27.91 crore for implementing the Saur Kranti Solar Pump Scheme in five districts, to be completed within four months of execution of agreement. Audit observed that the scheme was not completed even after a lapse of nine months of the execution of agreements despite availability of funds.

ii. BREDA was to install 100[6] SSLs for which an amount of ₹ 0.19 crore was received from the three[7] beneficiaries. However, these SSLs had not been commissioned so far (November 2014).

iii. Audit scrutiny of records of DDC, Muzaffarpur revealed that out of 18 SSLs received (June 2011) only nine were installed (November 2014). BREDA failed to monitor the complete installation of the same.

iv. The State Government released (2007-08) ₹ 0.50 crore to BREDA and MNRE had to provide CFA of ₹ one crore for establishing State Level Energy Park. The park was not established and funds were surrendered (July 2012) after three years. The SNA stated that State Government did not allot the required 2.5 to 3 acres of land resulting in non-construction of the energy park and the grant was refunded.

v. Ten Solar Roof Top power plant of 50 kW and four Solar Roof Top power plant of 200 kW totaling 1.3 MW were to be installed under Mukhyamantri New and Renewable energy scheme for which BREDA received ₹ 24.67[8] crore during 2008-14, but the scheme was yet to be implemented.

Jammu & Kashmir

i. MNRE sanctioned (December 2010) ₹ 32.70 crore for installation of SPPs of 1,090 kW at 69 district hospitals/ health centres. Audit observed that 22 plants had not been installed even after a lapse of 32 months. Also the contract was placed on a firm[9] whose turnover was not certified by a Chartered Accountant as required under the eligibility conditions.

MNRE stated (May 2015) that the project was still incomplete and the SNA was to follow tender conditions in which it would not interfere.

ii. MNRE sanctioned (February 2012) installation of SPPs of 905 kW at 107 Community Information Centers for ₹ 24.44 crore. Audit observed that 22 plants had not been installed (August 2014) even after a lapse of 20 months.

MNRE stated (May 2015) that some of the companies to whom the contract was awarded had gone to Court and the project was stalled.

iii. MNRE sanctioned (September 2012 - February 2013) installation of 22 SPPs of 752 kW at 22 locations and nine SPPs of 900 kW in nine institutions. Audit observed that the plants had not been installed (August 2014) due to non-finalization of tenders.

MNRE stated (May 2015) that the project was under court litigation.

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6 Three at Betiya, 27 at Gaya, and 70 at the units of Bihar State Tourism Development Corporation.

7 ₹ 0.05 crore from Gaya Engineering College, ₹ 0.14 crore from Bihar State Tourism Development Corporation and ₹ 0.58 lakh from District Magistrate (DM), West Champaran, Bettiah.

8 MNRE-₹ 0.49 crore, State- ₹ 24.18 crore.

9 M/s Sova Power Ltd.

iv. MNRE sanctioned (September 2009) establishment of State Level Energy Park for ₹ one crore and seven Akshya Urja shops for ₹ 0.04 crore, but the same had not been established (August 2014) and the funds remained unutilised.

MNRE stated (July 2015) that project had been cancelled.

Madhya Pradesh

i. The installation of 2,12,800 Litres per day (LPD) capacity SWHSs at 41 places was to be completed by M/s Waree Energy Pvt. Ltd, Mumbai by December 2013. Audit observed that only six *per cent* work was completed upto March 2014.

ii. A work order was placed on M/s Steam Power Entertech Pvt. Ltd, Rajkot for installation of 40,000 LPD capacity SWHS at MP State Cooperative Diary Federation, Gwalior at ₹0.59 crore to be completed by November 2013. There was no progress in the work (March 2014).

Mizoram

i. MNRE sanctioned (January 2006) an Education Park for ₹ 1.50 crore to create awareness about solar energy. ZEDA failed to arrange suitable land in Aizwal city, and after four years (October 2010) arranged a plot in Mizoram University campus, 14 km away from the city. ZEDA unilaterally dropped a number of systems to be installed and terms of AMC were also relaxed for the contractor[10]. At present the park was not being used. MNRE also failed to monitor successful implementation of the project.

MNRE stated (July 2015) that park has been completed but due to funds constraint, AMC could not be signed. The fact remains that there was delay of more than seven years in completion of the project.

ii. MNRE sanctioned (February 2008) solar dryer for drying turmeric for import and export. Work order for seven 35 kg solar dryers were placed (July 2008) and the order for the rest was to be placed after setting the dryer in the most optimum condition suiting the climate of Mizoram. Audit observed that the contractor[11] supplied (November 2012) 42 solar dryers without identification of the site and required infrastructure by the user[12] agency. These solar dryers had not been installed leading to unfruitful expenditure of ₹ 1.11 crore.

Nagaland

i. MNRE approved (November 2011) ₹ 22.31 crore for installation of SPPs of 670 kW at 45 locations in Kohima, to be completed by May 2012. Although installation work was completed, commissioning and handing over of 17 SPPs (260 kW) had not been done (May 2014) and commissioning of 16 plants was also delayed by seven to 18 months. The delay was attributed to delay in release of payments to contractors. The State Government stated that it had released the balance civil deposit amount of ₹ 1.71 crore in September 2014 and the contractor had been asked to commission the balance 17 SPPs at the earliest.

[10] M/s Swastik Enterprise, Kolkata.
[11] National Research Development Corporation, a PSU.
[12] Mizorganic Producers Company Limited, a private company.

ii. MNRE accorded (2003) sanction of ₹ 0.83 crore for installation and commissioning of solar devices to be completed within 24 months. MNRE released ₹ 0.42 crore in 2003 but the State share[13] was released after a delay of five years. The work was awarded to M/s V K Keguruse without inviting open bid. Due to delay in completion of work, the contract was subsequently cancelled (August 2013) after incurring an expenditure of ₹ 1.30 crore. MNRE accepted the facts (May 2015).

Uttar Pradesh

i. UPNEDA was to install 292 SWHSs (January 2011) at KG Residential Balika Vidhyalayas in 48 districts. Audit observed that installation of 190 SWHSs was still pending as the firms could not supply the equipment. The work was retendered but even then the work could not be completed. Despite lapse of more than two and half years the work was still incomplete. The main reason for non-completion was lack of coordination between UPNEDA and Education Department.

ii. MNRE approved (July 2010) CFA of ₹ 2.77 crore for providing SPPs of 4.8 kW and six SSLSs to each of the 57 Rajkiya Ashram Padhati Vidhyalayas located in 42 districts. Though 342 SSLSs (six SSLSs for each of 57 SPPs) were installed, the firm[14] could install only 22 SPPs (April 2011) and none of them were functional. Payment of ₹ 1.32 crore had been made to the firm. The work could not be completed by UPNEDA even after a lapse of over four years[15]. UPNEDA stated that the firm had been blacklisted and performance guarantee forfeited and 22 SPPs would be operationalised soon and remaining 35 SPPs would also be installed.

West Bengal

i. MNRE released CFA of ₹ 8.67 crore to WBREDA during September 2011 - March 2013 for installation of standalone SPV system of capacity 5 kW each at 100 Government aided schools in South and North 24 Parganas and Murshidabad districts along with one 24 kW SPV system at Jalpaiguri Engineering College. WBREDA installed solar rooftop PV plant in 70 out of 100 schools and 25 kW SPV plant at Jalpaiguri college at a cost of ₹ 6.61 crore as of September 2014. WBREDA had not identified the remaining 30 schools on which rooftop SPV plant was to be installed under the programme.

MNRE stated (May 2015) that the project was still incomplete and the Ministry would consider cancelling the projects for the remaining 30 schools based on audit observations.

ii. MNRE sanctioned a project for installation of 500 SWHSs in different institutions/domestic areas at a cost ₹ 0.32 crore, to be completed within twelve months and released ₹ 0.22 crore in September 2011. MNRE's sanction stipulated that remaining funds (₹ 0.10 crore) would be released to WBREDA on demonstration of SWHS with the report of monitoring of the systems by third party. However, Audit observed that WBREDA could spend only ₹ 0.14 crore on installation of 137 SWHSs against the target of 500 SWHSs, as of September 2014. WBREDA did not conduct any third party monitoring as required under MNRE's sanction.

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[13] Civil works ₹ 0.56 crore (State share); and Supply, installation and commissioning of solar devices ₹ 0.83 crore (CFA).

[14] M/s Gangotri Enterprise, Lucknow.

[15] October 2010 to September 2014.

4.1.4. Deficiencies in award of work for Solar Power Plants

Applicable guidelines are to be followed by the SNAs/ implementing agencies while executing the projects with regard to tendering and award of the work. The State wise audit findings are given below:

Assam

MNRE sanctioned (December 2011) 354[16] kW SPV power plants for ₹ 8.73 crore to be completed by December 2012. AEDA awarded the work (February 2013) to an ineligible contractor[17]. The work, that was to be completed by August 2013, was started by the contractor in October 2013 with an undertaking to complete it by February 2014. Thereafter, the contractor sub-contracted the work to M/s Geetanjali Solar Enterprises. The work was not completed till date (June 2014). Audit also observed that another order was placed on M/s Umgreen Lighting for installation of two SPV power plants of five kW of similar nature, specifications and location at a lower rate which led to an excess expenditure of ₹ 0.22 crore.

Jammu & Kashmir

Inspection report of the Director General Quality Assurance (DGQA) indicated that 5,000 SHLSs supplied by a firm[18] for ₹ 5.44 crore were not as per Indian Standard specification as envisaged in the Notice Inviting Tender (NIT) and Chinese solar cells were used which were not allowed as per NIT. JAKEDA did not take any action against the defaulting firm and justified the deviation to Audit on the grounds that the firm was to maintain the system for five years free of cost.

MNRE stated (July 2015) that all procured items were test certified as per MNRE requirements and there was no restriction on Chinese cells. The reply is not tenable as it violates the standard given in NIT and modules were not indigenous as envisaged in programme guidelines.

Jharkhand

Scrutiny of records revealed that two mini-grid (off-grid) power plants of 120 kW (Jhargaon and Jari villages in Gumla District) were allotted to developers[19]without inviting tender.

MNRE stated (July 2015) that with no party coming forward to work in Gumla District, work was awarded on nomination basis by the State Government.

4.1.5. Irregular payments

Audit observed that in two States, SNAs had released payment to firms without following MNRE guidelines and obtaining requisite installation/commissioning reports. The State wise audit findings are given below:

[16] Five kW capacity each at 27 DC offices and one kW SPV power plant at 219 Aryabhatta science centers.
[17] M/s Eversun Energy Pvt. Ltd, who had the experience of manufacturing, supply, installation and maintenance of off-grid SPV systems of 250 kW instead of required 350 kW in the previous three years.
[18] M/s Jain Irrigation Systems Limited.
[19] M/s DD Solar India Pvt Ltd and M/s Bergen Solar Power & Energy Ltd.

Jammu & Kashmir

The SNA awarded contracts for installation of 422 SWHSs to two firms[20]. It was observed that without following the guidelines and obtaining requisite installation/ commissioning reports, photographs of systems installed and full details of solar collector type and area installed, the SNA released payment of ₹ 0.41 crore to the firms.

Tamil Nadu

MNRE approved (May 2011) installation of six SPPs in Coimbatore at a cost of ₹ 12.60 crore. CFA of ₹ 3.42 crore was sanctioned of which ₹ 1.70 crore released to TEDA. TEDA in turn released (June 2011) the entire amount of ₹ 1.70 crore received from MNRE to the supplier. Audit observed that TEDA released the CFA to the supplier directly, instead of releasing it to the beneficiary, which was not as per MNRE guidelines. Despite the entire CFA being released to the supplier none of the six SPPs had been commissioned as of June 2014.

Accepting the facts, MNRE stated (July 2015) that TEDA had released ₹ 1.70 crore without bank guarantee and now TEDA has filed police case against the supplier.

Uttar Pradesh

i. Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA) purchased 7,517 Compact Fluorescent Lamp (CFL) based SSLSs (ordered at the rate of ₹ 22,301) and installed them (January/March 2011), under Project Mode even when cheaper Light Emitting Diode (LED) based SSL (at the rate of ₹ 16,830) were installed under Dr. Ambedkar Gram Yojna (2010-11) in September 2010, leading to an extra expenditure of ₹ 4.11[21] crore.

   The SNA stated that CFL based SSLSs was ordered as per sanction of MNRE. The reply was not tenable as the UPNEDA could have sent revised proposal based on LED for the project.

ii. In another case UPNEDA purchased (December 2011) 16,507 CFL based SSLSs at a higher price of ₹ 22,301 per unit, thereby paying an excess amount of ₹ 10.40[22] crore, even though there was a valid rate contract[23] for supply of cheaper and technically better Light Emitting Diode (LED) based SSL[24].

iii. Further, despite having above rate contract for LED based SSLSs (at the rate of ₹ 16,000), UPNEDA ordered (September, November 2011) for 13,262 and installed 13,185 LED based SSLSs at higher cost (at the rate of ₹ 18,500) under Dr. Ambedkar Gram Yojna (2011-12) at an extra expenditure of ₹ 3.30[25] crore.

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[20] M/s Electrotherm and M/s Tata BP.

[21] ₹ (22,301-16,830) X 7,517= ₹ 4.11 crore.

[22] (₹ 22,301 - ₹ 16,000) X 16,507 = ₹ 10.40 crore.

[23] M/s Linker Associates Lucknow. Executed in July 2011 and valid till January 2012 to supply LED based SSLSs at the rate of ₹ 16,000 per unit.

[24] A comparison between CFL and LED based SSLSs showed that luminosity of an 11 watt CFL-SSLS provides a lumen of 900 while a 10 watt LED-SSLS provided the same lumen (at the rate of 90 lumen per watt decided by MNRE). CFL based SSLS of 11 watt used solar panel of 75 watt and 75 AH tubular plate battery whereas solar panel of 45 watt and 40 AH tubular plate battery was used in LED based 10 watt SSLS. The working life of a LED and CFL was 50,000 hours and 8,000 hours respectively. Thus, it could be seen that a 10 watt LED based SSL is far better than an 11 watt CFL based SSLS both in terms of luminosity and price.

SNA stated that LED based SSLSs were not purchased (rate contract at the rate of ₹ 16,000 per system) because these systems were not as per standard and specification of MNRE. The reply was not tenable because in such circumstances the supplier[26] should have been disqualified instead of signing of rate contract. Further UPNEDA could have installed 16,507 LED instead of CFL based SSLSs.

MNRE stated (July 2015) that procurement was as per demand of public in rural areas and during 2011-12 CFL based light was proven system. The reply is not tenable as during the same year LED based SSLSs were installed at a cheaper rate.

4.1.6. Non-adherence to contractual obligations

Audit observed that in two States, SNAs were not able to ensure that the contractors adhere to the contractual obligations. The State wise audit findings are given below:

Nagaland

M/s Electrotherm was allowed (May 2012) to install and commission the incomplete portion of the SWHS work, initially allotted to it, after cancellation of work order and release of EMD amounting to ₹ 0.10 crore, instead of forfeiting the same. Penalty of ₹ 0.21 crore[27] on undelivered portion as stipulated in contract agreement was not levied. Similarly, the Department of New and Renewable Energy (DNRE) had also failed to impose penalty of ₹ 0.06 crore[28] on M/s Swastik for the delay in supply of SWHS materials and paid the Earnest Money Deposit (EMD) amount of ₹ 0.10 crore in full instead of forfeiting the same.

Punjab

i. MNRE sanctioned ₹ 2.48 crore for installation (November 2007) of 4,000 SHLSs and 500 SSLSs. Audit observed that though 3,600 SHLSs were not supplied by the contractor[29], PEDA did not levy penalty of ₹ 0.44 crore as per contracted terms. Also the project was completed with extra payment of ₹ 0.13 crore, which was not recovered from the defaulting contractor due to not including an enabling clause in the contract. The subsequent contractor[30] was also contractually liable to a penalty of ₹ 0.12 crore for delaying supply beyond December 2008 without approval of extension of time.

   MNRE stated (May 2015) that this decision was taken by PEDA and the Ministry could not interfere in the mater.

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[25] ₹ (18,500-16,000) X 13,185=₹ 3.30 crore.
[26] M/s Linker Associates.
[27] The amount of penalty calculated for a period of 28 weeks (November 2011 to May 2012) was (0.5 *per cent* x ₹ 1.48 crore x 28 weeks).
[28] Delay for the period of four months or 16 weeks amounting to ₹ 0.06 crore (0.5 *per cent* x ₹ 0.80 crore x 16 weeks).
[29] M/s Divayam Solar Energy Development Agency, Jalandhar.
[30] M/s Suntime Energy Delhi

ii. MNRE sanctioned (July 2011) installation of 600 solar pumps for ₹ 22.20 crore to be completed by March 2012 and released ₹ one crore as the first installment. The supply order for 100 pumps was placed (May and November 2013) by PEDA, and the pumps were installed with a delay of 25 to 151 days for which a penalty of ₹ 0.09 crore was not imposed. Also incorrect UC for ₹ one crore against the due subsidy claim of ₹ 0.81 crore was sent by PEDA to MNRE in June 2013.

iii. The State Government agreed to pay 40 *per cent* subsidy of ₹ 1.12 crore to PEDA for 100 pumps valuing ₹ 2.80 crore. However, it did not release the agreed amount of subsidy.

MNRE stated (May 2015) that penalty figure was imaginary. Further PEDA had also informed that the entire amount was spent and documents for release of balance CFA were under process. The reply was not tenable as work order provides the imposition of Liquidated damage at the rate of 0.5 *per cent* per week and maximum of 10 *per cent* of the contract value.

Tamil Nadu

MNRE sanctioned for installation of 60,000 SHLSs for houses constructed for BPL families under the Chief Minister's solar powered green houses scheme. TEDA decided to implement the scheme with CFL bulbs in 49,650 houses and with LED bulbs in the remaining 10,350 houses. Tenders were invited (October 2012) for commissioning and maintenance for five years for the 49,650 CFL based system and Letters of Acceptance (LoA) after evaluation of the bids was issued to the successful bidders by TEDA on 21 June 2013 by which time, the validity of the bids had already expired on 1 June 2013. As one of the parties to whom LoA was issued expressed its inability to extend the validity, the LoA for 28,596 units was cancelled (July 2013). In the subsequent tender for 2013-14, the backlog quantum was awarded at a higher rate of ₹ 22,276 per system as against the originally decided price of ₹ 19,860 in 2012-13. The delay in finalizing the tender led to additional expenditure of ₹ 6.91 crore besides loss of opportunity to generate solar energy in 28,596 houses.

MNRE stated (May 2015) that delay was due to retendering as bidder expressed inability to fulfill order. The reply was not tenable as there was delay in the process of award of work.

4.1.7. Excess recovery of beneficiary share

Audit observed that in some States excess beneficiary share was collected by SNAs. MNRE had no mechanism to monitor such cases. The State wise audit findings are given below:

Madhya Pradesh

Excess amount of ₹ 1.26 crore received from MNRE and Madhya Pradesh Jail Department towards installation of 126 SPPs, was not returned by Urja Vikas Nigam Ltd, Bhopal. Further, excess amount of ₹ 0.07 crore received as beneficiary share from Commissioner Nagar Nigam, Gwalior and Tribal Research Institute, Bhopal had also not been returned since the last four years (August 2010 to August 2014) by Urja Vikas Nigam Ltd, Bhopal.

Meghalaya

MNRE sanctioned (September 2008) CFA of ₹ 1.77 crore for installation of 1,000 SSLSs in the State, for which the contract was awarded in March 2010 by MNREDA and work was completed in June 2010. It was observed that beneficiary share was very high at ₹ 9,450, as compared to State share of ₹ 2,000. Also MNREDA was only able to provide a list of only 170 beneficiaries to Audit, instead of 1,000, indicating that the project was not completed.

4.2. Monitoring and evaluation

Cases of irregular installation, non installation of solar devices and poor quality of work were noticed which indicated deficiencies in monitoring and evaluation. The detailed audit findings are given below:

4.2.1. Deficient monitoring system

As per JNNSM guidelines, Information and Communication Technology was to form the backbone of monitoring system. At primary level the monitoring was to be done by the Channel Partners and additional monitoring could be done by reputed civil society groups, eminent persons, corporate houses, SNAs and MNRE officials, on random sample basis. Also, certified energy auditors were to be empanelled for certifying whether the outputs of the system correspond to the parameters laid down in the in-principle approval for non-credit linked projects.

Audit observed that third party monitoring was not carried out by MNRE/ SNAs and information technology was not made use of for monitoring. Energy auditors were also not empanelled by MNRE/ SNAs to certify the output of the systems.

MNRE stated (July 2015) that primary monitoring was done by SNAs and MNRE officials also visit the systems on random basis. MNRE accepted that Information Technology enabled monitoring was an issue.

4.2.2. Deficiencies in installation of solar devices

Projects were sanctioned by MNRE based on the proposal received from SNAs/ other agencies. Test audit revealed instances of irregularities in installation of solar devices which indicated deficiencies in monitoring. The State wise audit findings are given below.

Assam

MNRE sanctioned (July 2006 to March 2008) setting up of 10 district level energy parks for ₹ 0.65 crore. Inspection of one[31] park (October 2010) by AEDA revealed that poor quality work was done and there were deficiencies in 10 of the 16 allotted works. No action in this regard was taken by AEDA. AEDA furnished the UCs to MNRE in November 2013 and claimed the balance of ₹ 0.30 crore.

[31] Don Bosco High School.

Chhattisgarh

MNRE sanctioned (October 2010) installation of one kW SPP in nine Janpad sites[32] of Surguja district. Out of nine, only four plants[33] were installed and two[34] of these plants were installed at unapproved locations. Five plants were not installed because of technical reasons. MNRE accepted the facts (May 2015).

Himachal Pradesh

i. Himurja installed 560 SSLSs under MNRE programme in villages Kandaghat and Batal during the years 2012-14 at an expenditure of ₹ 1.07 crore. Audit observed (August 2014) that Himurja again installed 95 SSLSs at the cost of ₹ 0.19 crore out of funds sanctioned by the Department of Tourism for installation of SSLSs in the above villages. It was further noticed that SSLSs were mostly installed adjacent to the electrical SSLSs.

ii. MNRE sanctioned CFA of ₹ 0.20 crore in November 2008 for installation of 12 kW capacity wind-solar hybrid systems at Pooh in Kinnaur District. The first installment of ₹ 0.15 crore was released by MNRE to Himurja in March 2009 and it released ₹ 0.13 crore to M/s Machnocraft, Pune in the same month. The systems were installed in July 2009 but it could generate only 1,300 kW upto November 2009 and were not working satisfactorily thereafter. The balance grant of ₹ 0.02 crore had not been released by Himurja so far (March 2014.) Himurja accepted the facts (February 2015).

Jammu & Kashmir

Audit observed that 236 SPPs (capacity: 4,473 kW) sanctioned during 2008-14 were installed in Government buildings in areas which were connected with electricity grids. MNRE accepted the facts (May 2015).

Mizoram

Almost all SPPs were installed in areas where grid connected power was available and more than 50 *per cent* of the projects were commissioned in Aizwal city only. This indicated that preference was not given to isolated un-electrified rural areas. The State Government stated (January 2015) that ZEDA was not involved in the implementation of systems as these were implemented by Channel Partners of MNRE. It also stated the beneficiaries who are willing to contribute their share were selected. Due to shortage of fund it failed to extend its activities to far flung areas. The reply was not justified since solar systems were more required in rural areas than urban areas. MNRE accepted the facts (May 2015).

[32] Ambikapur, Kusmi, Shankargarh, Manpat, Balrampur, Udaipur, Ramchandrapur, Odgi and Premnagar.
[33] Balrampur, Udaipur, Odgi and Premnagar.
[34] Balrampur and Premnagar.

Nagaland

i. Contract for installation of 4,200 SSLSs in 139 villages was awarded to three contractors[35]. According to progress report submitted (October 2013) to MNRE, 3,786 SSLSs had been installed, in 196 villages. However, Audit observed that only 3,046 SSLSs were installed, leading to inflated reporting of installation of 740 SSLSs of ₹ 2.22 crore[36]. MNRE stated (May 2015) that it would seek clarification in this regard from the SNA.

ii. Audit scrutiny of completion reports submitted by the firms, revealed that out of 1,579 certificates submitted, 199 had identical serial numbers of major components of the devices reported to have been installed, leading to doubt on the installation of SSLSs amounting to ₹ 0.60 crore.

Uttar Pradesh

With the aim of providing electricity in the remote unelectrified villages, UPNEDA decided (October 2010) to install 1.2 kW mini grid SPPs at 47 villages of 16 districts. Contracts were assigned (December 2011) to five firms for the work of design, supply, installation and commissioning of the plants. While three firms failed to execute the contract, two firms could install 23 plants in 23 villages of 11 districts (December 2012). Audit observed that most of the installed plants were lying non-functional since July 2013. As per the project report each plant was to have a maximum of 200 connections but these ranged from 46 (Hajipur, Sitapur) to 176 (Kathelakothi, Sidharth Nagar). SNA stated that the design of the project was not as per the electricity requirement of the villagers. It was also stated that some of the villagers drew electricity irregularly by tempering with the wires due to which the plants frequently became non-functional.

4.2.3. Non preparation of beneficiaries list

As per MNRE guidelines, all programme implementing organizations were required to prepare a record containing details of beneficiary and SPV systems. The data was to be made available on a computer floppy/ Compact Disc (CD) for verification/ audit purpose. The implementing agency was to prepare the beneficiary lists as per guidelines before sending the proposal to MNRE. The State wise audit findings are given below:

Assam

MNRE sanctioned two SWHS projects (October 2012 and October 2013) for ₹ 3.33 crore and ₹ 3.50 crore. In the first project, out of 5,925 square metre (sqm) of collector area at various locations, only 58 sqm area had been installed and AEDA was still to prepare a list of beneficiaries. No progress was made in the second project at Guwahati Municipal Corporation.

[35] M/s Sunshine Power Products Pvt Ltd., M/s Microsun Solar Tech. Pvt. Ltd. and M/s Sanmati Traders.
[36] 740 X ₹ 30,000 per set.

Odisha

SPV systems were centrally procured by Head Office (HO) of Odisha Renewable Energy Development Agency (OREDA) and issued to different RE cells of the districts based on their requisitions. Test check of beneficiaries' list of districts by Audit revealed that they were incomplete as these did not contain detailed address of beneficiaries.

SPV systems were issued in the name of the concerned technicians, but details of beneficiaries to whom technicians supplied the systems were not on record. In one case of Khurda District, SPV systems were issued directly from HO to beneficiaries, details of beneficiaries could not be made available to Audit.

OREDA stated that targets were fixed depending upon the willingness of the user organization assessed by the districts as well as HO. The reply is not tenable as there were no records of assessment of SPV systems by the district offices and at OREDA headquarters.

Punjab

Out of 2,500 beneficiaries to whom SLs were distributed, PEDA did not provide list of beneficiaries in respect of 678 lanterns valued at ₹ 0.18 crore.

4.3. Deficiencies in Annual Maintenance Contract (AMC) of systems

As per MNRE guidelines upto January 2010 (before JNNSM), the SNA/ implementing agency had to enter into an AMC for the maintenance and proper running of the equipment after warranty period and quarterly report regarding maintenance of systems/equipment was to be sent to MNRE by SNA. However, Audit observed that in some States there were deficiencies in maintenance of systems by SNAs. MNRE had no mechanism to monitor such cases in the States. State wise audit findings on the maintenance of systems are given below:

Assam

During beneficiary survey, it was seen that out of 48 SHLS systems installed under different off-grid SPV schemes during 2009 – 2013, as many as 30 were defective or not working within one year of installation.

Chhattisgarh

As per suggestion of the System Integrator, for better generation, solar panels should be cleaned twice a week. During the test check of the records of SPV power plant of 100 kW installed in October 2012 at MGM Welfare Society, Raipur, Audit observed that power generation from the plant was only 78,700 kWh per year (about 50 *per cent*) due to non-cleaning of panels.

Haryana

Village Energy Committees were to be constituted to ensure maintenance and upkeep of the off-grid systems. The concerned Panchayat were required to deposit an amount of ₹ 2,500 per SSL system in the account of Village Energy Committee, as one time grant to meet the future maintenance expenditure. Audit observed that Village Energy Committees had not been formed.

Himachal Pradesh

Himurja executed AMC with the suppliers for off-grid systems installed in various villages. Audit observed (June 2014) that the representatives of these suppliers were not visiting the sites regularly. During physical verification of Chango village, the Pradhan Gram Panchayat stated that local skilled person attended to the complaints and rectified the defects in the solar systems installed. Himurja accepted (February 2015) the facts.

Jharkhand

i. Audit observed (July 2014) that AMC/CMC were done only for 2,827 out of 3,467 SSLSs. No AMC/CMC was done for 7,000 SLs.

ii. The suppliers were required to submit quarterly reports duly certified by the concerned local panchayats or bodies designated by JREDA on functioning of the systems, but suppliers neither submitted any report nor claimed (March 2014) AMC charges (August 2014). JREDA also did not ensure submission of regular quarterly progress report. SNA accepted the audit observation.

iii. Audit observed that Bharat Coking Coal Limited (BCCL) Dhanbad reported (between November 2011 and February 2013) 70 *per cent* non-functional systems out of 299 SSLSs installed during 2010-12 due to non maintenance of the systems. Further, on the ground of non maintenance of installed systems, BCCL withdrew (April 2013) its subsequent installation of SSLSs. SNA accepted the audit observation.

Madhya Pradesh

100 kW SPP commissioned (November 1999) at Jaitpura costing ₹ 3.59 crore was lying idle since October 2011 due to lack of maintenance.

Maharashtra

Under Special Area Demonstration Programme (SADP) systems were installed at important Government buildings at a cost of ₹ one crore per site, inclusive of procurement and installation of systems and devices along with AMC. Audit observed that the system installed under SADP at Raj Bhavan, Mumbai at a cost of ₹0.63 crore was not working satisfactorily. No action was taken to rectify the deficiencies in the working of the system. An amount of ₹ 0.23 crore under the programme remained unutilized with the SNA.

Punjab

i. PEDA allotted the work of maintenance to private contractors including warranty period of two to 10 years, but it was found during joint physical verification by Audit and PEDA, that contractors were not providing services properly, as three out of nine off-grid SPV systems inspected were found to be non-functional due to lack of maintenance.

ii. MNRE sanctioned (October 2010) ₹ 5.40 crore for commissioning of SPPs in 17 villages of Gurdaspur district to be completed by 30 June 2012, and to be operated and maintained for 10 years by the contractor under warranty clause. Plants were installed (October 2012) by the contractor at a cost of ₹ 2.63 crore but these were not working (September 2013) as the contractor was not maintaining the plants,

despite these being covered in the warranty period. Joint physical verification of three out of nine power plants conducted by Audit and PEDA, disclosed that all the three plants were not working. PEDA also did not levy penalty of ₹ 0.21 crore for delay in installation of the plants. One plant of 10 kW capacity valuing ₹ 0.29 crore in village Lodhi Naggal was installed in a private house against the project proposal to install the same on Government Land/Panchayat buildings.

MNRE stated (July 2015) that defects were rectified but did not comment on the issue of levy of penalty and installation of plant on a private house.

Uttar Pradesh

MNRE approved (February 2010) setting up SPPs at 340 police stations for ₹ 14.96 crore. Audit observed that the work was completed (June 2011) after a delay of six months but 90 systems were not functioning (August 2012). The supplier[37] did not repair the systems even though these were within the two years warranty and three years AMC. In Gonda eight out of 15 plants installed were lying non-functional for almost one year. Payment of ₹ 8.52 crore had been made to the supplier. SNA stated that the systems became non-functional due to excess use and overloading. The reply was not acceptable as the full amount of ₹ 8.82 crore was released (November 2011) to the firm and systems were covered under warranty and AMC.

Uttarakhand

i. UREDA made an agreement with Central Electronic Limited (November 2008) for the supply and maintenance of SSLSs in the State with two years warranty. In case the contractor could not rectify the defects within 15 days of receipt of complaint, UREDA would restore the devices in working condition at the contractor's expenses. Audit observed that 54 street lights were given to Zilla Panchayat (ZP), Tehri Garhwal for installation in 29 villages and remaining were distributed to the Gram Pradhans. Audit also observed that 45 out of 54 street lights installed were inoperative since June, 2011 i.e. within the warranty period. UREDA did not restore the systems at the contractor's expenses. It was also noticed that in respect of 10 inoperative streets lights, the plates, batteries and CFL were stolen. The State Government accepted the facts (December 2014).

ii. Under Special Area Demonstration Programme of MNRE, CFA of ₹ 0.41 crore was sanctioned (July 2010) for installation of ten solar devices at Raj Bhavan, Dehradun. Scrutiny of the records revealed that three[38] out of the seven solar devices[39] actually installed were inoperative since their installation (May 2011). UREDA did not make any effort to rectify the inoperative solar devices at the contractor's expenses (August 2014). Accepting the facts, MNRE stated that action for rectification of solar devices had now been taken (May 2015).

[37] M/s Kotak Urja Pvt Ltd, Bangalore.
[38] Solar road stud, solar pump and solar water purifier
[39] Out of ten, Raj Bhavan authorities did not permit for installation of two devices and for one device fund was not allocated.

4.4. Physical verification of off-grid systems by Audit

In order to check the functionality of the installed off-grid systems, Audit conducted physical verification on a sample basis, the results of which are summarized in Table 31. The audit findings indicate that large numbers of systems were not functioning properly in a number of States. Details may be seen in **Annexure XIII**.

Table 31: Summary of physical verification of off-grid systems

System	No. of systems inspected	No. of systems not working	No. of systems missing	Observations
SHLS	1,191	372	29	Issues ranged from lack of maintenance and after sales service facility to irregular issuance of systems to already electrified villages.
SSLS	1,233	857	19	A large number of systems were not working due to lack of maintenance facilities.
SL	1,413	580	2	Almost half the systems were not in working condition. Diversions of usage to factories/temples were also observed.
SPP	24	9	Nil	In addition to large number of idle systems, very low Cumulative Utilisation Factor was observed in working systems.
SWP	91	47	Nil	Issues like theft of modules, misuse towards commercial activities and very low discharge of water were observed.
SWHS	7	3	Nil	Nil
Total	**3,959**	**1,868**	**50**	

Note: Solar Home Lighting System (SHLS), Solar Street Lighting System (SSLS), Solar Power Plant (SPP), Solar Lantern (SL) and Solar Water Pump (SWP).

Physical verification of sampled systems by Audit revealed that 47 *per cent* of the off-grid systems were not working and one *per cent* of the systems were found missing and five *per cent* of the systems were issued to villages already electrified.

4.5. Non implementation of awareness programme

As per the JNNSM guidelines, awareness and demonstration of effective and innovative use of solar systems for individual/ community/ institutional/ industrial applications were to be promoted. Audit observed that in some States awareness and demonstration programmes were not implemented as per JNNSM guidelines. The State wise audit findings are given below:

Assam

MNRE sanctioned (September and November 2005) an amount of ₹ 0.34 crore to District Level Renewable Energy Advisory Committee (DLREACs) under Information & Public Awareness Programme in 23 districts. Audit observed that only three[40] districts had set up these committees. MNRE had expressed its dissatisfaction over the working of the DLREACs from time to time and had stressed on improving their functioning.

Gujarat

GEDA received ₹ 0.38 crore during the period 2007-10 out of which it utilised only ₹ 0.05 crore and refunded ₹ 0.33 crore to MNRE as unutilised amount. Out of the above amount, ₹ 0.26 crore was given to GEDA for conducting functions/activities to generate mass awareness about the need, benefits and use of new and renewable energy on 20 August of each year on the occasion of Rajiv Gandhi Akshay Urja Diwas. But 80 *per cent* of the fund was refunded to MNRE thereby defeating the very purpose and objective of the programme. Further, an amount of ₹ 0.12 crore was given to GEDA for setting up of renewable energy clubs in engineering colleges/institutions and creating awareness and publicity of renewable energy in the year 2007-08. However, the entire amount of ₹ 0.12 crore was refunded.

Himachal Pradesh

Himurja made efforts to create awareness through exhibition, Doordarshan/All India Radio, newspapers, National and State level trade fairs, events, publicity campaigns and mobile exhibitions in rural / remote areas during 2007-13. Against allocated financial target of ₹ 0.84 crore (2007-14), MNRE released ₹ 0.60 crore. Of that, Himurja spent ₹ 0.59 crore. However, the SNA could not organize the awareness programme during the year 2013-14 due to non-release of funds by MNRE.

Uttar Pradesh

MNRE released (August 2006) ₹ 0.11 crore for setting up Renewable Energy Clubs in engineering colleges/institutions approved by AICTE in order to create awareness about RE, its various systems and devices among students. Audit observed that out of the 64 colleges selected by UPNEDA, 16 colleges were non-engineering colleges and only three colleges utilized ₹ 0.45 crore.

Uttarakhand

Against available fund of ₹ 1.80 crore during 2007-14, UREDA incurred expenditure of only ₹ 1.35 crore on awareness programme through seminars, exhibitions, training and capacity building. Further, a Mobile Exhibition Van (MEV) costing ₹ 0.10 crore was procured (2004) by UREDA for organizing exhibitions/publicity on RE in schools, colleges, public places including remote and far flung areas. Audit observed (August 2014) that the MEV was under utilized[41] since January 2012. Rural areas including non-electrified villages were rarely covered. Further the publicity systems/devices (solar TV/ Biogas tank) installed in the MEV for demonstration purpose were not functioning. The State Government accepted the facts (December 2014).

[40] Karimganj (May 2005), Kamrup (June 2005) and Dibrugarh (July 2008)
[41] Was used in one rural area and six urban areas of Dehradun and Nainital.

4.6. Failure of training centers in achievement of objectives

As per MNRE guidelines, SNAs were required to setup training centres for demonstration of solar appliances to be installed under RE off-grid programmes and for that, SNAs were to fix targets for organizing training programme. Audit observed that in Uttar Pradesh, Training centre at Chinhat had received ₹ 0.27 crore in 2009-10 and 2012-13 for conducting training programmes but for remaining years 2007 to 2014 (except 2009-10, 2012-13), neither any training proposal was submitted by UPNEDA nor were any funds released by MNRE for the purpose. Further, a demonstration-cum-training centre `Non Conventional Energy Research Institute' (NERI) was set up at Ghosi, district Mau in 1993-94 for ₹ 1.76 crore. Audit observed that only one training programme for 40 persons (Industrial Training Institute passed unemployed youths) was organized (March 2014) and no research work was done at the Institute. The building was lying vacant. Thus, the training centre failed in achieving its objectives**.**

4.7. Mandatory requirement of SWHS

Audit examined whether the State Governments/SNAs/Municipal Corporations had come up with policies that encourage hotels/institutions/society/ individual home etc, to install SWHSs and that new building in certain categories were not constructed unless solar assisted water heating systems were installed in the building.

Audit examination revealed that the State Government in Andhra Pradesh issued (December 2004) orders making SWHSs mandatory for all hospitals, nursing homes, hotels, guest houses, lodges and multi storied buildings in colonies. No Objection Certificate (NOC) for building plan was to be issued only after deposition of 25 *per cent* of estimated cost of SWHSs as refundable performance guarantee, to be refunded on successful installation of the SWHSs. Audit observed that as of March 2013, an amount of ₹ 9.69 crore was pending refund by the Non conventional Energy Development Corporation (NREDCAP) to residential apartments/commercial complexes/ hospitals after installing the SWHSs. These advances were outstanding since 2005 onwards.

5. Conclusion

MNRE did not align its solar photovoltaic off-grid targets with the Jawaharlal Nehru National Solar Mission targets and only 31 *per cent* of the Phase I, Jawaharlal Nehru National Solar Mission targets were achieved. Most of the States did not set any solar photovoltaic off-grid targets and in cases where the targets were set, the same were not achieved. The Project Appraisal Committee did not review the progress of the projects and the processing of applications was not Information Technology enabled as envisaged under the Jawaharlal Nehru National Solar Mission guidelines.

Audit noticed instances of non submission of utilization certificates. Cases of excess recovery of beneficiary share were also observed. There were instances of irregularities in distribution of solar devices, delay in distribution, irregular purchase of solar devices, deficiencies in award of works for solar power plants, irregular payments and delay in completion of projects by the States.

Maintenance of the off-grid systems was also not done as per the guidelines and the provisions of Annual Maintenance Contract. Physical verification of sampled systems by Audit revealed that 47 *per cent* of the off-grid systems were not working, one *per cent* of the systems were found missing and five *per cent* of the systems were issued to electrified villages.

6. Recommendations

- *MNRE must ensure that targets set under the programme are in alignment with Jawaharlal Nehru National Solar Mission.*
- *MNRE may review all delayed off-grid projects, set clear timelines for completion of these projects by the State Nodal Agencies/State Governments and ensure adherence with the same.*
- *MNRE may set up an effective mechanism, in coordination with the State agencies, to ensure that the off-grid systems are properly maintained and remain functional through their useful life.*

Chapter - VIII

National Biogas and Manure Management Programme

1. Introduction

The Central Sector Scheme on National Biogas and Manure Management Programme (NBMMP) mainly catered to setting up of family type biogas plants. It has been under implementation since 1981-82. The programme was implemented by State Nodal Agencies (SNAs)/State Nodal Departments (SNDs) like Agriculture Department, District Rural Development Agencies (DRDAs) and Khadi and Village Industry Commission (KVIC) centres.

The main objectives of the scheme were to provide clean bio-gaseous fuel mainly for cooking purposes; for reducing use of Liquified Petroleum Gas (LPG) and other conventional fuels; and to provide bio-fertilizer/ organic manure to reduce use of chemical fertilizers.

1.1. NBMMP policy

NBMMP provides for grant of central subsidy to the plant; turn-key job[1] fee linked with five years free maintenance warranty; financial support for repair of old non-functional plants; training of users, staff, entrepreneurs, etc. and publicity and communication.

CFA was being released to the concerned SNA/ SND and other implementing agencies at the rate of ₹ 16,700 per plant for North Eastern Region (NER) States and ₹ 8,000 to ₹ 10,000 per plant for other States.

2. Potential, target and achievements

2.1. Shortfall in achievement of targets

The targets and achievements under the 11th Five Year Plan (FYP) and 12th FYP upto 2014 are given in Table 32 below:

Table 32: Targets and achievement under 11th and 12th FYP

(Number in lakh)

S. No.	Year	Target	Achievement	(Shortfall)/excess	Percentage of shortfall
11th Five Year Plan Period (2007-12)					
1	2007-08	1.04	0.89	(0.15)	14.42
2	2008-09	1.24	1.08	(0.16)	12.91
3	2009-10	1.50	1.20	(0.30)	20.00
4	2010-11	1.50	1.51	0.01	-

[1] A job or contract in which the contractor agrees to complete the work of building and installation to the point of readiness for operation or occupancy.

S. No.	Year	Target	Achievement	(Shortfall)/excess	Percentage of shortfall
5	2011-12	1.52	1.40	(0.12)	7.89
	Total	6.80	6.08	(0.72)	10.58
12th Five Year Plan Period (upto 2014)					
6	2012-13	1.30	1.25	(0.05)	3.85
7	2013-14	1.06	0.84	(0.22)	20.75
	Total	2.36	2.09	(0.27)	11.44
	Grand Total	**9.16**	**8.17**	**(0.99)**	**10.81**

Source: MNRE

From the above table it can be seen that against the target of 9.16 lakh biogas plants, 8.17 lakh (89 *per cent*) biogas plants were installed during the period 2007-14. Except in the year 2010-11, targets were not achieved in any of the years covered in audit.

MNRE stated (May 2015) that the shortfall of only 11 *per cent* over the period of seven years was not a major shortfall and was attributable to reasons such as - (i) Poor economic conditions of the beneficiaries/farmers; (ii) Increased cost of construction and appliances; (iii) Increasing infiltration of domestic LPG as well as free LPG connections on first registration of most potential beneficiaries of biogas plants; (iv) Some of the States are high in potential but low priority is given for the scheme by the State Governments; and (v) Increasing wages of labourer and trained biogas masons and also due to lack of labourer availability, particularly after launching of the MGNREGA in the States. It also stated that on an average MNRE subsidy was only about 32 to 35 *per cent* of the costs of a biogas plant except in the North Eastern States where this was about 50 *per cent* and remaining amount was invested by the beneficiary from his pocket. A biogas plant cannot be subsidised 100 *per cent* to achieve the target because of limitation of budgetary allocations.

The reply is not tenable because as per guidelines, the State Governments had to constitute Unit Cost Committees at the State Level to examine all issues relating to fixation of unit cost of installation of various models and sizes of biogas plants. But the same was not done and MNRE did not revise the subsidy amount for the biogas plants.

2.2. State wise potential, target and achievement

State-wise target, potential, achievement and the total number of plants installed since 1981-82 are given in **Annexure XIV**. The estimated potential of biogas plants was 1.23 crore plants of which 47.52 lakh plants (39 *per cent*) had been installed upto March 2014. From the annexure it was observed that:

(i) There was high potential exploitation in Mizoram, Maharashtra (95 *per cent* each) and in Kerala (94 *per cent*).

(ii) The potential exploitation was lowest in Jammu & Kashmir, Jharkhand, Chhattisgarh and Bihar where it ranged between 2.37 *per cent* to 17.71 *per cent.*

(iii) In Nagaland and Sikkim the reported achievement exceeded the potential which appeared to be anomalous.

(iv) All States except Meghalaya fell short of achieving their targets.

Some of the audit findings that illustrate the reasons for shortfall in achieving targets are given below:

Bihar

Bihar Renewable Energy Development Agency (BREDA) retained unspent balance of ₹ 52.82 lakh sanctioned for NBMMP during 1984-87 for more than 27 years. It was also observed that MNRE stopped further funding from 2001-02 onwards as the final settlement of accounts was a pre-requisite condition for implementation of the scheme. After the year 2009-10 neither BREDA nor MNRE provided any fund under this scheme.

Nagaland

Department of New and Renewable Energy (DNRE) reported that 3,371 biogas plants had been commissioned, but actually 1,416 plants had been commissioned, leading to inflated reporting of 1,955 plants being commissioned for a value of ₹ 1.82 crore.

Punjab

During 2007-11 Punjab Energy Development Agency (PEDA) was able to achieve the targets fixed for installation of biogas plants. There was shortfall of 8,372 units during 2011-14 and shortfall was highest during 2011-12 (32.65 *per cent*). The targets for 2012-13 and 2013-14 included targets of 2,000 and 500 units respectively for Scheduled Caste (SC) beneficiaries, against which only five units (0.25 *per cent*) and `nil' units were installed leaving a shortfall of 1,995 (99.75 *per cent*) and 500 units (100 *per cent*) during these years.

MNRE stated (July 2015) that the estimated potential of family type biogas plant is based on cattle census of 1981-82 and the households having cattle holding of four and above. This may have varied from State to State in the following period of 30 years. Hence, the achievements made so far cannot be compared exactly with the tentatively estimated potential of 1981-82. It further stated that the farmers/villagers cannot afford the balance cost of plant in Jammu & Kashmir.

3. Implementation

3.1. Irregularities with respect to distribution of beneficiary share

i. As per guidelines, Central Financial Assistance (CFA) for construction of biogas plant[2] was to be directly released to the beneficiary on completion of work. In Gujarat, Audit found that Gujarat Agro Industrial Corporation Limited (GAICL) in its books of accounts of 2012-13 had shown ₹ 2.06 crore as subsidy payable to beneficiaries for installation of biogas plant up to 2008-09. This amount

[2] CFA for North Eastern Region was fixed by MNRE at ₹ 16,700 and for other States it was ₹ 10,000. Rest of cost was to be borne by the beneficiary.

included subsidy given by MNRE as well as State Government for NBMMP programme which was unpaid due to the same being unclaimed by the beneficiary. GAICL should have either made efforts to identify the beneficiary or refund the amount. MNRE stated (May 2015) that the concerned implementing agency in Gujarat have been asked to give the factual position regarding non-payment of subsidy in Gujarat.

ii. MNRE enhanced (November 2009) the additional CFA for toilet linked biogas plants from ₹ 500 to ₹ 1,000 per plant for implementation of NBMMP during the 11th Five Year Plan, effective from 1 November 2009. In Karnataka, it was observed that the Zilla Panchayat (ZP), Belgaum did not comply with this, leading to short payment of additional CFA of ₹ 0.66 crore in respect of 13,287 toilet linked biogas plants constructed during 2010-14. The State Government stated (October 2014) that ZP Belgaum utilised an amount of ₹ 0.47 crore towards additional CFA for sanitary linked biogas plants. The documents, however, indicated that the payment was made only at the rate of ₹ 500 per beneficiary.

3.2. Non adherence to the scheme guidelines regarding payment to Turn key Job Workers (TKJWs)

As per MNRE guidelines, each TKJW would be paid an amount of ₹ 700 in the first year and ₹ 200 for next four years per plant for regular maintenance, after completing the inspection and providing satisfactory services. As per the scheme guidelines, the TKJW were to visit the plant twice a year, at least during the warranty period. However, Audit found that the SNAs/ SNDs did not have complete records relating to the visit of TKJWs. The State specific findings are given below.

Himachal Pradesh

Audit noticed (July-August 2014) that in eight[3] districts turn key job fee of ₹ 0.70 crore was paid during 2012-14 to the *mistries* in one installment at the rate of ₹ 1,500 per biogas plant, instead of in five installments spread over five years and linked with visits as per MNRE guidelines.

Jharkhand

JREDA allotted construction of biogas plants to Non Governmental Organisations (NGOs) and technicians on turn key basis with the condition to maintain the plants for five years after commencement of the projects. For all 1,683 plants, no report regarding maintenance was available but payment of ₹ 0.26 lakh at the rate of ₹ 500 per plant for 52 plants installed in 2007-08 and of ₹ 0.28 lakh at the rate of ₹ 350 (50 *per cent* of admissible rate of ₹ 700) for 80 plants installed during 2008-09 and 2010-11 were made to the NGOs that had installed the plants.

[3] Bilaspur, Chamba, Hamirpur, Kangra, Mandi, Sirmour, Solan and Una.

Karnataka

i. Annual payment of ₹ 200 per completed biogas plant was not being made to TKJWs but retained as caution money deposit. Karnataka Renewable Energy Development Agency (KREDA) stated (October 2014) that KVIC had informed them that it had not received any claims for the refund and the amount would be refunded on receipt of claims.

ii. In three[4] Zilla Panchayats, CFA of ₹ 4.20 crore was not released by MNRE and payment of ₹ 0.49 crore was pending to the turnkey agents for installation of 8,118 biogas plants.

KREDA stated (October 2014) that it had now made available the funds to clear the pending bills.

Odisha

During 2007-14, Odisha Renewable Energy Development Agency (OREDA) executed 33,244 family type biogas plants. Out of 33,244, 8,387 plants were executed departmentally by OREDA in deviation of guidelines for which OREDA claimed ₹ 1.02 crore during the period 2007-12, which was also released by MNRE.

16,081 plants were executed through deployment of TKJWs for which payment of ₹ 2.13 crore was made during 2007-12 but the payment was not linked to five years warranty condition.

OREDA stated that in order to generate revenue for its sustainability, it had been executing biogas projects on turn key basis through its staff. The fact however remained that turn key fees was not admissible for the departmentally executed projects as per MNRE's guidelines.

3.3. Irregular payment of CFA

Given below is a Case Study from Karnataka where overall non-compliance with the MNRE guidelines was noticed.

Case Study II
Payment for incomplete Biogas plants and records in Karnataka

There was irregular payment of CFA and State Financial Assistance of ₹ 4.37 lakh and ₹ 10.98 lakh in Udupi and Shimoga ZPs respectively as the biogas plants were incomplete and the payment was irregularly made without any details of date of construction and commissioning recorded on the completion report.

These apart, deficiencies like only photocopies of beneficiary records being produced to Audit, the beneficiary not signing in his/her application for biogas plant, claim form of beneficiary not being signed by the Executive Officer (EO) of Taluk Panchayat (2010-11 onwards), not obtaining the signature of beneficiary on the advance stamp receipt and issuing inspection certificate without recording the date of installation and commissioning of the biogas plant were noticed at Shimoga ZP.

[4] Udupi, Shimoga and Tumkur.

4. Monitoring

4.1. Monitoring and physical verification of biogas plants

As per the guidelines, the SNA had to send a quarterly report to MNRE regarding the number of plants installed in the State and how many of them were functional/ non-functional. The SNA had to select at least two villages in each month for determining the status of biogas plant earlier set up. Some State specific audit findings are given below.

Arunachal Pradesh

i. APEDA did not select two villages each month to determine the status of the biogas plant set up earlier as required in MNRE guidelines. Quarterly progress reports were not sent to MNRE after physical verification. As a result, details of the number of biogas plants in working condition, etc; were not available on record.

ii. APEDA did not conduct training/user courses for beneficiaries, masons, technicians, etc. under this scheme. However, it was stated that beneficiaries were explained how to use biogas plants at the time of installation.

Bihar

Audit observed that SNA had not carried out any district wise assessment of the performance of the installed biogas plants except in Nalanda district where nine plants remained non-functional out of 70 plants installed during 2010-11.

Gujarat

GAICL had also not selected two villages for physical verification.

Haryana

Data base of functional and non-functional plants was not maintained by the Agriculture Department.

Jammu & Kashmir

Jammu & Kashmir Energy Development Agency (JAKEDA) did not carry out assessment of the number of non-functional plants and details of cost of repairs on these plants. At least two villages in each month were to be selected for determining the status of biogas plant earlier set up and quarterly reports thereof needed to be sent to MNRE. It was seen in audit that these agencies had not devised any such mechanism to ascertain the performance of plants.

Karnataka

Since quarterly progress reports were not submitted, the information on functioning and non-functioning biogas plants could not be assessed. Audit noticed during physical verification of 35 biogas plants of selected districts (RDPR) that 10 biogas plants were found to be non-functional.

KREDA stated (October 2014) that the project engineer working in the programme had brought to its knowledge that cracks had developed in the plants due to quality of sand, black soil etc.; the cost of repair worked out to ₹ 10,000 and beneficiaries were not coming forward to set right the defects but were evincing interest for new plants.

Uttar Pradesh

Uttar Pradesh New and Renewable Energy Limited (UPNEDA) was to select at least two villages each month for determining the status of biogas plants but this was done only once in 2012. Inter district inspection was carried out by the project officers to verify the status of the plants. Once in May 2010 field inspection and evaluation was carried out by MNRE.

Uttarakhand

Uttarakhand Renewable Energy Development Agency (UREDA) monitored the biogas programme through turnkey agents. The Biogas Development and Training Centres (BDTCs) also carried out inspections of the installed plants. However, SNA did not maintain any records for functioning of the systems.

MNRE stated (July 2015) that SNAs are monitoring the biogas programme through turn key agents, biogas development and training centres and carried out inspections of installed plants from time to time by visiting the biogas plants for physical verifications before the release of subsidy, TKJW fees etc. and the record related to visits and verification of biogas plants were maintained by SNAs and the completion certificate are issued after 100 *per cent* inspection of the plants. It further stated that it was getting evaluation studies carried out by independent organizations from time to time as part of monitoring and evaluation of the programme. As per the last two independent evaluation studies carried out for implementation of the programme during the 10^{th} and 11^{th} FYP Period, the study reports have brought out a functionality rate of 95.80 *per cent* for the plants installed in six States during the 10^{th} FYP Period and 95.45 *per cent* for the biogas plants installed in eight States during the 11^{th} FYP.

However, the fact remained that audit examination on a test check basis in selected States threw up instances of non-compliance with programme guidelines in this regard. The physical verification conducted by Audit revealed that 26 *per cent* plants test checked were not working (Refer to para 4.3).

4.2. Independent evaluation

As per the guidelines, the SNA could involve independent organizations and reputed NGOs in the monitoring and evaluation of the programme. State specific audit findings with regard to third party evaluations are given below.

Gujarat

GAICL carried out evaluation of the plants implemented in Gujarat during last 13 years (i.e. from 2001-02 to 2012-13) by Gujarat Industrial and Technical Consultancy Organisation Limited (GITCO) in July 2013. GITCO in its inspection/study reported that 219 Sintex make, 1,429 Deenbadhu make and two KVIC floating dome biogas plants were not working out of 3,559 Sintex plants, 66,472 Deenbandhu plants and 128 KVIC plants respectively.

Jharkhand

A third party evaluation was done by Gram Vikas Abhiyan Kendra, Ranchi for 270 units out of 1,683 units in 2009-10. Out of 270 units 200 (74 *per cent*) were found non-functional due to reasons of insufficient dung, water logging and pipe leakage. No action was taken by Jharkhand Renewable Energy Development Agency (JREDA) against the NGO for non-functional units. However, no further work was allotted in subsequent years (2010-13).

4.3. Physical Verification by Audit

Audit conducted a physical verification of the biogas systems on a test check basis in the 24 sampled States to gauge the condition of the systems installed and the problems faced by the users. The Audit findings are given in Table 33. Details may be seen in **Annexure XV**.

Table 33: Summary of physical verification of NBMMP systems

System	No. of systems inspected	No. of systems not in working condition (in *per cent*)	Observations
Biogas	429	112 (26)	A large number of systems were found to be in non-working conditions due to following reasons: • Non availability of raw material • Use of alternate fuels like LPG and firewood • Damaged plants • Lack of maintenance

Physical verification of sampled systems by Audit revealed that 26 *per cent* of the biogas plants were not working.

5. Awareness/training

As per guidelines, the SNA had to prepare standard publicity materials such as Do's and Don'ts, leaflets, booklets, posters, etc. for wider dissemination in the State availing the financial assistance. Audit findings based on test check, with regard to awareness and training are given below.

Gujarat

Except during 2010-11 (beneficiaries meeting at Surat) no training was imparted to beneficiaries for biogas plant. Moreover, training was imparted to masons in the year 2007-08 only.

Karnataka

Mass media has been utilized extensively to bring about awareness regarding the policies and incentives available but there was lack of community participation due to non-involvement of local bodies. KVIC creates awareness about biogas plants through booklets and leaflets.

Rajasthan

Biogas Development and Training Centre (BDTC) and KVIC were creating awareness about the biogas projects in the State. Publicity was done through distribution of printed material like posters, pamphlet and other manuals by BDTC on a large scale. Information regarding incentives and subsidy were also advertised through these materials. However, it was noticed that there was no proper participation of local bodies like Panchayats in this scheme and the same was not provisioned in the scheme also.

MNRE stated (July 2015) that it is supporting the SNAs /SNDs and KVIC as well as BDTCs across the country for taking up promotional activities through communication and publicity component. Targets for various training courses including for awareness / promotional activities are allocated annually to all the designated SNAs /SNDs and KVIC and BDTCs. They all conduct regular training programmes besides preparation of publicity material for wider dissemination of the NBMMP in the States. However, the reply is silent on the adequacy of number of training programmes and participation of local bodies.

6. Conclusion

The total estimated national potential for biogas plants was 1.23 crore, of which 47.52 lakh biogas plants (39 *per cent*) had been achieved as of March 2014. During 2007-14, against a target of 9.16 lakh biogas plants, 8.17 lakh (89 *per cent*) biogas plants were installed. None of the States except Meghalaya were able to achieve their targets during the period 2007-14. However, the planning was done based on the potential assessment done on the cattle census of 1981-82.

Audit observed that several States did not follow the guidelines with respect to timing and amounts released to turn key workers and complete records of visits of turn key workers were not maintained. In some States, implementing agencies did not conduct physical verification as required under the programme guidelines.

Physical verification of sampled systems by Audit revealed that 26 *per cent* of the biogas plants were not working.

7. Recommendation

- *MNRE may ensure better compliance with guidelines, particularly with regard to successful functioning of the biogas plants constructed under the programme.*

Chapter - IX

Remote Village Electrification

1. Introduction

The Remote Village Electrification (RVE) Programme was designed to provide financial support for electrification of those remote unelectrified census villages and unelectrified hamlets of electrified census villages where grid-extension was either not feasible or not cost effective; and were not covered under Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY). Such villages were to be provided basic facilities for electricity/lighting in distributed power generation mode, through various Renewable Energy (RE) sources like Small Hydro Power (SHP), biomass gasification based electricity generation systems, Solar Power Plants (SPP), etc depending upon local availability.

Projects under the RVE Programme were intended to cover all the households in the village/hamlets, including those in the *dalit bastis* of the village, and creation of capability for availability of electricity as laid down in the National Electricity Policy 2005, i.e., a minimum of one kWh per household per day. However, if the State Governments concluded that the norm of one kWh per household per day was not achievable in a cost effective manner through various RE technologies, due to inadequate availability of the resources, then as a last resort they could decide to provide at least the basic lighting facilities through Solar Home Lighting Systems (SHLSs) for each of the willing households in the village. However, as per the Rural Electrification Policy 2006 of the Government, villages/hamlets using isolated lighting technologies like SPV, were not to be designated as “electrified”.

The programme was to be implemented through State Nodal Agencies (SNAs)/ Power Departments/Electricity Boards/Corporate Entities with active involvement of District-level Bodies, Panchayati Raj Institutions, Village Councils, etc. However, the State Governments were to notify the nodal agency which would be responsible for coordination of all the efforts in the State pertaining to electrification of remote unelectrified census villages through non-conventional energy sources.

2. Targets and achievement

2.1. Position of electrification of remote villages/hamlets

At the end of the 10th Five Year Plan (FYP), 3,254 remote villages/ hamlets had been covered under the programme. The State wise targets and achievements for the period 2007-14 are given in **Annexure XVI**. The consolidated position as per MNRE for the period 2007-14 is detailed in Table 34 below:

Table 34: Targets and achievement under 11th and 12th FYP

S. No.	Year	Target (No. of villages/ hamlets)	Achievement (No. of villages/hamlets)
Up to 10th Five Year Plan Period		#	3,254
11th Five Year Plan Period (2007-12)			
1	2007-08	2,000	1,297
2	2008-09	1,500	326
3	2009-10	1,500	1,013
4	2010-11	1,500	1,537
5	2011-12	500	1,056
	Total	7,000	5,229
12th Five Year Plan Period (upto 2014)			
6	2012-13	Not fixed	975
7	2013-14	Not fixed	860
	Total	Not fixed	1,835
	Grand Total		**10,318**

Source: MNRE.
- Figure not furnished by MNRE.

Table 34 above revealed that progressively from 2007-08 onwards the coverage under the RVE programme declined. No targets were fixed by MNRE for the years 2012-13 and 2013-14. MNRE stated (July 2015) that it had sanctioned 13,059 villages/hamlets during the period 2007-14 out of which 11,308 had been completed/ electrified. The total of the year wise achievement as depicted in Table 34 did not match with the achievement claimed by MNRE for the period 2007-14.

It was also observed that the release of Central Financial Assistance (CFA) decreased from ₹ 132.81 crore in 2007-08 to ₹ 17.92 crore in 2013-14 and this was not commensurate with the RVE targets.

Such wide variations in all parameters of target setting and achievement raise doubts on the reliability of the planning process and the data maintained by MNRE.

2.1.1. Short achievement of targets

Under RVE programme, Andhra Pradesh, Goa, Kerala and Nagaland completed electrification in villages/hamlets as per MNRE's sanction. However, Chhattisgarh, Jammu & Kashmir, Jharkhand, Karnataka, Odisha, Uttar Pradesh and West Bengal could not cover all the villages/hamlets sanctioned by MNRE under the scheme.

2.1.2. Coverage of excess villages/hamlets under RVE programme

Under RVE programme, in the following States more villages/hamlets were reported to be covered than the villages identified as eligible by REC, thus indicating that ineligible villages/hamlets were covered under the RVE programme. The States in which the number of villages/hamlets identified as eligible as REC were less than the actual coverage reported are given in Table 35.

Table 35: States which covered more villages/hamlets than identified as eligible by REC.

State	Number of villages/hamlets verified by REC	Number of villages/hamlets completed upto 2013-14
Goa	0	19
Haryana	149	241
Himachal Pradesh	1	20
Tripura	583	606

2.1.3. Improper planning by the States

As per the scheme guidelines of RVE, villages/hamlets covered under RGGVY based on certification by REC, were not eligible for coverage under the RVE programme. However, Audit observed deviations in this regards in some States. The State wise audit findings are given below:

Assam

i. The State Government notified three agencies for implementing RVE – Assam Power Distribution Company Limited (for 1,057 villages), Assam Energy Development Agency (AEDA) (for 920 villages) and Forest Development Agencies (for 162 villages). As of November 2014, 191 villages remained to be electrified, but no record of basis of prioritization among villages was available. All residents of the villages were not covered and the basis of selection of individual beneficiary was not on record.

ii. Audit observed that out of 206 villages identified for electrification, one had no beneficiaries, ten were already electrified and four were covered under village energy security programme. Four villages electrified under RVE programme had already been covered under RGGVY. As per DPR approved in February 2008, in 19 villages in Dhubri district there was a vast difference in the number of beneficiaries actually present, which led to delay of four years in implementation of scheme.

Chhattisgarh

REC prepared DPR for electrification of 10 villages under RGGVY. However in disregard of the programme guidelines, electrification of Kurkuriya village (Jashpur district) was done by CREDA through solar power. Similarly, out of 85 villages covered under RGGVY scheme, nine more villages were being electrified by CREDA.

Jharkhand

Jharkhand Renewable Energy Development Agency (JREDA) did not have a complete list of un-electrified villages in the State. During 2007-14, it prepared annual work plans to implement the programme in 792 villages but could not send proposals to MNRE during 2007-08 and 2012-14. As such, programmes of RVE was sanctioned by MNRE only for 251 villages. However, 353 villages[1] were covered under this programme during 2007-14.

[1] RVE for 102 villages was sanctioned in 2006-07.

Jammu & Kashmir

Jammu and Kashmir Energy Development Agency (JAKEDA) had not undertaken surveys of remote villages for assessment of demand for electricity and availability of RE sources. As such, DPR and lists of beneficiaries had not been prepared despite the fact that JAKEDA received ₹ 2.86 crore from MNRE, which had been utilized on unapproved items like purchase of five vehicles, Petrol, Oil and Lubricants, Travelling Allowance, air fares, lunch in hotels, repair of vehicles, hiring of vehicles, office equipment, wages etc. during 2008-14. Audit observed that the SNA relied on the lists of remote villages/ beneficiaries framed by the Rural Development Department, which were vetted by the concerned Deputy Commissioners. The criteria adopted by the Rural Development Department for formulation of lists of remote villages/ beneficiaries was not on record. It was seen in audit that long term as well as short term targets had not been fixed for electrification.

MNRE stated (May 2015) that identification of beneficiary and survey for demand of electricity was a State subject and a clarification will be sought from JAKEDA with reference to expenditure. The reply is not tenable because MNRE did not monitor the use of CFA either through utilization certificate or otherwise.

Odisha

RVE programme was implemented in eleven districts during 2007-12 with CFA of ₹ 51.77 crore and State Financial Assistance of ₹ 21.93 crore. The targeted number of 1,621 villages were electrified after delays ranging from five months to three years due to indecisiveness of the State Government. Further, delay in release of State share of financial assistance, delay on the part of administrative department[2] to finalise mechanism for implementation and consequential delay in placement of orders on vendors, etc led to CFA of ₹ 1.45 crore pertaining to the period 2008-10 to be refunded (January 2013).

West Bengal

Out of 24 villages only six villages had been covered due to delay in tendering. Further, provision was made for electrification of 18 villages by SHL system but the project had not yet commenced. MNRE stated (May 2015) that the State had been advised through meeting, video conferencing to expedite the implementation.

2.2. Funding of the programme

As per MNRE guidelines, CFA of upto 90 *per cent* of the costs of the RE generation systems was to be provided for approved projects, subject to the maximum amounts, and balance cost was to be financed through contributions from State funds, beneficiaries, or other sources.

Further, 70 *per cent* of the CFA was to be released along with sanction. The amount was to be used as early as possible. In case it was not possible to utilize the funds, the same was to be kept in interest bearing separate bank account and the accrued interest credited towards CFA. The second installment of 30 *per cent* was to be released after the receipt of

[2] Science and Technology Department of the Government of Odisha.

Utilisation Certificates/ Statement of Expenditures (SoEs) and periodical monitoring reports from SNA /independent bodies.

2.2.1. Irregularities in release of CFA and its utilisation

Audit observed that there were issues like non release of CFA by MNRE, CFA not being released in proportions fixed for the programme, CFA being kept in non-interest bearing account etc. The State wise audit findings are given below:

Assam

During 2005-14, MNRE sanctioned eight packages covering 882 villages with a CFA of ₹ 62.13 crore. As per guidelines the initial installment of 70 *per cent* was to be released along with the sanction. Audit observed that in five packages, MNRE released initial installment of only 0.38 *per cent* to 31 *per cent* and subsequent installments were released after lapse of 32 to 1,627 days. CFA of ₹ 12.20 crore was yet to be released by MNRE. Delay in release of sufficient installments impacted smooth progress of the projects. AEDA submitted Utilisation Certificates (UCs) with a delay of 652 to 1,755 days. Further, AEDA did not have an interest bearing account for the CFA received, which led to loss of interest of ₹ 67.72 lakh during phase I of the programme.

Meghalaya

Contrary to guidelines, in respect of two projects (70 and 66 remote villages) CFA of ₹ 2.18 crore and ₹ 1.68 crore released by MNRE was kept in non-interest bearing account leading to loss of interest of ₹ 9.78 lakh. MNRE withheld the final release of installment of ₹ 0.89 crore and ₹ 0.71 crore, respectively due to violation of guidelines and non evaluation of projects by third party.

Odisha

During 2006-07 to 2011-12, Odisha Renewable Energy Development Agency (OREDA) neither kept the fund in a separate bank account nor credited the interest on the unutilised funds to that account. Thus, CFA of ₹ 15.84 lakh to ₹ 10.63 crore were blocked without utilisation for a period ranging from 15 to 652 days leading to loss of interest of ₹ 1.72 crore. OREDA stated that interest accrued on this account is utilized to meet several contingencies in the execution of the programme. However, it was observed that interest earned on the funds were not identified and added to the CFA.

Rajasthan

During the years 2011-13, MNRE sanctioned ₹ 13.41 crore for installation of 12,941 SSLSs. The systems had been commissioned, but ₹ 3.29 crore were yet to be released by MNRE for want of third party evaluation.

2.2.2. Irregularities in collection of beneficiary share

The State wise audit findings are given below:

Assam

i. Audit observed that there was excess collection of beneficiary share of ₹ 2.72 crore by the implementing agencies for SHLSs in 305 villages.

ii. AEDA did not procure systems at the cost fixed by MNRE which led to an additional burden of ₹ 28.33 lakh to be shared between the State Government and the beneficiaries.

Jammu & Kashmir

Beneficiary share of ₹ 750 per SHLS and ₹ 500 per SL was to be recovered before issue of these equipment. Audit observed that an amount of ₹ 25 lakh had been outstanding against district officers as beneficiary share as of March 2014 for the systems issued during 2009-13. Further, foolproof mechanism for recovery of beneficiary share had not been formulated as beneficiary share to be recovered was not indicated in the SHLS distribution lists. As a result, the district officer, Baramulla had collected (2011-12) beneficiary share in the range of ₹ 1,600 to ₹ 3,000 in villages of Jabla and Gakhrote in place of approved amount.

3. Implementation of the RVE programme

Audit noticed instances of inordinate delays in completion of projects, award of contracts to ineligible contractors, irregular distribution of lighting systems and incomplete/non-installation of Remote Village Electrification systems. The detailed audit findings are given below:

3.1. Delay in completion of projects

As per MNRE sanctions, all projects were to be completed within one year of release of funds. However, Audit observed that there were inordinate delays in completion of projects. The State wise audit findings are given below:

Chhattisgarh

Under RVE programme, MNRE sanctioned ₹ 23.18 crore for 314 villages and released ₹ 16.21 crore during 2007-09. CREDA had executed the electrification work of 252 villages. MNRE did not release the remaining CFA as electrification work could not be completed even after seven years, due to law and order problems affecting the villages.

Meghalaya

A project of 70 villages approved in March 2007 was completed with a delay of 22 months as State share was not released on time and there were changes in the list of villages[3] and increase in number of households[4]. Another project of 66 villages sanctioned in March 2010 was completed (May 2011) with delay of two months and only 52 villages were electrified[5] as 11 villages were covered by other schemes and three villages were not inhabited.

MNRE stated (May 2015) that efforts were being made through video conferences and meetings to expedite the implementation within the stipulated time.

3.2. Non utilization and diversion of funds

Audit observed that there were cases of non utilization of funds and diversion of funds. The State wise audit findings are given below:

Bihar

An amount of ₹ 20 lakh received from the State Government during 2007-08 was lying unutilized for last six years as no project was taken up by BREDA. Further, ₹ 0.52 lakh was transferred to Rajiv Gandhi Akshaya Urja Diwas during 2012-13 from this amount. BREDA accepted the facts.

Chhattisgarh

MNRE sanctioned (June 2007) an amount of ₹ 2.14 crore for electrification of village Kachhar. Instead electrification work at three villages (Arsiya, Lalpani, Tumnar) was done by utilizing MNRE share of ₹ 59.40 lakh. Further, cases of deviation in number of sanctioned households, SHLS, SLS, power plants were also noticed. In some villages SPV Power Plants had been sanctioned but no Power Plants were installed and electrification was done through SHLSs and SLSs only.

MNRE stated (May 2015) that during the final settlement CFA was disbursed only for those villages which were approved and no deviation was allowed without prior approval. The reply is not tenable because electrification was not done in the villages as per the sanctions accorded.

3.3. Award of contract to ineligible contractors

As per MNRE guidelines, competitive bidding process was to be followed in award of works to contractors. For SPV systems, procurement was to be done from suppliers having valid test certificate from a MNRE authorized test centre. The State wise audit findings are as follows:

[3] 12 villages in the original list had to be replaced as 11 villages were unwilling and one was abandoned.

[4] There was an increase in the total number of households which led to increase in installation of SHLSs to 1,570.

[5] Six villages were already electrified by MeECL, five villages were covered by it under Ministry of Tribal Affairs Programme/other programme and three villages were uninhabited.

Jammu & Kashmir

JAKEDA placed orders[6] (26 October 2009) for supply of 11,227 SHLS[7] for ₹ 11.24 crore. Audit observed that the supply order was placed without the approval of the JAKEDA board and it was split into 14 supply orders in order to avoid cheques being jointly signed by the CEO and Commissioner/ Secretary. Taking serious note of the matter the Minister[8] ordered cancellation (November 2009) of supply order, but JAKEDA did not cancel the supply order placed with Directorate General of Supplies and Disposals (DGS&D). Further, DGS&D rate contract was to lapse by 31 October 2009. The new DGS&D rate contract for the systems was lower (₹ 12,500) than the previous rate contract (₹ 12,978), leading to loss of ₹ 32.81 lakh.

MNRE stated (May 2015) that at the time of final Settlement the SNA had to certify that the CVC guidelines have been followed while selecting the contractor**.**

Nagaland

M/s Kuwe Mero, who had qualified in both the technical and financial bids had quoted the lowest rate among the tenderers for supply of SHLSs and SSLSs. The supply orders were however awarded to M/s Kuovisie Rio and M/s Kevi Chadi at a rate higher than that quoted by M/s Kuwe Mero. No justification for selection of bidder at higher rate was on record. This led to excess expenditure of ₹ 26.60 lakh.

The Department of New and Renewable Energy (DNRE) accepted the fact and stated that though lowest rate was recommended for award of contract, the Directorate of DNRE, recommended award of contract to higher bidder. Accordingly, supply order was issued.

3.4. Excess/irregular distribution of RVE systems

As per MNRE guidelines, the implementation of the RVE systems should be certified by authorized village/district level officials/bodies to the effect, that the village has been electrified or that work had been carried out as per the sanction order/DPR (for SHLS). Further, periodic monitoring should be done by the SNA/independent agency and report thereof submitted to MNRE. MNRE should also monitor the progress of the project through the reports submitted by the SNAs so that RVE systems are distributed as per MNRE sanction. The State wise audit findings are given below:

Jammu & Kashmir

i. In four test-checked districts, records showed that 25,016 SHLSs were approved for 25,016 households of 148 villages. JAKEDA procured only 22,690 SHLSs out of which only 10,324 SHLSs were distributed as per sanction. 3,382 SHLSs were distributed in 34 unapproved villages/ hamlets without obtaining the approval of MNRE and 8,984 SHLSs were distributed in 37 electrified hamlets. The State Government stated (July 2014) that the villages which had been electrified during the process of obtaining

[6] With Director General Supplies and Disposals (DGS&D), New Delhi.
[7] 6,872 SHLS of M/s Bharat Electronics Ltd make and 4,355 SHLS of M/s Kotak Urja Private Ltd. make.
[8] Science and Information Technology Department.

sanction from MNRE were dropped and only actual un-electrified villages were covered. However, Audit observed that the due process of obtaining prior permission from MNRE for distribution of SHLSs among the beneficiaries was not followed and SHLSs were distributed in electrified hamlets.

ii. The executive committee of the JAKEDA decided (May 2009) that the hospitals which were suitably connected with grid would not require SPP as a backup and decided to install SPP only in the health centres of the REC cleared villages which were without electricity. Records, however, showed that 47 SPPs were installed at district/sub-district hospitals which were grid connected. Similarly, 40 SSLSs (cost: ₹ 10 lakh) were installed (November 2011) at four hospitals of Jammu city which were already provided with grid based SSLSs.

3.5. Incomplete /Non deployment of RVE systems

Audit observed that there were cases of incomplete installation of RVE systems and non deployment of RVE systems. The State wise audit findings are given below:

Jammu & Kashmir

MNRE had released CFA of ₹ 64.32 crore during 2007-14 for installation/distribution of 1,04,118 SHLSs/SSLSs. However, only 48,298 (46 *per cent*) SHLSs had been distributed as of March 2014.

Jharkhand

As per MNRE guidelines, RVE systems installed in the village should be redeployed if the village was connected to a grid before expiry of at least five years of the installation of RVE systems.

However, Audit observed that in 14 villages of Potka block in East Singhbhum, RVE systems (SHLS: 902 and SSLS: 89) installed were not redeployed on getting grid connectivity under RGGVY.

Uttarakhand

The State Government approved (December 2008) construction of two SHP projects at Pinswad (50 kW) and Kotijhala (200 kW) under RVE programme for providing electricity to 2,700 inhabitants of 502 households for ₹ 0.81 crore. Construction of both projects was stopped (December 2012) after incurring an expenditure of ₹ 0.43 crore because of lack of interest by Urja Samitti, deviation in drawing, substandard work (May 2011) and further damage caused by natural disaster in June 2013. MNRE stated (May 2015) that as informed by the SNA, the work was in progress.

West Bengal

MNRE sanctioned ₹ 36.76 crore (February 2010) with CFA of ₹ 21.60 crore for electrification of 18 remote villages of Sundarban by providing SHLS to 23,845 households and 2,008 SSLSs.

Audit observed that no work was taken up (September 2014) because of delay in finalization of the beneficiary list, delay in tendering and absence of infrastructural support. Although only ₹ one lakh was spent but UC for the full amount was sent to MNRE. MNRE also did not monitor the implementation of the project. MNRE stated (May 2015) that it accepts the UC certified by SNA, however, in this case a clarification will be sought from WBREDA and that WBREDA has been instructed to finish the project in time.

4. Monitoring and evaluation

As per MNRE guidelines, the concerned State Departments/ Implementing Agencies were to ensure close monitoring of the implementation of the projects and to provide periodic progress reports to MNRE. Third party monitoring by an independent, reputed agency after completion of the projects was mandatory before release of the final installment. MNRE provided ₹ 50,000 per village as service charge to the Implementing Agencies for third party monitoring by an independent, reputed agency.

After installation also it was the responsibility of the implementing agencies to ensure functionality of the systems and periodic monitoring was to be carried out by them. The district/village level agencies were to be closely associated in planning, implementation and monitoring of all projects.

MNRE was also to carry out its own monitoring and evaluation of the projects directly or through independent agencies appointed by it.

Test audit revealed deficiencies in monitoring by SNAs and MNRE. The State wise audit findings are given below:

Arunachal Pradesh

Arunachal Pradesh Energy Development Agency (APEDA) conducted third party monitoring only once after installation of SHLSs under RVE programme in 2005-06 by Arunachal Pradesh Aditya Solar Society, Itanagar (NGO). However, there was no data on the number of SHLSs functioning. MNRE stated (May 2015) that clarification will be sought from APEDA in respect to evaluation report.

Assam

The three[9] implementing agencies got the systems evaluated by third parties like Assam Financial Corporation, IIT Guwahati, Tezpur University etc. The deficiencies pointed out included non installation of systems as per work order, insufficient training, systems being stolen, systems sold/transferred to others, excess collection of beneficiary share, demands for grid connected power so that other household needs could be fulfilled, non creating of corpus funds for maintenance and replacement of batteries, systems not working to the full extent etc.

[9] AEDA, APDCL and FDAs.

Chhattisgarh

CREDA received an amount of ₹ 1.09 crore from MNRE as service charges for RVE projects but monitoring and evaluation of the completed RVE projects was not conducted through any agency/organisation. MNRE stated (May 2015) that third Party monitoring was a mandatory requirement for final settlement of projects and CREDA had been asked for submission for the same.

Jammu & Kashmir

i. Audit observed that the SNA had neither carried out periodic inspections nor monitored the implementation of the projects through independent agency. As a result, performance of these projects could not be ascertained. The State government stated (July 2014) that since the projects had been recently completed, the third party monitoring got delayed and it would be taken up immediately. The reply is not tenable as RVE had been running since 2007-08.

ii. The UCs and SoE in respect of installation of SHLSs under RVE programme were not submitted to MNRE within the scheduled period of time as detailed below:

- UCs and SoE in respect of electrification of 68 villages (sanctioned in February 2009), 77 villages (March 2010), 27 villages (March 2010), 80 villages and 20 hamlets (March 2010) and 48 villages (July 2010) were submitted to the MNRE in January 2013 after a delay of 31 to 47 months;
- The UCs and SoE in respect of 12 projects sanctioned during November 2007 to February 2012 were submitted to the MNRE during the period April 2010 to May 2014 after delays ranging between 14 and 36 months; and
- The UCs and SoE in respect of installation of one SPP of 100 kW capacity sanctioned (December 2011) had not been submitted as of August 2014 due to non-completion of the project.

Kerala

Audit observed that no monitoring was done by the ANERT, thereby violating the terms and conditions of the RVE programme.

Maharashtra

i. In 30 villages the quarterly reports were submitted for periods two to three years only as against the full duration of five years. Quarterly reports for the entire period were not available with MEDA in respect of the remaining five villages[10].

ii. In 14 villages the Gram Sevaks did not submit six monthly reports to MEDA, in the absence of which the functioning of solar equipments (home/street lights) could not be ascertained in audit.

iii. The report on training, orientation and awareness programmes for operating the solar equipments for various target groups / stake holders conducted by the supplier during the period 2007-14 were not furnished to Audit. In the absence of reports, it could not be ascertained whether the trainings were conducted or not.

[10] Bhatpur district Gadchiroli, Ahire-Khandi district Pune, Charmali district Jalgaon, Gongwada and Rameshgudam district Gadchiroli.

Meghalaya
Third party monitoring was done by private consultants only for the project of 70 villages. As per the monitoring report submitted, 97.49 *per cent* of the total systems were found available at the time of survey. However, in the absence of the third party monitoring report for the other project for electrification of 52 villages, the impact of the project implementation could not be ascertained in audit.
Nagaland
As per the DPR, a Village Energy Management Board (VEMB) was to be formed for long term sustainability of the project, monthly collection of revenue and periodic monitoring. However, records on actual functioning of the VEMB and its monitoring by DNRE could not be furnished to Audit. DNRE stated that as per MNRE guidelines, VEMB was formed in all the eight villages. However, collection of revenue was not done by VEMB inspite of the Department's directives.
Uttar Pradesh
Audit observed that there was no periodicity of sending monitoring reports to MNRE and the same was sent as and when demanded by MNRE. However, copy of reports could not be furnished to Audit.
Uttarakhand
SNA did not maintain any record to indicate functionality of systems under RVE which was also confirmed during physical verification.

MNRE stated (May 2015) that under the provisions of the RVE Programme, maintenance and long-term sustainability of installed systems was primarily the responsibility of the concerned State Governments/SNAs. The reply is not tenable because MNRE did not carry out its own monitoring and evaluation through an independent agency to address the problems.

5. Maintenance

Deficiencies in maintenance of systems were noticed across the sampled States due to under collection of user charges and deficiencies in maintenance arrangements. The detailed audit findings are given below:

5.1. Collection of user charges from beneficiaries

As per the programme guidelines, user charges on an upfront basis and/or monthly basis were to be collected from beneficiaries. Where SHLSs are used, a charge of ₹ 20 per month or ₹ 10 per month were to be collected depending on the model of SHLS installed. This money was to be kept in a separate account for use for replacement of batteries and other components. A willingness to pay this amount by the beneficiaries was to be obtained before installation. The State wise audit findings in this regard are given below:

Assam

Audit observed that the Village Electrification Committees remained non functional which led to beneficiary share not getting collected, maintenance issue not being taken up with the contractors / implementing agencies and non monitoring the use of electrical and electronic gadgets by beneficiaries which had an adverse affect on the life of the systems.

Chhattisgarh

CREDA invited tenders in 2011-12 for AMC of SPPs, SSLSs and SHLSs installed in the villages. During the period 2000-01 to 2013-14, a total 708 villages/hamlets were electrified covering 25,873 beneficiaries. Audit observed that user charges of ₹ 20.45 lakh were not collected from beneficiaries.

Gujarat

Gujarat Energy Development Agency (GEDA) awarded contract for installation of 509 SHLSs and 39 SSLSs under RVE programme during 2005-06 for electrification of 36 remote villages. These contracts had a provision for recovery of ₹ 20 per user per month as user charges for maintenance of SHLSs by the contractor. The three contractors were to install 509 SHLSs and should have recovered ₹ 6.11 lakh from the beneficiaries for the period of five years and deposited the same with GEDA. Audit observed that only Bharat Electronics Limited (BEL) had collected ₹ 30,500 and deposited the same with GEDA. Thus, there was short recovery of ₹ 5.80 lakh required for the replacement of batteries after the five year period.

Jharkhand

Test check of records of five villages revealed that JREDA did not have system to collect the beneficiary share for maintenance. SNA accepted the facts.

Jammu & Kashmir

Audit observed that JAKEDA distributed 48,298 SHLSs to households of un-electrified villages during 2008-13. However, Audit observed that the SNA did not obtain the requisite willingness from the beneficiaries for payment of user charges leading to an annual loss of ₹ 1.16 crore. The State Government stated (September 2013 and July 2014)) that it was very difficult to manage the collection of user charges in the rural and far flung areas as JAKEDA did not have adequate manpower for the purpose.

Maharashtra

Audit observed that under RVE programme for the period 2007-14, in 35 villages monthly charges amounting to ₹ 36.53 lakh were not recovered from 3,044 beneficiaries by the Village Panchayats.

Meghalaya

There was irregular collection of beneficiary contribution of ₹ 1,500 towards capital cost and ₹ 60 month towards maintenance. Further, there was no database of the installed systems with MNREDA, which indicated lack of monitoring. The same was also not checked by MNRE.

Nagaland

Though system of collection of ₹ 50 per month from beneficiaries through Village Energy Management Board (VEMB) was set up, no collections were being made as of November 2014.

MNRE stated (May 2015) that collection from beneficiary was not mandated by MNRE and it was upto to the States to decide considering successful implementation and maintenance of systems and that the State Government certify that the replacement of batteries after five years was their responsibility.

The reply is not tenable because as per MNRE guidelines the willingness to pay had to be taken from the beneficiaries before installation.

5.2. Deficiencies in maintenance arrangements

As per Programme guidelines, to ensure long term operation, maintenance and sustainability of the projects, appropriate arrangements were to be made for suitable AMC for a minimum period of five years. The State wise audit findings are given below:

Chhattisgarh

i. In Gariyaband District, 81 villages were electrified through SPPs/SPV devices (commissioned during 2004 to 2008). Work order for operation and maintenance of the power plants in these clusters was issued to M/s Friends Solar Pvt Ltd, Raipur. As per conditions, the SSLSs were to be operational for a minimum of 25 days and 90 *per cent* SHLSs should be operational in a month. Scrutiny of monitoring reports and payment vouchers for the period 2010-14 revealed that the SHLSs and SSLSs and the power plant remained non-functional for three to 10 months continuously. For instance, SPPs at Paylikhand[11], Kochenga[12], Kurrubhata[13] and Gajimuda[14] were not functional due to theft of modules, inverter and battery problems. Thus, there was no electricity in these villages continuously for five to six months. Due to lack of proper maintenance of the systems, regular supply of electricity to the villagers could not be ensured. SNA accepted the facts (December 2014).

ii. Audit also observed that out of the fund granted by the State Government under RVE programme, every year a provision of ₹ one crore was being made for village electrification Operation and Maintenance (O&M) fund which was kept in Terms Deposits (TD). The present value of TD was ₹ 10 crore (as of March 2014). Thus, fund provided for incurring O&M expenditure had been kept in TD, which was violation of the financial rules.

[11] June 2012 to October 2012.
[12] October 2010 to January 2011 & June 2012 to December 2012.
[13] September 2013 to November 2013.
[14] June 2012 to December 2012.

Haryana

HREDA signed Comprehensive Maintenance Contract (CMC) with the suppliers for maintenance of the systems which were commissioned in June-July 2006, for five years which expired in June 2011. Thereafter, for maintenance of the plants[15] a village level Akshay Urja Samiti was formed. The said Samiti collected monthly charges of ₹ 60 from the beneficiaries to be used for repair and maintenance of the plant. The monthly charges of ₹ 1.50 lakh were collected from the panchayats for two years. Thereafter, the charges had not been deposited by the beneficiaries. After the expiry of warranty period, these systems remained non-functional.

Jharkhand

As per CMC, service centers of the suppliers were to send summary service reports to JREDA on half yearly basis regarding number of systems covered by the service station, number of systems working satisfactorily, number of complaints received, number of complaints attended, major cause of failure as observed and major replacement made. But, no such reports were submitted by the service centres to JREDA. As such JREDA was unaware of number of non-functional systems and reasons thereof.

Jammu & Kashmir

Audit observed that maintenance of SHLSs had not been provided by eight out of 13 suppliers, as these suppliers had not established service centers in the respective districts. Audit also observed that four out of five service centers established in district Doda were non-functional (August 2014) and that service centers had not been established in Anantnag and Poonch districts. Further, free of cost maintenance during the warranted period of five years was to be provided. But the service centre of M/s Kotak Urja established in Gurez charged fees of ₹ 200 to ₹ 400 from beneficiaries. JAKEDA had not initiated any action against the defaulting suppliers who had not established service centers or charged fees from beneficiaries. Accepting the facts, the State Government stated (July 2014) that JAKEDA had been ensuring setting up of proper service centers and that these would be strengthened further.

Kerala

As per the contract, the preventive/routine maintenance was to be done by the manufacturer at least once in every four/six months. For effective carrying out of maintenance at least one service centre was to be developed by the manufacturer for every 500 SPV systems. But the same was not done.

Nagaland

Department of New and Renewable Energy (DNRE) did not insert the clause of "security Deposit" of five *per cent* of the contract agreement while placing the supply order on M/s Kuovisie-Rio and M/s Kevi Chadi, with the result that the suppliers did not submit the security deposit of ₹ 4.59 lakh. Further, DNRE had to release ₹ 4.59 lakh (five *per cent* of the contract agreement) towards AMC to suppliers in a span of five years (at the rate of one *per cent* every year), however the same was released in full to suppliers.

[15] SPV power plants of 5 kW at Babarwali, Khairi, Nagrasu, Thandaut, Kahlon and Dudhla hamlet of Panchkula District.

DNRE stated that it was due to inexperience and oversight and there was no complaint from beneficiaries as systems are working satisfactorily. However, in case of breakdown, the systems were not attended to by suppliers but were being individually maintained by the beneficiaries.

MNRE stated (May 2015) that under the provisions of the RVE programme, maintenance and long-term sustainability of installed systems was primarily the responsibility of the concerned State Governments/SNAs. The State Governments also undertook to provide funds and ensure replacement of batteries and other major maintenance expenditures as and when required. The CFA sanctioned by MNRE included the cost of a five year AMC with the suppliers. MNRE provided additional financial support for organization of training of beneficiaries and awareness camps. The reply is not tenable because due to lack of proper maintenance of the systems, regular supply of electricity to the villagers could not be ensured. The AMC was also not executed as per MNRE guidelines and service centres were not established. MNRE also did not monitor the working of the RVE programme.

6. Physical verification of systems installed under RVE programme

Audit conducted a physical verification of the RVE systems on a test check basis to see the condition of the systems installed and the problems faced by the users. Audit findings related to 45 sites in 11 States are given in Table 36. The State wise details are given in **Annexure XVII**.

Table 36: Summary of physical verification of RVE systems

System	No. of systems inspected	No. of systems not working	No. of systems missing	Observations
SHLS	2,527	532	177	A large number of systems were lying idle due to issues such as battery failure, availability of quality grid power to users and lack of maintenance.
SSLS	345	48	6	Audit observed issues of delayed maintenance and poor quality of parts.
Biomass Gasifier plants	14	14	Nil	Audit observed that there was lack of user interest in these systems due to availability of grid power. Further the systems were provided in electrified villages.
SPP	1	1	Nil	System was not working and performance bank guarantee was not encashed.
SHP	1	1	Nil	Machinery defects resulted in idling of plant.
Total	**2,870**	**585**	**183**	

Note: Small Hydro Power (SHP), Solar Home Lighting System (SHLS), Solar Street Lighting System (SSLS) and Solar Power Plant (SPP).

Physical verification of sampled systems by Audit revealed that 20 *per cent* of the RVE's systems were not working and six *per cent* of the systems were found missing.

MNRE stated (May 2015) the clarification from all States will be sought with respect to the remarks made by the Audit.

7. Conclusion

Remote Village Electrification programme aimed at providing financial support for electrification of those villages and hamlets where electrification through grid extension was either not feasible or not cost effective. During the 11th Five Year Plan, MNRE set a target for electrification of 7,000 villages and achieved the same in 5,229 villages. Progressively from 2007-08, the coverage under the Remote Village Electrification programme declined over the years. No targets were fixed by MNRE for the years 2012-13 and 2013-14. It was also observed that the release of Central Financial Assistance decreased from ₹ 132.81 crore in 2007-08 to ₹ 17.92 crore in 2013-14 and this was not commensurate with the Remote Village Electrification targets.

Audit observed that in some States there were mismatches between the list of remote villages verified by Rural Electrification Corporation Limited, those sanctioned by the MNRE and the villages actually reported as covered by the States. In Assam and Chhattisgarh villages already covered under the Rajiv Gandhi Grameen Vidyutikaran Yojana, were also taken up under this Programme.

There were instances of irregularities in release of Central Financial Assistance and its utilization.

Audit also observed shortcomings in implementation of the programme in the States. There were instances of inordinate delays in completion of projects, award of contracts to ineligible contractors, irregular distribution of lighting systems and incomplete/non-installation of Remote Village Electrification systems.

There were instances of non maintenance of data to evidence functionality of systems under Remote Village Electrification. Monitoring reports were not available as per the scheme guidelines. There were deficiencies in the maintenance of systems due to under collection of user charges and deficiencies in maintenance arrangements.

Physical verification of sampled systems by Audit revealed that 20 *per cent* of the Remote Village Electrification systems were not working and six *per cent* of the systems were found missing, indicating poor maintenance and monitoring.

8. Recommendations

- *MNRE must ensure that only eligible villages/hamlets and beneficiaries are covered in the Remote Village Electrification programme.*

- *MNRE must ensure long term operation, maintenance and sustainability of the Remote Village Electrification systems.*

Chapter - X

Ladakh Renewable Energy Initiative

1. Introduction

MNRE sanctioned (June 2010) Ladakh Renewable Energy Initiative (LREI) for promotion of RE in Ladakh region. The duration of the project was three and a half years i.e. up to 31 December 2013.

The project was being implemented by two agencies: Leh Renewable Energy Development Agency (LREDA) and Kargil Renewable Energy Development Agency (KREDA). Both these agencies are registered as Societies under the Jammu & Kashmir Societies Registration Act 1941.

2. Grid Connected Power

2.1. Planning

The State Government formulated (December 2011) policy for development of Micro/ Mini Hydro Power (MHP) projects[1] up to two MW with the objective to attract investors for the development of the State's water resources and to provide a solution to the energy problems in remote and hilly areas where extension of grid system was un-economical or un-viable. In the State, power projects up to two MW were implemented by Jammu & Kashmir Energy Development Agency (JAKEDA)/ LREDA/ KREDA.

LREDA along with the Alternate Hydro Energy Centre (AHEC) of the Indian Institute of Technology, Roorkee had conducted (2010-11) comprehensive feasibility studies to assess the total hydro power potential in Leh District and identified 63 potential sites for hydro projects of aggregate capacity of 45 MW. Audit observed that the inventories of all the identified sites had not been put in public domain. LREDA had not prepared long term plans to exploit hydro resources in the Leh District separately.

KREDA had neither conducted assessment of hydro power potential in Kargil District, nor prepared comprehensive plans to exploit the hydro power. MNRE stated (May 2015) that KREDA had got the pre-feasibility report of the executed projects from Civil Investigation Department (CID), Kargil and the same had been approved by the Governing Board of Ladakh Autonomous Hill Development Council (LAHDC). However, the fact remains that the agencies did not prepare long term and comprehensive plans to exploit the hydro power of the region and none of the SHP/MHP projects had been completed (March 2014) as discussed below.

2.2. Target and achievement (2010-14)

The target and achievements of LREDA and KREDA during 2010-14 is given in Table 37.

[1] The power projects upto 100 kW are defined as micro and power projects from 101 kW to 2,000 kW are defined as mini hydel as per the policy.

Table 37: Target and achievements of LREI

LREDA						KREDA					
Targets		Revised target		Achievement		Target		Revised target		Achievement	
Nos	Capacity	Nos.	Capacity	Nos.	Capacity	Nos.	Capacity	Nos	Capacity	Nos	Capacity
19	11.2 MW	10	6.1 MW	Nil	Nil	11	12.5 MW	7	11 MW	Nil	Nil

Source: LREDA and KREDA

As can be seen from Table 37, even after four years of implementation of the Programme, none of the 17 Small and Micro Hydro Power projects sanctioned had been commissioned as of July 2015.

2.3. Budgetary provisions

The details of budget and expenditure for the period 2010-14 are given in Table 38.

Table 38 : Budget and expenditure of LREI

(₹ in crore)

Activities	MNRE Grant as per Sanction	Funds received from MNRE as of 31 March 2014		Interest earned as on 31 March 2014		Total Expenditure		Un-utilised fund (including interest)	
	LREDA+ KREDA	LREDA	KREDA	LREDA	KREDA	LREDA	KREDA	LREDA	KREDA
SHP/ MHP projects	266.80	24.02	20.23	0.34	NA	24.26	17.72	0.10	2.51

Source: LREDA and KREDA

MNRE sanctioned ₹ 266.80 crore for MHPs for LREI, but it released only ₹ 44.25 crore and the expenditure was only ₹ 41.98 crore.

Audit also observed that MNRE had released funds of ₹ one crore for trees and land compensation during November 2011. KREDA had not identified (August 2014) the status of land[2] and as a result, ₹ 0.99 crore had remained unutilized as of August 2014. KREDA however, had shown these funds as utilized in the utilization certificates for the year 2012-13. This indicated that the KREDA had reflected incorrect position in the utilization certificates.

MNRE stated (May 2015) that the status of land had been taken up with the Assistant Commissioner (Revenue), Kargil and remaining amount of tree and land funds had been utilized for other SHP purposes, being the scheme under SHP head.

3. Implementation

The projects were sanctioned without allotment of land, statutory clearances such as environmental, forest, irrigation clearances and technical approvals. This was compounded by slow progress in execution of projects. The detailed audit findings are given below:

[2] Whether it was forest or private land. Also refer to para 3.2.

3.1. MHP projects sanctioned by MNRE without proper feasibility studies/ statutory clearances

MNRE sanctioned (June 2010) 30 MHP projects of 23.68[3] MW for ₹ 266.80 crore on the basis of preliminary reports, to be completed by December 2013. Subsequently, well after sanction of projects by MNRE, LREDA and KREDA allotted (August 2010 to August 2012) the work of survey, investigations and preparation of Detailed Project Reports (DPRs) in respect of 31 MHP projects[4]. On the basis of DPRs the projects were revised downwards to 17[5] (17.10 MW) for an estimated cost ₹ 219.58 crore.

None of the MHP projects had been completed (July 2014).

3.2. MHP projects allotted without obtaining necessary clearances

Audit observed that LREDA and KREDA allotted 17 mini hydro power projects to contractors for development without ascertaining the status of land of identified sites of these projects, taking statutory clearances viz environmental clearances, forest clearances, irrigation and land clearances etc. and technical approvals as given at Table 39.

Table 39: Status of statutory clearances and technical approvals for MHP projects

Agency	Projects (MW)	Allotted cost (₹ in crore)	Status of land	Allotment of contracts	Issue of land acquisition taken up	Clearances of MoWR[6]	Other clearances
LREDA	10 (6.10)	87.67	Not ascertained	September 2011 to June 2013	June to December 2013	December 2012	Technical approval of IIT Roorkee was not obtained
KREDA	07 (11.00)	134.00	Not ascertained	August 2012 to November 2013	March to May 2014	Not obtained	

Records showed that LREDA and KREDA had incurred (March 2014) an expenditure of ₹ 41.98[7] crore on these projects without land acquisition and obtaining technical approval. MNRE released (November 2011) ₹ one crore for land compensation but the funds were diverted (August 2014), as in absence of surveys it was not ascertainable whether land was Government, forest or private land.

MNRE stated (May 2015) that the matter for land acquisition had already been taken up with the Revenue Department of the State Government for transferring the land for hydro projects.

[3] 11.18 MW in Leh covering 61 villages and 12.50 MW in Kargil covering 63 villages.
[4] Which included only 23 sanctioned projects.
[5] Four of which were not in the original list approved by MNRE.
[6] Ministry of Water Resources.
[7] Leh: ₹ 24.26 crore; Kargil: ₹ 17.72 crore.

3.3. Contract awarded without establishing reasonability of rates

As per CVC guidelines estimated rate is a vital element in establishing the reasonability of prices. Audit scrutiny revealed that the Project Director, KREDA had prepared cost estimates and invited (June 2010) tenders for "surveys, investigation and preparation of DPR and supervision till successful commissioning" for 10 MHP projects. However, the orders were placed (August 2010) for surveys, investigation, detailed engineering design and preparation of DPR at a cost of ₹ 2.11 crore omitting 'the supervision till successful commissioning' without corresponding reduction in the cost. Thus, alteration in the scope of work in the contract without corresponding reduction in price indicated that undue benefit was given to the contractor with an extra expenditure of ₹ 1.35 crore incurred on preparation of DPRs of 10 projects by KREDA.

MNRE stated (May 2015) that the terrain of the project sites are very difficult to traverse for contouring and detailed survey and investigation as compared to project sites of LREDA and JAKEDA, thus attracting higher rates. The reply is not acceptable as the average expenditure per DPR was more than double the expenditure incurred by LREDA or JKEDA and KREDA did not see the reasonability of the price.

3.4. Poor physical progress of construction of MHP projects

KREDA had invited (December 2011) tenders in respect of seven MHP projects which were finalized (August 2012 and November 2013) after a period of eight to 23 months, to be completed within 24 months. Audit observed that physical progress in respect of these projects was poor even though an expenditure of ₹ 21.94 crore had been incurred (June 2014). The construction work in respect of four projects - Khandi, Sangrah, Bairas and Chilong was in the initial stage[8] and construction work in respect of remaining three projects Raru, Matayeen and Zunkul had not been started (June 2014).

LREDA allotted (September 2011 to December 2011) projects to be completed by October 2013, but progress of civil works and pen stock[9] works of six out of 10 MHP projects was slow as given in Table 40.

Table 40: Progress of civil and pen stock works

Details of work	Head works	Feeder channel	By pass channel	De-silting Tails	Foreway	Power house	Tail Race	Penstock
Progress (in *per cent*)	Nil to 50	Nil to 100	Nil to 100	Nil to 100	Nil to 95	30 to 90	Nil to 70	Nil to 60

Similarly, the construction work in respect of remaining four projects allotted during December 2012 to June 2013 was in the initial stage[10].

MNRE stated (May 2015) that lack of bidders, inaccessible terrain and locations, short working seasons and delay in release of funds resulted in poor progress.

[8] Earthwork, trench excavation, Plinth/Floor level of store rooms and staff quarters.
[9] A penstock is a sluice or gate or intake structure that controls water flow.
[10] Part earthwork in respect of civil structures, non-completion of approach roads, RCC works taken up in only one project as of May 2014.

4. Off-Grid/Decentralised systems

4.1. Target and achievement (2010-14)

The target and achievement for the Off-Grid/Decentralised systems for LREI is given in Table 41.

Table 41: Target and achievement for the Off Grid/Decentralised systems for LREI

Programme	LREDA				KREDA			
	Targets		Achievement		Target		Achievement	
	Nos.	Capacity (in kW)	Nos.	Capacity (in kW)	Nos.	Capacity (in kW)	Nos.	Capacity (in kW)
SPPs of 5 to 100 kWs with battery support for villages	51	1,502	34	1,033	23	1,100	19	840
SPPs of 5 to 10 kWs for Institutions	60	447	58	422	65	367	64	357
SPPs of 100 kWs in Defence establishments	15	810	14	790	2	157	1	100
SWHS (in sq m)	-	20,384	2,002	5,378	-	-	68	131
Dish Cookers	4,500	-	1,200	-	5,500	-	186	-
Steam Cooking Systems	15	-	1	-	10	-	Nil	-
Domestic Green houses for BPL families	2,500	-	2,500	-	3,000	-	3,000	-
Commercial Green houses	250	-	250		250	-	240	-
Solar Dryers	500	-	Nil	-	500	-	Nil	-
Experimental System – Ground supported heat pumps etc	5	-	Nil	-	5	-	Nil	-
SHLS	2,000	74	Nil	-	2,000	74	Nil	-

Source: LREDA and KREDA.

Note: Below Poverty Line (BPL), Solar Home Lighting System (SHLS), Solar Power Plant (SPP) and Solar Water Heating Systems (SWHS).

4.2. Budgetary provisions

The details of budget and expenditure for the period 2010-14 are given in Table 42.

Table 42: Budget and expenditure for the Off-Grid/Decentralised systems of LREI

(₹ in crore)

Activities	MNRE grant as per sanction	Funds received from MNRE as of 31 March 2014		Interest earned as on 31 March 2014		Total Expenditure		Un-utilised fund (including interest)	
	LREDA+ KREDA	LREDA	KREDA	LREDA	KREDA	LREDA	KREDA	LREDA	KREDA
SPPs and lighting systems	132.00	57.83	46.93	0.25	NA	58.06	39.72	0.02	7.21
Solar water heating/ cooking/ solar passive heating/ green houses/ solar dyers	64.20	7.65	3.54	0.06	NA	6.64	4.32	1.07	(-) 0.78
Capacity building, training, consultancy etc.	10.00	4.00	4.00	0.07	NA	3.51	3.46	0.56	0.54
Total	**206.20**	**69.48**	**54.47**	**0.38**	**0**	**68.21**	**47.50**	**1.65**	**6.97**

Source: LREDA and KREDA.

4.3. Implementation

4.3.1. Solar Power Plants (SPPs) sanctioned without feasibility studies

MNRE sanctioned (June 2010) 200 SPPs for installation in villages, institutions and Defence establishments in Leh and Kargil districts without preparation of DPRs and identification of sites. Sites of 19 villages in Kargil District were changed after placement (September 2010) of supply order, as most of these villages were electrified with the commissioning of Chutuk hydro power project during November 2012 and January 2013. Similarly, sites of 12 institutions were also changed due to non-availability of space for installation of SPPs.

MNRE stated (May 2015) that new sites were identified by LAHDC and prefeasibility report was prepared. The reply was not tenable as the KREDA had to change the sites due to electrification of villages and due to non-availability of space for installation of SPPs which indicate the lack of reliable feasibility studies.

4.3.2. Inappropriate selection of sites

i. It was observed that the village Saliskote in Kargil district was covered under Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) for Chutak hydro project (2010-11). As a result of this one SPV power plant of 65 kW approved (September 2010) for Saliskote village was shifted to another village Prachik Yogma, but another SPV power plant of 40 kW installed (December 2011) in the same village was not shifted. Further, another SPV power plant of 75 kW to be installed at Hardass village was shifted to Saliskote village (December 2011), despite the village being already covered under RGGVY. Thus the expenditure of ₹ 2.01 crore (cost of 75 kW) incurred by KREDA was avoidable.

MNRE stated (May 2015) that the change of sites was suggested by the Governing Board. The facts remains that change of sites led to wasteful expenditure.

ii. SPPs at villages Chikten Zgang (37.5 kW) and Techna (42.5 kW) were shifted due to their connectivity with Chutak hydro power project. They were installed at Sheep breeding farm Kakakul (37.5 kW) and at co-operative marketing society Kharul (42.5 kW) without ascertaining the power load requirement of these institutions by the respective representation of LAHDC and without approval of MNRE. KREDA records showed that the power load requirement of sheep breeding farm was five kW leading to under utilization and consequent injudicious utilisation of funds of ₹ 2.42 crore.

MNRE stated (July 2015) that the excess power was utilized in the nearby school. The reply is not tenable as the MNRE had not explained whether the full capacity of 80 kW was being utlilized. Further, the KREDA had not done the feasibility study leading to change of site.

4.3.3. Physical progress of installation not monitored

LREDA placed (2010-11) orders for installation of 126 SPPs in Leh District. Audit observed that 13 SPPs (totaling to a capacity of 465 kW) had not been commissioned (June 2014) despite lapse of 39 to 44 months. Similarly, records of KREDA showed that six SPPs (totaling to a capacity of 327.50 kW) out of total of 88 had not been commissioned (June 2014) despite a lapse of 45 months. Non-commissioning of systems had rendered the expenditure of ₹ 10.30 crore incurred on the 19 SPPs unfruitful.

The Project Director KREDA stated (September 2014) that SPPs could not be installed due to some disputes at sites even though the plants had been supplied by the firms. LREDA stated (May 2015) that the SPPs shall be installed within a period of four to five months or during the coming season.

4.3.4. Solar power plant installed without establishing reasonability of rates

As per CVC guidelines estimated rate was a vital element in establishing the reasonability of prices. Audit observed that, there was no coordination between LREDA and KREDA, and the cost of installation solar power plants by KREDA was higher than that by LREDA, leading to excess expenditure of ₹ 0.95 crore as given in Table 43.

Table 43: Cost of installation of SPV power plants

Capacity of SPV power plants (in kW)	Cost of SPV power plant		Cost difference per plant (in ₹)	No. of systems	Total extra cost(in ₹)
	LREDA	KREDA			
5	12,54,041	13,23,690	69,649	18	12,53,682
10	20,55,000	21,92,342	1,37,342	16	21,97,472
37.50	78,38,000	82,21,620	3,83,620	5	19,18,100
42.50	91,51,000	94,47,025	2,96,025	4	11,84,100
57.50	1,20,66,000	1,23,39,000	2,73,000	3	8,19,000
65	1,37,48,000	1,40,59,268	3,11,268	6	18,67,608
100	1,73,00,000	1,76,25,361	3,25,361	1	3,25,361
Total				**53**	**95,65,323**

Similarly, in case of Evacuated Tube Based Collector SWHS the rates difference given by the same contractor in Leh and Kargil was ₹ 7,997 for 300 Litres per day SWHS and ₹ 25,549 for 500 Litres per day SWHS leading to excess expenditure of ₹ 0.09 crore[11] by KREDA.

MNRE stated (May 2015) that the public tender procedure was followed. The rates were a little higher than LREDA. The reply is not acceptable as the cost difference was very high and KREDA could have negotiated with the firm who had supplied the same systems to LREDA.

4.3.5. Solar Home Lighting Systems distributed to ineligible beneficiaries

MNRE sanctioned (June 2010) 2,000 SHLSs for Kargil district under LREI. Audit observed that KREDA had not conducted any survey to identify the beneficiaries and 451 SHLSs for ₹ 53.22 lakh were distributed in villages falling within the electric connectivity of hydro power projects and 251 SHLSs for ₹ 29.61 lakh in the villages where the SPV power plants had been established during 2010-12. Audit also noticed that 246 SHLSs were issued against 192 households in four villages where as in nine villages 205 SHLSs were distributed against 350 households in these villages, which was anomalous.

MNRE stated (May 2015) that the distribution was as per the decision of Governing Board of LAHDC. However, the fact remains that KREDA had not conducted any survey to identify the beneficiaries, leading to ineligible beneficiaries being given SHLSs.

4.3.6. Excess expenditure incurred by not invoking the 'risk and cost' clause

The terms and conditions of the bidding document envisaged that if the supplier failed to make supply within the stipulated period, risk purchase at the cost of the supplier will be made within two months of the expiry of stipulated delivery period by inviting short term quotations. Based on the bidding process, LREDA placed order on four agencies[12]for design, manufacture, supply, installation and commissioning of SWHSs covering 7,500 sqm. It was observed in audit that the suppliers covered only 3,432 sqm during 2011-12 leaving a balance of 4,068 sqm. LREDA instead of taking penal action against the suppliers, invited (March 2013) fresh Notice Inviting Tender (NIT) and placed supply order for purchase of systems of 15,000 sqm collector area including 4,068 sqm at a rate higher than the rate approved in earlier tendering process. LREDA had not recovered excess cost of ₹ 22.65 lakh from the pending bills of the suppliers who had earlier partly supplied the systems.

MNRE stated (May 2015) that the 7,500 sqm was an envisaged target and not necessarily equal to the supply orders. Demand upto 2013 was only for 3,432 sqm hence supply orders for this number of systems were issued. The reply is not acceptable as the work order was placed for 7,500 sqm.

4.3.7. Irregularities in establishment of polygreen houses

MNRE sanctioned (June 2010) CFA for establishment of 5,500 domestic green house for Below Poverty Line (BPL) families and 500 for commercial purpose. Audit observed that,

[11] 300 LPD- 6 Nos = ₹ 7,997 X 6 = ₹ 47,982, 500 LPD – 70 Nos = ₹ 25,549 X 70 = ₹ 17,88,430.
Total extra expenditure = ₹ 47,982 + ₹ 17,88,430 = ₹ 18,36,412, On 50 *per cent* payment = ₹ 9,18,206.

[12] M/s Electrotherm Renewables, M/s Solarium Solar Power Systems, M/s Neutech Solar Systems Pvt Ltd and M/s Solar Energizers Pvt Ltd.

during 2011-14, only 600 poly green houses were established for BPL families and 1,900 were given to other interested non-BPL beneficiaries.

As per guidelines, ₹ 11,500 per house or 50 *per cent* of the cost whichever was less, was to be recovered from the beneficiary but LREDA under recovered ₹ 1.42 crore and KREDA did not recover any amount.

MNRE stated (May 2015) that there was no further BPL family taker for the 1900 poly greenhouses, hence decision was taken by LAHDC that left over domestic green houses be distributed to every block of the district on population basis, to the interested beneficiaries. Reply cannot be accepted as the agencies had not taken the permission of MNRE for distribution to other than BPL family and recoveries should be as per MNRE's guideline. Further, the cost of poly greenhouses was ₹ 23,000, much higher than benchmark rate of MNRE.

4.4. Monitoring

Audit observed that periodic monitoring to ensure proper functionality of systems had not been carried out. Third party evaluation was not done. Further the functional status of plants installed under LREI was not ascertained and the Agency had no relevant data in this regard.

MNRE stated (May 2015) that the required third party inspection for the project on LREI shall be done soon.

4.5. Physical Verification

Audit conducted physical verification of the systems installed under LREI on a test check basis to see the condition of the systems installed and the problems faced by the users. Audit findings are given in Table 44.

Table 44: Physical verification of LREI systems

Type of system	Location	Reasons
Solar Power Plant	Saliskote Village	Two plants were installed. One plant of 40 kW installed in December 2011 was not working properly. The battery backup was very poor and had not been rectified despite the firm (M/s TATA BP) being approached. The village was also covered by RGGVY.
	Village Umba	Connection was provided only to 65 households out of 150 because of non-laying of distribution network.

MNRE stated (May 2015) that due to the scattered nature of the village and low capacity of the SPV power plant the lighting system was connected to only 65 households. Hence LAHDC has decided to approach MNRE for another SPP for the remaining hamlets of the same capacity, so that entire village could be covered. However, the fact remains that 85 households were still to get electricity from SPP.

5. Conclusion

Ladakh Renewable Energy Initiative was taken up with the objective of promotion of renewable energy in Ladakh region. The duration of the project was three and a half years (June 2010 to December 2013).

Audit observed that Ladakh Renewable Energy Development Agency and Kargil Renewable Energy Development Agency did not undertake comprehensive feasibility studies to assess the total hydro power potential. Though the two implementing agencies viz. Ladakh Renewable Energy Development Agency and Kargil Renewable Energy Development Agency set targets of 11.2 MW (revised to 6.10 MW) and 12.50 MW (revised to 11 MW) respectively during 2010-14, neither of the two agencies were able to put in place any capacity during the period. Even after four years not a single Small Hydro Power/ Mini Hydro Power project was installed.

Audit further observed poor due diligence in implementation of sanctioned projects, such as allotment of land without taking statutory environmental, forest, irrigation and land clearances and technical approvals, excess payments to contractors, diversion of funds besides non-completion of projects. Monitoring mechanism was also found to be deficient.

Audit observed that off-grid solar power projects were sanctioned by MNRE without conducting feasibility studies. As a result, two solar plants were installed in a village that was already covered under Rajiv Gandhi Grameen Vidyutikaran Yojana and 702 Solar Home Lighting Systems were distributed to ineligible beneficiaries. There were deficiencies in implementation of the projects.

It was further observed that contracts were awarded without adhering to bidding document requirements. Instances of excess payment to contractors and awarding of contract without establishing reasonability of rates were also noticed.

6. Recommendations

- *MNRE must ensure that comprehensive and reliable feasibility studies of the sites are conducted before sanctioning projects.*
- *Prior to sanctioning of the projects all statutory clearances, particularly land clearances, must be taken.*
- *Evaluation of progress of work during implementation and post implementation must be carried out by MNRE or State Agencies or reliable third parties.*

Chapter - XI

Prime Minister's Special Package for Arunachal Pradesh

1. Introduction

The Prime Minister announced a package of ₹ 550 crore in January 2008, to electrify/illuminate villages[1] in Arunachal Pradesh through Solar Power and Small Hydro Power projects by December 2011. The programme was extended with the approval of the Cabinet till March 2015.

2. Target and Achievements

The year wise targets and achievements under the PM's special package are given at Table 45.

Table 45: Year wise targets and achievements under the PM's special package

(in Nos.)

Year	Target				Achievement			
	No. of Households		No. of border villages		No of Home Lighting Systems		No. of Villages	
	SPV	SHP	SPV	SHP	SPV	SHP	SPV	SHP
2008-09	5,758	48,331	546	868	-	27,859	-	216
2009-10	-	6,707	-	191	5,852	3,470	523	100
2010-11	-	-	-	-	-	2,339	-	58
2011-12	-		-	-	-	3,477	-	108
2012-13	-	-	-	-	-	664	-	27
2013-14	-	-	-	-	-	688	-	19
TOTAL	**5,758**	**55,038**	**546**	**1,059**	**5,852**	**38,497**	**523**	**528**

Source: APEDA and DHPD.
Note: SPV – Solar Photovoltaic and SHP – Small Hydro Power.

As can be seen from Table 45, 1,605 un-electrified border villages were to be electrified for which funds were given by Planning Commission and MNRE. The breakup of targets and achievements between Planning Commission and MNRE are given at Table 46.

[1] Apart from villages already covered under RGGVY.

Table 46: Breakup of targets and achievements between Planning Commission and MNRE

		Planning Commission		MNRE	
		Target	Achievement	Target	Achievement
No. of villages		486	303	1,119	748
No. of households		29,212	23,867	31,584	20,482
No. of SHP projects (capacity in MW)	DHPD[2]	46 (61 MW)	37 (25 MW)	48 (16 MW)	35 (8 MW)
	APEDA[3]	-	-	67 (2 MW)	42 (1 MW)

Source: APEDA and DHPD.

The shortfall in achievement of Planning Commission targets was mainly on account of non-completion of nine SHPs (36 MW), against which expenditure of ₹ 358.46 crore (including expenditure prior 2007-08 and State share as of August 2014) had been incurred. Against a target of 486 villages only 303 had been electrified.

The shortfall in achievement of MNRE targets was because Department of Hydro Power Development (DHPD) did not complete 13 hydel projects (capacity: eight MW) and APEDA not completing 25 (capacity: one MW) due to various reasons, such as, delay in completion of projects by turnkey contractors and non-availability of funds. The delay ranged from two to three years. Against a target of 1,119 villages only 748 had been electrified.

MNRE stated (May 2015) that some of the projects got delayed due to site conditions and some under installation projects also got damaged due to heavy rains and that the DHPD had further requested for additional fund of ₹ 1,719.11 crore from the Central Government, to complete the SHP projects.

3. Budgetary provisions

The details of budget and expenditure for the period 2007-14 are given at Table 47.

Table 47: Details of budget and expenditure for the period 2007-14

(in ₹ crore)

Year	CFA released by MNRE[4]	Funds released by Planning Commission	State/ Individual Share	Actual Expenditure 2007-14
2007-08	-	69.11	-	-
2008-09	18.73	100.14	1.86	126.01
2009-10	56.00	105.31	0.22	132.09
2010-11	60.75	-	1.28	149.62
2011-12	62.09	-	10.77	74.61
2012-13	34.00	-	23.95	49.58
2013-14	9.75	-	8.85	25.41
Total	**241.32**	**274.56**	**46.93**	**557.32**

Source: APEDA and DHPD.

[2] Department of Hydro Power Development.
[3] Arunachal Pradesh Energy Development Agency.
[4] CFA released by MNRE included funds released to Department of Power (₹ 38 crore), DHPD (₹ 148.82 crore) and APEDA (₹ 54.50 crore) from 2007-08 to 2013-14.

During the period 2008-09 to 2013-14, out of total available funds of ₹ 562.81 crore an expenditure of ₹ 557.32 crore was incurred, leaving a balance of ₹ 5.49 crore.

3.1. Diversion of funds

The DHPD diverted (March 2011) ₹ 13.17 crore out of ₹ 13.85 crore released in 2008-09 for construction of Sipit and Sidip SHP projects, later scrapped in October 2011 for construction of an additional unit of four MW Halaipani SHP project without approval of the Planning Commission.

DHPD stated that matter was placed before State Level Monitoring Committee and approved by the State Government. However, the fact remains that no approval was obtained from the Planning Commission.

MNRE offered no comments as the projects were supported by the Planning Commission directly to the State.

4. Implementation and Power Generation

Audit observed that some of the projects were non functioning due to defective equipment, natural calamities, lack of repair, abandoning of projects by contractors, etc. which resulted in losses in power generation. The detailed audit findings are given below:

4.1. Absence of a specific State Government policy for acquisition of land

Absence of State Government policy regarding acquisition of land for projects, compensation, resettlement and rehabilitation of land owners led to delay in completion of Sirikorang SHP project (500 kW) by two years due to disputes with villagers for acquisition of land. This resulted in cost escalation of ₹ 1.43 crore, which could have been avoided.

4.2. Non levy of Liquidated Damages (LDs)

As per terms and condition of the agreement with the developers/ contractors, if the commissioning/ supply were delayed beyond a certain period, then LDs at the rate of 10 *per cent* were to be charged. Audit findings in this respect are brought out in the Table 48.

Table 48: Contractors on which Liquidated Damages (LDs) were not levied

S.No.	Particulars of work	Delay period	Amount of LD (in ₹ crore)
1	APEDA did not deduct LDs from turnkey contractors (M/s Gita Flow Pumps, M/s Jal Sakhti Engg. & M/s Ushwin) for delayed completion of 42 SHP projects and non completion of 25 SHP projects for 55 months.	3 to 39 months	1.18
2	Delays in completion of works relating to supply and installation of SHLSs from the contractors, namely, M/s Sun Energy Systems, Gujarat, M/s ICOMM Tele Limited, Hyderabad, and M/s Reliance Industries Limited, Kolkata.	Eight months	0.86

S.No.	Particulars of work	Delay period	Amount of LD (in ₹ crore)
3	₹ 20.37 crore were sanctioned (January 2010) by the Planning Commission for Sambachu SHP project (three MW) in Tawang District, to the Hydro Power Development Corporation of Arunachal Pradesh Limited (HPDCAPL). M/s Nortech Power Project (P) Ltd., Kolkata could complete (August 2014) only 80 *per cent* of the work. Performance bank guarantees of ₹ 2.59 crore and ₹ 0.82 crore towards Security Deposit had also not been collected.	Three years	1.29

4.3. Non-functional SHP projects

4.3.1 Six SHP projects not working due to damage in floods

Six SHP projects with a capacity 195 kW, were not working for different periods ranging from one to 24 months due to flood damage to power channels, head works and penstock pipes. As a result, expenditure of ₹ 4.04 crore incurred on the projects remained unproductive.

MNRE (May 2015) accepted the facts and stated that 30 *per cent* of the projects were not working due to natural calamities.

4.3.2 Unfruitful expenditure

As per Memorandum of Understanding (February 2001), the National Hydro Power Corporation, Ltd. (NHPC), handed over the Kambang MHS project completed by turnkey contractor, M/s Kirloskar Brothers, Pune, to the DHPD for operation and maintenance without full load testing. An expenditure of ₹ 62.43 crore was incurred on the project.

Unit III of the project remained non-operative since April 2010 due to defective equipment. As per the Defective Liabilities Clause – Clause 27.2 of the Agreement, the turnkey contractor was responsible for successful operation for a period of 24 months from the date of operational acceptance. But the contractor neither repaired nor replaced the defective equipment even after a lapse of 49 months.

Later, Units I and II were also shut down from January to June 2014 due to vibration and oil leakage. As of June 2014, the turnkey contractor had not repaired Units I and II. As a result, the Department lost generation of 4.3 Million Units (MUs) of power in respect of Unit I and 4.3 MUs in respect of Unit II, whereas non-operation of Unit III since commissioning resulted in loss of potential generation of 42.34 MUs (May 2010 to June 2014). Thus, expenditure of ₹ 62.43 crore incurred on the project remained unfruitful. The expenditure of ₹ 0.32 crore incurred on repair and rectification of electrical equipment was also not recovered from the turnkey contractor by the Department.

In the Exit Conference (December 2014) held with the officials of DHPD, it was stated that the contractor abandoned the project (Kambang MHS). However, a notice was served to the contractor to resume works.

MNRE stated (May 2015) that it is the State's responsibility to complete the work as per work contract.

4.3.3 Inoperative Liromoba SHP project

M/s Swamina International Private Limited, Kolkata, completed the works of overhauling, repairing, renovation, modification, erection, testing and commissioning of Electrical & Mechanical (E&M) equipment of Liromoba SHP project (2 x 1 MW) after a delay of 27 months (March 2009) from the date of Agreement (September 2006). But the LD of ₹ 0.14 crore was not levied on the contractor as per terms and conditions of the Agreement. Reasons for delay were also not on record. Since commissioning (March 2009) till October 2012, the project was operated with a load of 130-140 kW on manual mode due to problems with the electronic governor which was unable to pick up any load exceeding 15 kW on both units. From October 2012 onwards the project remained non-operative, resulting in loss of potential generation of 15.55 MUs worth around ₹ 3.25[5] crore. The Department neither repaired nor replaced the defective equipment at the risk and cost of the contractor.

4.3.4 Under-utilisation due to non-availability of Transmission and Distribution lines

The DHPD constructed Solegamang SHP project (1 x 50 kW) (Menchuka Circle) at a cost of ₹ 0.88 crore, but it provided electricity supply to only one village against the target of eight villages due to non-availability of Transmission and Distribtution lines. Further due to operation of the project only at 15 kW capacity against its full capacity of 50 kW, the Department lost generation of 0.15 MUs (August 2013 to June 2014) valued around ₹ 0.32[6] crore.

4.4 Sub-standard work

As per scope of work agreement, the contractor was to perform at least one practical demonstration on laying, fixing, jointing, installation and commissioning of pipes in districts having up to five projects and at least two demonstrations in districts having more than five projects. If the demonstration failed or any material was found to be sub-standard during the demonstration or at any subsequent point of time, they would be rejected and the amount recovered, wherever applicable. However, the contractor installed penstock pipes without ascertaining their quality, as a result of which damages and leakages of fibre penstock pipes was reported from Jangtangpu Mini Hydel Power(MHP) projects. But no action was taken against the contractors by the APEDA.

APEDA stated that more than 15 *per cent* of the agreed cost was retained and the cost of defective work would be recovered before releasing final payment.

4.5 Overlapping work

Both the DPRs for construction of Khadiabe SHP project by APEDA and DHPD covered 10 villages, and the same villages were also covered under the RGGVY Programme. Thus, lack

[5] 15.55 MUs @ ₹ 2.09 per unit = ₹ 3.25 crore.
[6] 0.15 MUs @ ₹ 2.09 per unit = ₹ 0.32 crore.

of co-ordination and proper planning between the Agency and Departments resulted in overlapping of villages, which may have caused unnecessary expenditure.

In reply, DHPD stated that from the list of villages prepared by DHPD and APEDA, only two villages (Tania and Sube) overlapped.

The reply was not tenable as six villages were included in the DPRs prepared by DHPD and APEDA. Besides, the villages listed in the DPRs were taken up under RGGVY for supply of power through grid.

4.6 Work orders placed without tender process

As per GFR, works were to be executed through open tender and as per Central Public Works Department Works Manual, tenders should normally be called for all works exceeding ₹ 50,000. Audit observed that:

i. Contrary to the guidelines, DHPD carried out Civil and E&M Works, in respect of 17 projects under the PM package, valued at ₹ 68.86 crore, without following any tendering procedures. The civil works were executed through local villagers (stated to be land donors) by issue of a number of work orders, without any technical sanction or calling for open tenders.

   DHPD stated that the Department adopted splitting of works on piecemeal basis through Work Orders, mostly for earth work components, to benefit local people.

   The reply is not acceptable as the works were done in contravention of the Guidelines, and without ensuring economy and quality of works executed.

ii. MNRE released (2006-07) ₹ 4.70 crore for construction of Kambang MHP project. However, DHPD diverted ₹ 0.79 crore for reconstruction works on damage to Kambang MHP project in 2006-07 by flood during construction, without approval of the MNRE. The works were executed by issue of a number of work orders to individuals without calling for open tenders.

   DHPD stated that the Desilting Tank was severely damaged due to flash floods and immediate rectification was required for timely restoration of power supply.

   The reply was not acceptable as the released amount was diverted for flood damage works without approval.

5 Monitoring

i. Monthly generation data was not submitted to MNRE in respect of all commissioned projects, except for Kambang, Sippi and Nuranang SHP projects.

ii. APEDA neither monitored the progress of works nor received Progress Reports from the DHPD or Department of Power.

iii. DHPD monitored 67 SHP projects out of 94 SHP projects under the PM's Package through third parties like Nabard Consultancy Services (Private) Ltd. (NABCON) and Alternate Hydro Energy Centre, IIT Roorkee from June 2009 to March 2014. However, the other 27 SHP projects remained un-monitored by any agency.

MNRE stated (May 2015) that the monitoring works of SHP projects was assigned to AHEC and IIT Roorkee on random basis and that they had regularly monitored the SHP projects. The reply of MNRE should be considered in the context of the audit findings reported in the preceding paragraphs which revealed that 38 projects were yet to be completed.

6 Maintenance

6.1 Non-repair /replacement of equipment

Due to non-commissioning of Unit-II (250 kW) by the turnkey contractor - M/s BIEECO Lawrie Ltd., Kolkata and non-repair/rectification of fault in Unit-I(250 kW), the project Sirikorong SHP remained under operative, resulting in loss of generation 2.08 MUs valued around ₹ 0.44 crore[7] (August/2003 to July/2014) and unproductive expenditure of ₹ 6.40 crore.

6.2 Annual Maintenance Contract (AMC)

APEDA did not enter into any AMC with suppliers as per terms of the Agreement even after two years (July 2014) of installation of 5,852 Solar Home Lighting Systems (SHLSs). As a result, the full life efficiency/expectancy of the installed systems could not be ensured. Reasons for the same were not on record.

APEDA stated that AMC was in-built in the original contract agreement with the parties. It was further stated that effective implementation of AMC was difficult due to various logistical factors, site difficulties, lack of awareness of beneficiaries and fund constraints. The fact remains that APEDA did not implement the AMC.

MNRE stated (May 2015) that it has asked APEDA to make the AMC as the part of the contract Agreement with the PV equipment suppliers, and accordingly, it was the part of agreement. However, the effective implementation of AMC lies with implementing organization i.e. with APEDA.

6.3 Setting up of Service Centres

As per terms of Agreement, contractors were required to set up one Service Centre with a technician in each District or for every 500 SPV systems with all necessary spares. A maintenance report was to be submitted every three months to concerned APEDA Project Officers for the entire contract period. However, the contractors did not submit the maintenance reports to APEDA.

[7] 2.08MUs X ₹ 2.09 per unit = ₹ 0.44 crore.

APEDA stated that Service Centres were set up by contractors in all District Headquarters and that the Service Centres initially functioned satisfactorily. On completion of the two years of warranty period and there being no complaints against functioning of the systems provided, the Security Deposits/Bank Gurantees were released.

MNRE agreed with the reply given by the APEDA. However, it needs to be considered how the SPV systems would be maintained in the absence of Service Centres.

7 Conclusion

A Prime Minister's special package of ₹ 550 crore was announced in January 2008 for electrification of 1,605 border villages located in Arunachal Pradesh through Solar Power and Small Hydro Power projects. The project was to be completed by December 2011. Funds of ₹ 515.88[8] crore were released by the Planning Commission and MNRE.

As of 2013-14, only 1,051[9] i.e. 65 *per cent* of the villages were electrified. Audit observed that the shortfall was due to delay in completion of projects and non-availability of funds. Nine Small Hydro Power projects of 36 MW, funded by the Planning Commission, remained incomplete even after incurring an expenditure of ₹ 358.46 crore. 38 projects of nine MW aggregate capacity sanctioned by MNRE also remained incomplete. Even after completion, some of the projects were found to be not functioning due to defective equipment, natural calamities, inaction by contractors to repair the same, abandoning the projects by contractors, etc. which resulted in losses in power generation. MNRE agreed that 30 *per cent* of the projects were not functioning.

Audit observed instances where provisions of General Financial Rules and terms and conditions of the contracts were not followed, tendering process was not followed and substandard work was done.

Audit further observed that Annual Maintenance Contract for maintenance of solar equipment installed were not in place after the first two years. No service centres for maintenance of the projects were functioning. There were deficiencies in monitoring of implementation of the Small Hydro Power projects by MNRE and by the State Agencies.

8 Recommendation

- *MNRE must review the work done under Prime Minister's Special Package for Arunachal Pradesh and take action in coordination with the State Agencies for completing delayed projects, ensuring operations of commissioned projects and adequate post-project maintenance thereof.*

[8] MNRE - ₹ 241.32 crore and Planning Commission - ₹ 274.56 crore.
[9] SPV – 523 and SHP – 528.

Section IV –

Research, Design, Development and Demonstration Activities

Chapter - XII

Research, Design, Development and Demonstration Activities in the Renewable Energy Sector

1. Introduction

Research, Design, Development and Demonstration (RDD&D) activities of MNRE were aimed at resource assessment, technology development, demonstration and facilitating the industry to become internationally competitive. Accordingly, the RDD&D projects pertaining to the above sectors were sponsored to the various Research and Development (R&D) organizations/institutions, industries, autonomous organizations, etc.

The RDD&D policy framework of MNRE provided guidelines for project identification, formulation, evaluation by experts, approval, financial support, monitoring and appraisal. It specified two types of committees for providing overall guidance to the RDD&D efforts in new and renewable energy sector i.e. RDD&D Sectoral Project Appraisal Committee and RDD&D Project Appraisal Committee.

A total of 190 RDD&D projects with budget of ₹ 545.90 crore had been funded to various R&D institutions/ organizations, Non Governmental Organisations (NGOs), Industries, etc during 2007-14. The position of RDD&D Projects taken up during 2007-14 is detailed in Table 50.

Table 50: Sector wise projects sanctioned, completed and funds sanctioned by MNRE

S.No.	Area of project	Projects sanctioned	Amount sanctioned (in ₹ crore)	Projects completed	Projects under progress
1	Solar Thermal	22	143.77	13	9
2	Solar Photovoltaic	27	148.22	17	10
3	Bio-energy	7	39.09	1	6
4	Biomass Cook stove	7	4.43	5	2
5	Biogas	32	36.87	19	13
6	Bio-Fuel	30	27.15	14	16
7	Waste to Energy	3	9.23	3	Nil
8	Hydrogen Energy	40	125.58	23	17
9	Fuel Cell	14	6.06	9	5
10	Wind Energy	8	5.50	8	Nil
	Total	**190**	**545.90**	**112**	**78**

Source: MNRE.

2. Audit Observations

Subject to scope limitation reported in Para 8 of Chapter I of this Report, Audit scrutinized 58 project records produced to it. Of these 58 projects, audit observations on 50 projects are given below:

2.1. Non development of high efficiency Heterojunction with intrinsic thin layer solar cells

National Institute of Solar Energy (NISE) sanctioned (July 2008) an R&D project titled 'Development of high efficiency Heterojunction with intrinsic thin layer (HIT)solar cells' to be implemented by NISE in collaboration with Indian Institute of Technology (IIT), Mumbai with four[1] deliverables proposed. The total project outlay was ₹ 98.58 lakh and was fully funded by MNRE. IIT Mumbai, contributed in terms of space, equipment and infrastructure. The project duration was initially for three years, but after extensions, the project was completed (July 2012), after incurring an expenditure of ₹ 71.80 lakh. The audit findings in this regard were:

i. The project completion report indicated that a single side HIT cell with 12 *per cent* efficiency on a 4 cm^2 area was developed against the target of 10X10 cm^2 surface, double sided solar cell. Thus, the project parameters were not achieved. NISE in its reply accepted that only a single sided cell was developed due to technological constraints. It also stated that efforts were being made to fabricate a 36 cm^2 area cell.

ii. The envisaged cells were to have a rated capacity of two watts, however the final completion report did not indicate the achieved output. NISE replied that power output would be calibrated only after development of the cell on 100 cm^2 area surface.

iii. The final completion report was silent about development of a lab scale module as envisaged.

iv. The developed cell was to be sent to NISE for performance evaluation and field observation. NISE replied that only after developing a 36 cm^2 area cell, module would be prepared and sent for field trial. It further stated that module could not be developed due to technological constraints.

v. MNRE in its reply claimed that the process developed (Hot Wire Chemical Vapour Deposition) was novel and cost effective as compared to existing processes. However, it is observed in audit that the claim could not be verified as no effort was made to obtain the patent in this regard.

[1] Development of a 20 *per cent* efficiency HIT double sided solar cell on a 10 X 10 cm^2 surface with a power output of 2 watts, Demonstrate the lab scale module of PV cell, Performance evaluation of solar cells, their temperature dependence and field performance by NISE. After fabrication of HIT cell through Hot Wire Chemical Vapour Deposition (HWCVD), a unique process, patent to be obtained for fabrication of HIT cell.

vi. As per RDD&D guidelines of MNRE, for all projects, a third party monitoring mechanism was to be introduced to ensure timely execution and achievement of deliverables and also to allow mid course correction, if required. In this project, it was observed that the task of monitoring was assigned to NISE and IIT Mumbai. This posed a conflict of interest as both were the stakeholders in the project.

MNRE stated (May 2015) that additional large amount of funds for purchase of equipment were needed along with manpower and extension of project duration to achieve all objectives. Reply itself indicates deficiency in planning for the project. The project had, however, positively contributed in terms of award of PhD degree to two students.

Thus, though the research was aimed at developing high efficiency cells with an alternate and cost effective technology, the objectives of the project were overambitious and lacked necessary forecast for infrastructure. Lack of independent monitoring and follow up, evident through non filing of patent, exhibited a lackadaisical approach towards the research project.

2.2. Non-design and development of poly silicon deposition reactors

MNRE sanctioned (June 2009) a research project titled 'Development of solar grade poly silicon material' to be implemented by M/s Maharishi Solar Technology Pvt. Ltd (MSTPL), New Delhi at a total cost of ₹ 23.20 crore. Under the project it was proposed to design and develop process reactor and optimize the deposition process to make poly silicon for use in solar cell. The reactors for silicon production were to be indigenously designed and manufactured. MNRE's financial support was for ₹ 5.28 crore and was to be applied towards design and development of reactor and related equipments. MNRE released ₹ 1.76 crore in June 2009 as first installment to MSTPL. An expenditure of ₹ 1.74 crore was reported as incurred by MSTPL as on October 2010.

Audit scrutiny of the implementation of the project revealed the following:

i. From the utilization certificate submitted in October 2010 by MSTPL, it could be seen that expenditure on civil works, which was to be borne by MSTPL, was also booked against MNRE contribution, which was irregular.

ii. It was observed from the fourth quarterly report of MSTPL that till October 2010 the progress of project was slow. Works like civil work, infrastructure development, design of poly silicon reactor, arrangement of electrical power supply, plant and machinery and raw material storage facilities had not been completed by the MSTPL.

iii. Research and Development Project Approval Committee in its meeting (May 2009) recommended that in line with 50 *per cent* support to industry concept, the company must match the MNRE funding. However, it was noticed that no record of any expenditure by MSTPL from its own budget as against an expenditure of ₹ 1.74 crore contributed by MNRE was available.

iv. The monitoring of the project was lax as was evident from the fact that neither the report of the committee constituted by MNRE in July 2010 to visit the project site

was available in the records nor MSTPL submitted quarterly reports after October 2010.

v. Project completion report was not submitted.

Audit observed that MNRE did not object to the slow progress of the project, application of MNRE funds to ineligible works and MSTPL not contributing to the project in terms of its financial commitment.

MNRE stated (May 2015) that the solar grade polysilicon material was developed; however, it required detailed characterization to establish quality. In absence of any characterization, no further instalments were released. Reply itself was indicative of the fact that the objective of the project was not achieved.

2.3. Development of a Megawatt-scale National Solar Thermal Power Testing, Simulation and Research Facility

MNRE sanctioned (September 2009) an RDD&D project 'Development of a Megawatt-scale National Solar Thermal Power Testing, Simulation and Research Facility' to be implemented by Indian Institute of Technology (IIT) Mumbai in collaboration with NISE with specific objectives[2]. The total project outlay was ₹ 41.17 crore and was fully funded by MNRE. Cost of the project was revised from ₹ 41.17 crore to ₹ 48.12 crore. IIT Mumbai was to contribute in terms of space, equipment and infrastructure. The project duration was for five years and an expenditure to the tune of ₹ 43.51 crore had been incurred (July 2015).

Audit observed that:

i. Initially the site in Aurangabad was selected due to good amount of solar radiation and convenience for the project team of IIT Mumbai to frequently visit the site. However, the site was shifted to NISE campus. This resulted in increase in the estimated cost by ₹ 7.27 crore on equipment alone. This was required due to revision in technical specification[3] because of change in location.

ii. The site at NISE had a number of riverines and the quality of soil was very loose. In order to protect the civil foundations of various structures and collector fields from soil erosion, additional expenses towards soil pitching, drainage, check dams and associated land development work had to be undertaken.

[2] Establishment of a National Research Facility on Solar Thermal Power (one MW grid-interactive), Establishment of test facility for component and system characterization, Development of simulation facility for future scale-up of plant capacity, Facilitate R&D for cost reduction of concentrated solar power.

[3] The original project proposal was prepared for Aurangabad where the solar insolation was higher (800 Watt/m^2) than the solar insolation at NISE (600-650 Watt/m^2).Consequently, the aperture area of solar concentrators had to be increased to about 1.3 times to achieve the designed capacity of one MW. No specific reasons justifying the shift were found on record.

iii. As per Standing Finance Committee (SFC) memorandum, the participation of Indian industry[4], to the tune of ₹ 3.57 crore was proposed by MNRE. However, nothing on record showed that industry partners were involved. MNRE stated (May 2015) that a number of industry partners left due to change in site location and contributions received from industry were 'in kind'.

iv. As per RDD&D guidelines of MNRE the project was to be monitored regularly by an expert committee. To facilitate this, a provision of one *per cent* of the project cost was kept aside for monitoring charges. Such monitoring was to also review the industry participation and revenue generation by the project. However, nothing was on record to show that the project was monitored by any expert committee.

v. As per the MNRE's sanction, the extensive testing and data collection was scheduled to start from the third year of implementation. However, it was noticed in audit that work of extensive testing and data collection was not done even after lapse of third year of implementation.

MNRE stated (May 2015) that the plant was feeding power to the grid since May 2014. However it further stated that Power Purchase Agreement (PPA) with Distribution Company was yet to be signed. In the absence of PPA, there remains ambiguity regarding the status of grid connectivity.

2.4. Establishment of 3.5 MW Solar Thermal Power plant with 16 hours thermal storage for continuous operation

MNRE sanctioned a RDD&D project `Establishment of 3.5 MW Solar Thermal Power plant with 16 hours thermal storage for continuous operation' to World Renewal Spiritual Trust (WRST) at Mount Abu in October 2010 at a total cost of ₹ 63 crore. The project cost was to be shared amongst MNRE (₹ 12.60 crore), WRST (₹ 26.40 crore), BMU Germany (₹ 10 crore) and M/s Unnathi projects (industrial partner - ₹ 14 crore).

During the period October 2010 to November 2012, MNRE released ₹ six crore (50 *per cent* of its commitment) to WRST. Further, as per audited Statement of Expenditure (SoE) and Utilisation Certificates (UCs) submitted by WRST, WRST and M/s Unnathi projects together had released a sum of ₹ 8.10 crore for the project. In November 2012, WRST intimated that M/s Unnathi Projects had withdrawn from the project without contributing anything. It also proposed that the project cost should be revised to ₹ 81 crore and contributions enhanced. Accordingly MNRE enhanced (February 2014) its contribution to ₹ 21.20 crore, BMU's to ₹ 32.80 crore and WRST's to ₹ 27 crore. MNRE had released a total sum of ₹ 18.50 crore till date (July 2015).

Audit observed that the project was approved by RDD&D Project Appraisal Committee subject to involvement of an industrial partner, in addition to BMU Germany, for sharing the cost of the project. Accordingly M/s Unnathi Projects Ltd entered into a Memorandum of Understanding (MoU) (November 2009) with WRST with a contribution of ₹ 14 crore.

[4] L&T, KIE Thermosystems, Clique Development Pvt Ltd, Tata Power, Heavy Water Board and TCE consulting engineers.

Withdrawal of M/s Unnathi Projects at a later stage was in violation of this condition. Further, at the stage of revision in the project cost and contribution shares, MNRE did not raise the discrepancy in audited SoE regarding the fact that contribution of M/s Unnathi Projects and WRST was being shown together to give an impression that the industry partner was meeting its financial commitment. Thus, the failure of MNRE in monitoring SoEs and fund flows to the project resulted in a situation where MNRE was been saddled with extra financial burden due to withdrawal of industrial partner.

MNRE stated (May 2015) that it tried its best to convince and bring in another industry partner, but in vain. However, the fact remains that timely monitoring and securing M/s Unnathi Projects' contribution at early stages could have tied the partner to the project as envisaged. MNRE reply was silent on current status of the project.

2.5. Preparation of standards and guidelines and certification of Wind Power Systems

NIWE was established to render well organised support on a continuous basis to manufacturing industry, investors, developers and utilities in the Wind Energy Sector, including developing Indian standard and guidelines for design criteria, loads and safety in association with Bureau of Indian Standards (BIS).

Audit, however, observed that so far NIWE had not finalised standards and guidelines with respect to Indian conditions[5]. NIWE at present provided certificates to the wind turbines based on a provisional scheme titled 'Type Approval Provisional Scheme 2000 (TAPS 2000)'. Further, Audit also observed that certificates issued by the Centre had no universal acceptance.

During the last six years NIWE could undertake only 26 proposals for certification. Audit analysis revealed that after 2008-09, the number of certifications undertaken registered a declining trend. While in the year 2008-09 it was eight, it was only four in subsequent two years. In the year 2011-12, it was further reduced to three before it marginally rose once again to four. The amount of revenue earned also came down significantly. While it was ₹ 117.10 lakh in the year 2008-09, it was only ₹ 19.40 lakh in the year 2012-13.

Thus, the capability of independent certification with internationally acceptable standards was not developed even after a lapse of fifteen years of establishment of the Centre. NIWE replied that international accreditation was not obtained due to lack of adequate trained manpower in multi disciplinary engineering. As regards low number of certifications undertaken, NIWE replied that numbers could be increased only with an increase of manpower. As regards non-incorporation of Indian standards, NIWE stated that the BIS committee had already approved three draft standards and the documents would be printed in due course.

[5] To reflect special considerations for the country such as wind condition, grid conditions or temperature limits

2.6 Other audit findings

Apart from the significant audit findings reported in the preceding paragraphs, audit findings on the remaining 45 projects reviewed by Audit are given below. The project wise audit findings are given at **Annexure XVIII**.

2.6.1 Delays in completion of projects and deficiencies in monitoring

The audit findings relating to timely completion of projects, submission of UCs, monitoring of the projects, submission of Project Completion Reports (PCRs) and their evaluation with regards to these 45 projects, are summarized in Table 51.

Table 51: Summarised audit findings on 45 RDD&D projects

S.No.	Audit finding	Total (in Nos.)	Percentage
1.	Project not completed in time	32	71
2.	UCs not submitted in time	7	16
3.	Projects not monitored by independent Experts	16	36
4.	Project Completion Report not received	4	9
5.	Project Completion Report not evaluated by Experts	16	36

As can be seen from the table above 71 *per cent* of the projects could not be completed in time. In 36 *per cent* of the projects reviewed, neither the quarterly reports had been submitted nor were these reviewed by independent Experts. While in nine *per cent* of the reviewed projects the PCRs had not been submitted till July 2015, in 36 *per cent* of the cases where PCR had been received, it had not been evaluated by Experts.

2.6.2. Non achievement of objectives

Some project proposals approved by MNRE set out certain measurable outputs in terms of transfer of technology, patents to be filed and research papers to be published. Some projects also envisaged engagement of industry partners in the research project. Audit scrutiny in this regards revealed the following:

i. Of the 45 projects, in nine projects participation of industry was envisaged. In none of these projects such a partnership could be secured.

ii. In seven projects where it was anticipated that the research papers would be published, no such publications were made.

iii. In six cases though the project proposal targeted transfer of technology, this could not be achieved.

iv. In 16 cases, where filing of patents was committed to in the project proposal, no such patent was filed.

2.7 RDD&D activities in States

Audit observed that in the 24 selected States, only a few States had undertaken RDD&D activities. The audit observations on the projects undertaken by the States are given below.

Gujarat

For Wind Energy, GEDA had identified two focus areas for R&D without any feasibility study and had not implemented any project till 2013-14. For Biomass Energy GEDA had identified 10 focus areas for RDD&D without any feasibility study and had not implemented any project till 2013-14.

Kerala

No R&D activities were carried out by the State during the period 2007-2014 except for the development of two portable type biogas plants during the year 2012-13.

West Bengal

WBREDA signed (February 2013) MoU with Bengal Engineering and Science University for creating a Centre of Excellence for Green Energy and Sensor System to be funded through a Green Energy Fund. The Green Energy Fund was to be funded by an initial equity contribution from the State Government and then it was to generate sufficient revenues to be self-sustained. Audit observed that neither was the fund set up nor could the Centre of Excellence be established.

3. Conclusion

Under the Research, Design, Development and Demonstration programme, MNRE sanctioned 190 projects at a cost of ₹ 545.90 crore during the period 2007-08 to 2013-14 to various R&D organizations, of which 112 projects were completed and 78 projects were under progress.

Audit observed that although a large number of sanctioned projects were in alignment with focus areas identified under various Divisions of MNRE, realisation of deliverable outcome was not achieved in a majority of projects. This was partly due to the fact that industry participation could not be secured in the projects where it was envisaged, which limited the commercial exploitation of technologies developed. There were delays in implementation of projects and inability of the implementing agencies to either file patents or publish research papers as envisaged in the projects.

Monitoring of the projects by MNRE was lax, as in many cases, project progress reports were not submitted by the implementing agency and project completion reports were not evaluated by MNRE or by third parties.

MNRE sponsored research, design, development and demonstration activities did not yield significant results with regard to cost reduction or development of new technology and processes.

4. Recommendations

- *Project Completion Reports of research projects should invariably be vetted by field experts and peer groups before their acceptance, to validate the presented output.*
- *Emphasis should be laid on regular monitoring of ongoing projects to ensure that these are completed on time and if required, course correction introduced.*

(GURVEEN SIDHU)
Principal Director of Audit,
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New Delhi
Dated:

Countersigned

New Delhi
Dated:

(SHASHI KANT SHARMA)
Comptroller and Auditor General of India

Annexures

Annexure I
(Refer to para 6 in Chapter I)

State wise sample selected for audit of Small Hydro Power, Biomass bagasse and Biomass non bagasse

State	Small Hydro Power		Biomass bagasse		Biomass non bagasse	
	Total Projects	Sample Selected	Total Projects	Sample Selected	Total Projects	Sample Selected
Andhra Pradesh	67	7	24	2	10	5
Arunachal Pradesh	187	33	Nil	Nil	Nil	Nil
Assam	Nil	Nil	Nil	Nil	Nil	Nil
Bihar	13	1	Nil	Nil	Nil	Nil
Chhattisgarh	2	1	Nil	Nil	1	1
Gujarat	5	None	Nil	Nil	Nil	Nil
Haryana	4	Nil	4	2	17	9
Himachal Pradesh	88	13	0	0	0	0
Jammu & Kashmir	Nil	Nil	Nil	Nil	Nil	Nil
Jharkhand	Nil	Nil	Nil	Nil	Nil	Nil
Karnataka	87	12	53	5	13	3
Kerala	13	5	Nil	Nil	Nil	Nil
Madhya Pradesh	86	11	Nil	Nil	34	6
Maharashtra	46	5	81	8	18	2
Meghalaya	4	2	Nil	Nil	Nil	Nil
Mizoram	11	1	Nil	Nil	Nil	Nil
Nagaland	1	1	1	1	1	1
Odisha	5	1	Nil	Nil	1	1
Punjab	42	4	1	1	24	13
Rajasthan	10	Nil	14	2	1	1
Tamil Nadu	21	5	95	10	8	4
Uttar Pradesh	Nil	Nil	Nil	Nil	25	10
Uttarakhand	7	4	3	1	6	1
West Bengal	8	2	Nil	Nil	150	15

Source: MNRE.

Annexure I
(Refer to para 6 in Chapter I)

State wise sample selected for audit of wind energy programmes

States	Generation Based Incentive (GBI)		Accelerated Depreciation (AD)	
	Total Projects	Sample Selected	Total Projects	Sample Selected
Andhra Pradesh	NA	NA	42	4
Arunachal Pradesh	Nil	Nil	Nil	Nil
Assam	Nil	Nil	Nil	Nil
Bihar	NA	NA	NA	NA
Chhattisgarh	Nil	Nil	Nil	Nil
Gujarat	Nil	Nil	1,230	62
Haryana	Nil	Nil	Nil	Nil
Himachal Pradesh	Nil	Nil	Nil	Nil
Jammu & Kashmir	Nil	Nil	Nil	Nil
Jharkhand	Nil	Nil	Nil	Nil
Karnataka	145	15	Nil	Nil
Kerala	3	1	Nil	Nil
Madhya Pradesh	Nil	Nil	88	13
Maharashtra*	1,938	100		
Meghalaya	Nil	Nil	Nil	Nil
Mizoram	Nil	Nil	Nil	Nil
Nagaland	Nil	Nil	2	2
Odisha	Nil	Nil	Nil	Nil
Punjab	Nil	Nil	Nil	Nil
Rajasthan	Nil	Nil	71	8
Tamil Nadu*	11,598	170		
Uttar Pradesh	Nil	Nil	Nil	Nil
Uttarakhand	Nil	Nil	Nil	Nil
West Bengal	Nil	Nil	3	2

Source: SNAs.

NA – Not Available.

* In the States of Maharashtra and Tamil Nadu the total projects shown are combined i.e. installed under GBI and AD schemes.

Annexure I : (Refer to para 6 in Chapter I)

State wise sample selected for audit of grid connected Solar Renewable Energy programmes

State	JNNSM		Migration		RPSSGP		Demonstration Programme		Solar Projects under the State Policy	
	Total Projects	Sample Selected	Total Projects	Sample Selected	Total Projects	Sample Selected	Total Projects	Sample Selected	Total Projects	Sample Selected
Andhra Pradesh	5	2	Nil	Nil	11	1	1	Nil	28	4
Arunachal Pradesh	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Assam	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Bihar	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Chhattisgarh	Nil	Nil	Nil	Nil	2	1	Nil	Nil	2	1
Gujarat	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil	78	20
Haryana	Nil	Nil	Nil	Nil	9	2	Nil	Nil	Nil	Nil
Himachal Pradesh	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Jammu & Kashmir	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Jharkhand	Nil	Nil	Nil	Nil	8	4	Nil	Nil	Nil	Nil
Karnataka	2*	Nil	Nil	Nil	Nil	Nil	Nil	Nil	3	3
Kerala	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Madhya Pradesh	Nil	Nil	Nil	Nil	3	Nil	Nil	Nil	69	27
Maharashtra	3	1	3	1	3	3	1	1	2	1
Meghalaya	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Mizoram	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Nagaland	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Odisha	2*	Nil	Nil	Nil	8	2	Nil	Nil	Nil	Nil
Punjab	Nil	Nil	1	1	7	2	Nil	Nil	1	1
Rajasthan	50*	Nil	12	Nil	12	3	2	2	73	19

State	JNNSM		Migration		RPSSGP		Demonstration Programme		Solar Projects under the State Policy	
	Total Projects	Sample Selected	Total Projects	Sample Selected	Total Projects	Sample Selected	Total Projects	Sample Selected	Total Projects	Sample Selected
Tamil Nadu	1	Nil	Nil	Nil	7	2	1	1	Nil	Nil
Uttar Pradesh	1	Nil	Nil	Nil	5	Nil	Nil	Nil	Nil	Nil
Uttarakhand	Nil	Nil	Nil	Nil	3	1	Nil	Nil	Nil	Nil
West Bengal	Nil	Nil	Nil	Nil	Nil	Nil	1	Nil	1	1

Source: MNRE, State Nodal Agencies, NTPC Vidyut Vyapar Nigam Limited and Indian Renewable Energy Development Agency.

* One project each in these States have been cancelled. In addition to the above out of 62 JNNSM projects implemented by NVVN, 46 were selected for audit. Out of a total of 16 projects under Migration scheme implemented by NVVN, nine were selected for audit. Further, out of 67 RPSSGP project implemented by IREDA, 17 were selected for audit and out of a total of six Demonstration projects implemented by IREDA, three were selected for audit.

Annexure II
(Refer to para 2.2 in Chapter II)

Targets for Renewable Purchase Obligation (RPO) set by the State Electricity Regulatory Commissions from 2010-11 to 2019-20

(in *per cent*)

S. No.	State	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
	NAPCC Target	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00
1	**Andhra Pradesh**		5.00	5.00	5.00	5.00	5.00	5.00			
2	**Arunachal Pradesh**			4.20	5.60	7.00					
3	**Assam**		2.80	4.20	5.60	7.00					
4	**Bihar**	1.50	3.00	4.00	4.50	5.00	1.00	1.25	1.50	1.75	2.00
5	**Chhattisgarh**	5.00	5.25	5.75	5.75	5.75					
6	**Gujarat**	5.00	6.00	7.00	7.00	8.00	9.00	10.00			
7	**Haryana**	1.50	1.50	2.05	3.10						
8	**Himachal Pradesh**	10.00	10.01	10.25	10.25	10.25	11.25	12.25	13.50	14.75	16
9	**Jammu & Kashmir**		3.00	5.00	5.00	6.00	7.50	9.00			
10	**Jharkhand**	2.00	3.00	4.00	4.00	4.00	4.00				
11	**Karnataka**		7.25	7.25	7.25						
12	**Kerala**	3.30	3.60	3.90	4.20	4.50	4.80	5.10	5.40	5.70	6.00
13	**Madhya Pradesh**		2.50	4.00	5.50	7.00					
14	**Maharashtra**	6.00	7.00	8.00	9.00	9.00	9.00				
15	**Meghalaya**	0.50	0.75	1.00	1.00						
16	**Mizoram**	5.00	6.00	7.00							
17	**Nagaland**	5.00	7.00	8.00							
18	**Odisha**		5.00	5.50	6.00	6.50	7.00				
19	**Punjab**		2.40	2.90	3.50	4.00					
20	**Rajasthan**	8.50	6.00	7.10	8.20						
21	**Tamil Nadu**		9.00	9.00	9.00	11.00	11.00				
22	**Uttar Pradesh**	3.75	5.00	6.00	6.00						
23	**Uttarakhand**		4.53	5.05	6.05	7.08	8.10	9.30	11.50		
24	**West Bengal**				4.00	5.00	6.00	7.00	8.00		

Source: Ministry of New and Renewable Energy.

Note: NAPCC – National Action Plan for Climate Change.

Annexure III
(Refer to para 2.3 in Chapter II)

Status of Renewable Purchase Obligation (RPO) compliance between 2010-11 and 2013-14

S.No.	RPO notified/ achievement (in *per cent*)				
	State	**2010-11**	**2011-12**	**2012-13**	**2013-14**
	NAPCC	6.00	7.00	8.00	9.00
1	**Andhra Pradesh**		5.00/ NA	5.00/ 1.75	5.00/ NA
2	**Arunachal Pradesh**			4.20/ 8.41	5.60/ 8.87
3	**Assam**	0/ 8.40	2.80/ 4.02	4.20/ 3.44	5.60/ NA
4	**Bihar**	1.50/ 1.00	2.50/ 2.10	4.00/ 2.90	4.50/ 1.89
5	**Chhattisgarh**	5.00/ 0	5.25/ 2.76	5.75/ 2.96	6.25/ NA
6	**Gujarat**	5.00/ 2.76	6.00/ 4.73	7.00/ 6.50	7.00/ 6.72
7	**Haryana**	1.50/ 1.06	1.50/ 1.07	2.05/ 0.97	3.10/ 0.94
8	**Himachal Pradesh**	10.00/ 12.00	10.01/ 15.73	10.25/ 17.26	10.25/ 16.69
9	**Jammu & Kashmir**		3.00/ Nil	5.00/ Nil	5.00/ Nil
10	**Jharkhand**	2.00/ 0.19	3.00/ 0.28	4.00/ 0.39	4.00/ 0.42
11	**Karnataka**	0/ 10.70	7.25/ 10.73	7.25/ 9.93	7.25/ 10.97
12	**Kerala**	3.00/ 3.38	3.30/ 2.85	3.60/ 2.47	3.90/ NA
13	**Madhya Pradesh**		2.50/ NA	4.00/ NA	5.50/ NA
14	**Maharashtra**	6.00/ 5.77	7.00/ 7.15	8.00/ 7.05	9.00/ 7.66
15	**Meghalaya**	0.50/ 4.14	0.75/ 3.41	1.00/ 5.00	1.00/ 3.80
16	**Mizoram**	5.00/ 5.14	6.00/ 7.76	7.00/ 14.45	9.00/ 11.99
17	**Nagaland**	5.00/ Nil	5.00/ Nil	5.00/ Nil	5.00/ Nil
18	**Odisha**		5.00/ NA	5.50/ NA	6.00/ NA
19	**Punjab**		2.40/ 1.69	2.90/ 2.59	3.50/ 3.08
20	**Rajasthan**	8.50/ 3.55	6.00/ 5.16	7.10/ 6.30	8.20/ 7.25
21	**Tamil Nadu**	0/ 17.27	9.00/ 20.09	9.00/ 26.13	9.00/ 20.04
22	**Uttar Pradesh**	3.75/ 4.56	5.00/ 6.19	6.00/ 4.68	6.00/ 4.45
23	**Uttarakhand**		4.53/NA	5.05/ 3.78	6.05/ 3.15
24	**West Bengal**		2.00/ NA	3.00/ 1.47	4.00/2.54

Source: Data provided by respective State Nodal Agencies.

Note: NA – Not Available.

Annexure IV
(Refer to para 2.4 in Chapter II)

State wise Renewable Purchase Obligation (RPO) achievement

State	Total Electricity purchased during 2010-14 (in BU)	RPO Targets for 2010-14 (in MU)	RPO achieved through Renewable Energy purchase		RPO achieved through Renewable Energy Certificate mode (in MU)		Total RPO Achievement (in MU)	Shortfall (in MU)
			(in MU)	Percentage	(in MU)	Percentage		
Andhra Pradesh	76	3,800	1,330	100	Nil	Nil	1,330	2,470
Arunachal Pradesh	2.36	58.31	102.78	100	Nil	Nil	102.78	Nil
Assam	12.64	434.79	17.09	100	Nil	Nil	17.09	417.70
Bihar	24.21	793.32	488.72	100	Nil	Nil	488.72	304.60
Chhattisgarh	41.09	2,266.82	1,090	92.37	90	7.63	1,180	1,086.82
Gujarat	287.04	18,990	8,620	56.89	6,530	43.11	15,150	3,840
Haryana	144.56	2,981	1,452	100	Nil	Nil	1,452	1,529
Himachal Pradesh	30.02	5,000	4,620	100	Nil	Nil	4,620	380
Jammu & Kashmir	NA	NA	NA	NA	NA	NA	NA	NA
Jharkhand	39.96	1,319.36	39.36	100	Nil	Nil	39.36	1,280
Karnataka	214.70	15,020	22,712	100	Nil	Nil	22,712	Nil
Kerala	45.95	1,490	1,320	100	Nil	Nil	1,320	170
Madhya Pradesh	181.94	6,350	2,480	100	Nil	Nil	2,480	3,870
Maharashtra	373.84	28,252.59	25,675.09	98.86	296.49	1.14	25,971.58	2,281.01
Meghalaya	6.96	57.20	290	100	Nil	Nil	290	Nil
Mizoram	1.62	110.81	161.27	100	Nil	Nil	161.27	Nil
Nagaland	1.98	99.09	99.09	100	Nil	Nil	99.09	Nil
Odisha	NA	2,469	1,706	100	Nil	Nil	1,706	763
Punjab	131.68	3,888	2,900	89	368	11	3,268	620
Rajasthan	210.03	15,621	11,949	100	Nil	Nil	11,949	3,672
Tamil Nadu	203.15	13,740	42,359	100	Nil	Nil	42,359	Nil
Uttar Pradesh	291.05	17,738.84	15,053.26	100	Nil	Nil	15,053.26	2,685.58
Uttarakhand	32.87	1,714.52	1,219.29	90.76	124.12	9.24	1,343.41	371.11
West Bengal	154.69	5,030.06	2,536.19	99.99	2.81	0.10	2,539	2,491.06
Total			148220.14	95.23	7411.42	4.77	155631.56	28231.88

Note: NA – Not Available.

Annexure V
(Refer to para 2.5 in Chapter II)

Non levy of penalty on obligated entities for not complying with Renewable Purchase Obligation

State	Shortfall (in MU)	Estimated penalty* (in ₹ crore)	Remarks
Andhra Pradesh	2,470.00	370.50	Penalty for non solar at the rate of ₹ 1,500 per REC. For period 2012-13
Arunachal Pradesh	Nil	Nil	No shortfall
Assam	417.70	62.66	For period 2011-13
Bihar	304.60	45.69	Bihar Energy Regulatory Commission ordered creation of a separate fund of ₹ 21.08 crore for shortfall, however the same has not been done yet for period 2010-14
Chhattisgarh	1,086.82	163.02	For period 2011-13
Gujarat	3,840.00	576.00	For period 2010-14. The matter of RPO fulfillment is kept for judgment (petition no. 1437 and 1442 of 2014) by Gujarat Energy Regulatory Commission.
Haryana	1,529.00	229.35	For period 2010-14.
Himachal Pradesh	380.00	57.00	For period 2010-14.
Jammu & Kashmir	NA	NA	
Jharkhand	1,280.00	192.00	For period 2010-14.
Karnataka	Nil	Nil	For period 2007-14. Being an RE rich state, RPO targets were met. However Karnataka Energy Regulatory Commission has not prescribed any penalty for non compliance
Kerala	170.00	25.50	For period 2010-14.
Madhya Pradesh	3,870.00	580.50	For period 2007-14.
Maharashtra	2,281.01	342.15	Time extension upto 2013-14 for Non-Solar Projects and upto 2015-16 for Solar Projects were been granted by Maharashtra Energy Regulatory Commission for recoupment of the shortfall.
Meghalaya	Nil	Nil	For 2010-14. No shortfall.
Mizoram	Nil	Nil	For 2010-14. No shortfall.
Nagaland	Nil	Nil	No shortfall.
Odisha	763.00	114.45	For period 2012-14.
Punjab	620.00	93.00	For period 2011-14.
Rajasthan	3,672.00	550.80	For period 2007-14. Rajasthan Energy Regulatory Commission had not prescribed the scale of penalty for shortfall.
Tamil Nadu	Nil	Nil	No shortfall
Uttar Pradesh	2,685.58	402.84	No clause for imposition of penalty for non-compliance
Uttarakhand	371.11	55.67	Uttarakhand Energy Regulatory Commission had levied a token penalty of ₹ 20,000 on Uttarakhand Power Corporation Limited. Recently it had allowed carrying over of unmet RPO to FY 2014-15
West Bengal	2,491.06	373.66	For 2010-14.
Total	**28,231.88**	**4,234.79**	

* Calculated at a floor price of ₹ 1,500 per Renewable Energy Certificate (REC).
Note: NA – Not Available.

Annexure VI
(Refer to para 3.1 in Chapter II)

State wise list of projects registered under Solar and non Solar Renewable Energy Certificate (REC) as on July 2014

State	Projects registered under Solar REC		Projects registered under non Solar REC		Total projects registered under REC	
	Number	Capacity (in MW)	Number	Capacity (in MW)	Number	Capacity (in MW)
Andhra Pradesh	7	37.79	14	124.80	21	162.59
Bihar	0	0	5	26.60	5	26.60
Chhattisgarh	2	3.10	8	86.50	10	89.60
Gujarat	0	0	47	336.30	47	336.30
Haryana	0	0	6	18.56	6	18.56
Himachal Pradesh	0	0	7	55.51	7	55.51
Jammu & Kashmir	0	0	1	15	1	15
Karnataka	0	0	15	137.25	15	137.25
Kerala	0	0	2	23.20	2	23.20
Madhya Pradesh	53	83.77	9	63.17	62	146.94
Maharashtra	29	45.75	324	845.84	353	891.59
Nagaland	0	0	1	24	1	24
Odisha	1	2.50	2	30.40	3	32.90
Punjab	0	0	6	53.28	6	53.28
Rajasthan	59	159.12	20	141	79	300.12
Tamil Nadu	13	36.86	214	1,018.85	227	1,055.71
Uttar Pradesh	0	0	53	678.13	53	678.13
Uttarakhand	0	0	3	44	3	44
Total	**164**	**368.89**	**737**	**3,722.39**	**901**	**4,091.28**

Source: Renewable Energy Certificate Registry of India.

Annexure VII
(Refer to para 2 in Chapter III)

Estimated potential, target fixed and installed capacity of Solar power as on 31 March 2014

S. No.	State	Estimated potential[1] (in MW)	Targets fixed (2007-14)	Installed capacity as per MNRE (in MW)	Installed capacity as per States/ UTs (in MW)	Installation (in percentage) over estimated potential
		(i)	(ii)	(iii)	(iv)	(iii) x 100/(i)
1	Andhra Pradesh	58,850	Nil	131.84	95.98	0.22
2	Arunachal Pradesh	8,650	Nil	0.03	Nil	Nil
3	Assam	13,760	Nil	Nil	Nil	Nil
4	Bihar	11,200	Nil	Nil	Nil	Nil
5	Chhattisgarh	18,270	Nil	7.10	9.60	0.04
6	Delhi	2,050	-	5.15	-	0.25
7	Goa	880	-	Nil	-	Nil
8	Gujarat	35,770	Nil	916.40	891.16	2.56
9	Haryana	4,560	Nil	10.30	12.80	0.23
10	Himachal Pradesh	33,840	Nil	Nil	Nil	Nil
11	Jammu & Kashmir	1,11,050	Nil	Nil	Nil	Nil
12	Jharkhand	18,180	Nil	16.00	16.00	0.09
13	Karnataka	24,700	256.00	31.00	31.00	0.13
14	Kerala	6,110	Nil	0.03	Nil	Nil
15	Madhya Pradesh	61,660	748.38	347.17	272.77	0.56
16	Maharashtra	64,320	225.00	249.25	230.25	0.39
17	Manipur	10,630	-	Nil	-	Nil
18	Meghalaya	5,860	Nil	Nil	Nil	Nil
19	Mizoram	9,090	Nil	Nil	Nil	Nil
20	Nagaland	7,290	Nil	Nil	Nil	Nil
21	Odisha	25,780	Nil	30.50	13.00	0.12
22	Punjab	2,810	1,000	16.85	10.50	0.60
23	Rajasthan	1,42,310	1,380	730.10	725.50	0.51
24	Sikkim	4,940	-	Nil	-	Nil
25	Tamil Nadu	17,670	700	98.36	97.00	0.56
26	Tripura	2,080	-	Nil	-	Nil
27	Uttar Pradesh	22,830	Nil	21.08	Nil	0.09
28	Uttarakhand	16,800	Nil	5.05	5.00	0.03
29	West Bengal	6,260	100	7.05	2.00	0.11
30	Union Territories[2]	790	-	7.88		1.00
	Total	**7,48,990**	**4,409.38**	**2,631.14[3]**	**2,412.56**	**0.35**

Source: State Nodal Agencies (SNAs) and MNRE.

[1] As per National Institute of Wind Energy.
[2] Andaman & Nicobar Islands, Chandigarh, Dadar & Nagar Haveli, Daman & Diu, Lakshadweep and Puducherry.
[3] However, the year wise installed capacity as per MNRE was 2,656 MW.

Annexure VIII
(Refer to para 4.1.2 in Chapter III)

Year-wise project wise service charges deducted by Indian Renewable Energy Development Agency (IREDA)

(in ₹)

Year/ Name of project proponent	**M/s Reliance Industries**			**M/s Sapphire Industrial Infrastructures Private limited**			**M/s Par Solar Pvt ltd.**		
	Service charges charged by IREDA	Maximum limit	Excess charged by IREDA	Service charges charged by IREDA	Maximum limit	Excess charged by IREDA	Service charges charged by IREDA	Maximum allowable	Excess charged by IREDA
2011-12	15,67,647	5,00,000	10,67,647	10,79,545	5,00,000	5,79,545	0	0	0
2012-13	6,81,052	5,00,000	1,81,052	36,751	5,00,000	0	0	0	0
2013-14	0	0	0	10,54,562	5,00,000	5,54,562	8,56,391	5,00,000	3,56,391
Total	22,48,699	10,00,000	12,48,699	21,70,858		11,34,107	8,56,391		3,56,391
Adjusted in 2014-15			0	(6,21,619)			(2,89,501)		

The total excess charged by IREDA during 2011-14 works out to ₹ (12,48,699+11,34,107+3,56,391) = ₹ 27.39 lakh.

Annexure IX
(Refer to para 4.4.6 in Chapter III)

Details of delay in supply of bundled power in Jawaharlal Nehru National Solar Mission (JNNSM)

Name of Scheme	Number of projects	Date of commissioning of the projects	Allocation of NTPC thermal power made effective from	Number of days for which NVVN supplied only solar power (without bundling with thermal power)
Migration	7	10-15 October 2011 and 20 November 2011	26 October 2011 and 14 December 2011	11 to 24 days
Batch-I of JNNSM	8	1 January 2012 to 10 January 2012	21 January 2012	11 to 20 days
Batch-I of JNNSM	5	2 February 2012 to 22 March 2012	11 July 2012	111 to 160 days
Batch-II of JNNSM	8	23 December 2012 to 13 February 2013	1 March 2013	16 to 68 days
Batch II of JNNSM	17	11 February 2013 to 26 March 2013	6 April 2013	11 to 54 days

Annexure X
(Refer to para 2.3 in Chapter V)

State wise estimated potential and installed capacities of Small Hydro Power

S. No.	States	Estimated Potential		Installed Capacity		Sites used (in percentage)	Installed Capacity (in percentage)
		No. of sites	Capacity (in MW)	No. of sites	Capacity (in MW)		
1	Andaman &Nicobar Islands	7	7.91	1	5.25	14	66
2	Andhra Pradesh	387	978.40	68	221.03	18	23
3	Arunachal Pradesh	677	1,341.38	149	103.905	22	8
4	Assam	119	238.69	6	34.11	5	14
5	Bihar	93	223.05	29	70.70	31	32
6	Chhattisgarh	200	1,107.15	9	52	5	5
7	Goa	6	6.50	1	0.05	17	1
8	Gujarat	292	201.97	5	15.60	2	8
9	Haryana	33	110.05	7	70.10	21	64
10	Himachal Pradesh	531	2,397.91	158	638.905	30	27
11	Jammu &Kashmir	245	1,430.67	37	147.53	15	10
12	Jharkhand	103	208.95	6	4.05	6	2
13	Karnataka	834	4,141.12	147	1,031.658	18	25
14	Kerala	245	704.10	25	158.42	10	22
15	Madhya Pradesh	299	820.44	11	86.16	4	11
16	Maharashtra	274	794.33	58	327.425	21	41
17	Manipur	114	109.13	8	5.45	7	5
18	Meghalaya	97	230.05	4	31.03	4	13
19	Mizoram	72	168.90	18	36.47	25	22
20	Nagaland	99	196.98	11	29.67	11	15
21	Odisha	222	295.47	10	64.625	5	22
22	Punjab	259	441.38	47	156.20	18	35
23	Rajasthan	66	57.17	10	23.85	15	42
24	Sikkim	88	266.64	17	52.11	19	20
25	Tamil Nadu	197	659.51	21	123.05	11	19
26	Tripura	13	46.86	3	16.01	23	34
27	Uttar Pradesh	251	460.75	9	25.10	4	5
28	Uttarakhand	448	1,707.87	99	174.82	22	10
29	West Bengal	203	396.11	23	98.40	11	25
	Total	**6,474**	**19,749.44**	**997**	**3,803.678**	**15**	**19**

Source: MNRE.

Note: No Small Hydro Power potential was reported for Chandigarh, Dadar & Nagar Haveli, Daman & Diu, Delhi, Lakshadweep and Puducherry.

Annexure XI
(Refer to para 2.2 in Chapter VII)

Physical targets and achievements of off - grid Renewable Energy systems (2007-14)

S. No.	State	Target and Achievement	Solar Lanterns (Nos.)	Solar Home Lights (Nos.)	Solar Street Lights (Nos.)	Solar Water Pumps (Nos.)	Solar Power Plants (kW/Nos.)	Solar Water Heating (sqm/LPD/Nos.)
1	Andhra Pradesh	Target	30,625	150	3,156	NA	NA	88,934
		Achievement	29,117	21	2,845	5	1,581.83 kW	22,633
2	Arunachal Pradesh	Target	4,000	5,579	300	NA	2	NA
		Achievement	4,000	5,579	300	Nil	2	Nil
3	Assam	Target	500	1,041	638	NA	638 kW	6,597 (sqm)
		Achievement	Nil	291	588	Nil	220 kW	648 (sqm)
4	Bihar	Target	17,700	8,600	1,189	1,560	100 kW	15,000 LPD
		Achievement	17,700	8,600	1,089	1,300	100 kW	9,400 LPD
5	Chhattisgarh	Target	NA	NA	NA	NA	NA	NA
		Achievement	8,412	3,821	3,074	1, 834	4,640 kW	2,793
6	Gujarat	Target	NA	3,058	NA	NA	57	19,675
		Achievement	Nil	Nil	Nil	Nil	40	12,936
7	Haryana	Target	43,591	17,879	32,787	74	169	30,00,000 LPD
		Achievement	43,591	13,185	31,497	74	36	26,15,000 LPD
8	Himachal Pradesh	Target	16,052	2,040	35,062	NA	2,825 kW	33,773 (sqm)
		Achievement	12,292	2,040	35,062	Nil	2,825 kW	15,889 (sqm)
9	Jammu & Kashmir	Target	15,150	32,500	300	NA	4,473.30 kW	21,660 (sqm)
		Achievement	14,347	21,550	210	Nil	2,154.30 kW	2,464 (sqm)
10	Jharkhand	Target	7,000	NA	7,000	77	5,060 kW	250
		Achievement	7,000	Nil	3,467	Nil	230 kW	81
11	Karnataka	Target	NA	NA	NA	NA	NA	NA
		Achievement	Nil	Nil	Nil	Nil	Nil	98
12	Kerala	Target	NA	4,704	1,400	NA	11,780.65 kW	7,955 (sqm)
		Achievement	Nil	4,704	579	Nil	6,703.36 kW	3,428 (sqm)
13	Madhya Pradesh	Target	NA	4,700	12,979	4	1,586	843
		Achievement	Nil	3,805	12,875	4	576	843

S. No.	State	Target and Achievement	Solar Lanterns (Nos.)	Solar Home Lights (Nos.)	Solar Street Lights (Nos.)	Solar Water Pumps (Nos.)	Solar Power Plants (kW/Nos.)	Solar Water Heating (sqm/LPD/Nos.)
14	**Maharashtra**	Target	60,000	274	1,173	NA	NA	123 (sqm)
		Achievement	60,000	274	1,173	Nil	Nil	123 (sqm)
15	**Meghalaya**	Target	3,26,356	1,26,156	1,56,132	NA	422	186
		Achievement	330	1,28,130	1,34,128	Nil	424	186
16	**Mizoram**	Target	NA	NA	1,000	NA	41	NA
		Achievement	2,181	4,004	Nil	Nil	41	922
17	**Nagaland**	Target	NA	NA	4,200	NA	57	NA
		Achievement	5,503	2,791	3,816	Nil	55	1,232
18	**Odisha**	Target	NA	1,000	180	NA	NA	4,000 (sqm)
		Achievement	Nil	476	214	Nil	70	722 (sqm)
19	**Punjab**	Target	NA	NA	NA	600	NA	17,00,000 LPD
		Achievement	2,438	4,500	3,866	100	1,120 kW	8,42,000 LPD
20	**Rajasthan**	Target	NA	71,391	NA	15,550	7	5,100
		Achievement	Nil	67,587	90	14,414	7	2,015
21	**Tamil Nadu**	Target	NA	1,80,000	60,000	500	6,000 kW	50,000 (sqm)
		Achievement	Nil	78,343	21,130	134	2,055 kW	28,932 (sqm)
22	**Uttar Pradesh**	Target	NA	13,164	1,24,344	900	981	23,64,000 LPD
		Achievement	Nil	11,874	1,02,975	567	691	14,80,500 LPD
23	**Uttarakhand**	Target	1,13,259	9,985	18,543	NA	19	7
		Achievement	1,13,259	9,985	18,143	Nil	19	7
24	**West Bengal**	Target	15,000	34,783	8,325	Nil	101 kW	500
		Achievement	13,035	28,771	6,325	1	71 kW	137

Note – NA – Not Available, Nos – Numbers, LPD – Litre per day, sqm – square metre, Solar Home Lighting System (SHLS), Solar Street Lighting System (SSLS), Solar Power Plant (SPP), Solar Lantern (SL) and Solar Water Pump (SWP), LPD – Litres per day, sqm – square metres, kW – kilo Watt.

Annexure XII
(Refer to para 3 in Chapter VII)
Details of Central Financial Assistance (CFA) released to States and unspent balances

(in ₹ crore)

S. No.	State	Opening Balance	Budget			Total Budget	Expenditure	Unspent balance	Refund
			CFA	State share	Others				
1	**Andhra Pradesh**	Nil	15.36	Nil	Nil	15.36	8.36	7	Nil
2	**Arunachal Pradesh**	Nil	26.48	1.05	Nil	27.53	27.93	(-) 0.40	Nil
3	**Assam**	Nil	7.80	0.74	Nil	8.54	4.88	3.66	Nil
4	**Bihar**	Nil	5.96	68.13	22.01	96.11	34.77	61.34	Nil
5	**Chhattisgarh**	Nil	137.29	87.34	Nil	224.63	419.93	(-)195.30	Nil
6	**Gujarat**	Nil	17.07	0.87	Nil	17.94	12.21	5.73	0.45
7	**Haryana**	Nil	31.49	33.91	Nil	65.40	62.66	2.74	Nil
8	**Himachal Pradesh**	Nil	52.03	1.20	7.21	60.44	89.56	(-)29.12	Nil
9	**Jammu & Kashmir**	Nil	38.05	26.17	Nil	64.22	61.25	2.97	Nil
10	**Jharkhand**	Nil	15.44	81.45	14.47	111.36	76.88	34.48	Nil
11	**Karnataka**	Nil	3.45	Nil	Nil	3.45	Nil	3.45	Nil
12	**Kerala**	Nil	7.67	16.55	0.51	24.73	46.50	(-)21.77	Nil
13	**Madhya Pradesh**	Nil	27.29	13.42	Nil	40.71	44.44	(-)3.73	Nil
14	**Maharashtra**	Nil	40.98	Nil	Nil	40.98	40.98	Nil	Nil
15	**Meghalaya**	Nil	22.46	1.96	Nil	24.42	28.53	(-)4.11	Nil
16	**Mizoram**	Nil	6.57	4.95	2.15	13.67	13.67	Nil	Nil
17	**Nagaland**	Nil	16.06	11.62	Nil	27.68	24.33	3.35	Nil
18	**Odisha**	Nil	1.76	10.75	Nil	12.51	6.62	5.89	Nil
19	**Punjab**	Nil	20.66	1.42	Nil	22.08	21.88	0.20	Nil
20	**Rajasthan**	Nil	117.11	12.66	Nil	129.77	112.43	17.34	Nil
21	**Tamil Nadu**	Nil	56.93	157.60	Nil	214.53	214.53	Nil	Nil
22	**Uttar Pradesh**	Nil	72.75	114.11	Nil	186.86	185.45	1.41	Nil
23	**Uttarakhand**	10.87	87.52	28.24	51.90	167.66	164.93	2.73	Nil
24	**West Bengal**	Nil	35.94	32.45	16.11	84.50	78.87	5.63	Nil
	Total	**10.87**	**864.12**	**706.59**	**114.36**	**1,685.07**	**1,781.58**	**(-) 96.51**	**0.45**

Annexure XIII
(Refer to para 4.4 in Chapter VII)

Details of State wise physical verification of off-grid Solar systems by Audit

Type of System	Location and year of installation	Number of systems inspected	Audit observation
Andhra Pradesh			
SHLS and SSLS	Suddakunta village 2008-09	284 SHLS and 34 SSLS	Out of five households electrified, none was occupied, and one house holder was staying at Venkatadripalem village.
SHLS and SSLS	Billagondi hamlet	37 SHLS and 4 SSLS	37 SHLS and 2 SSLS were not working.
Assam			
SHLS	2009 to 2013	48	30 were not working. The beneficiaries in many cases were not aware of the person to be contacted and in 5 cases where AEDA had been informed, action was yet to be taken.
Arunachal Pradesh			
SSLS	East Siang 2007 and 2009	15	Two were not working and 13 were missing.
SSLS	2010 and 2011	25	Six were not working and six were missing. FIR lodged with police for the missing systems. No maintenance was carried out either by suppliers or by APEDA.
SHLS	11 villages 2005, 2006,2007, 2010 and 2012	163	87 were not working and 23 missing.
SHLS	Papumpare, East Siang and Tawang. 2012 and 2010	63 in Kimin village, 67 in Shyaro village and 79 in Debing village.	Though villages were electrified under RGGVY, SHLSs were still issued.
SL	Four villages 1999 and 2007	26	23 were not working.
Bihar			
SSLS	Ten districts.	519	353 were not working and 29 were not received.
SHLS	Ten districts.	65	21 were not working and eight were not received. Recipient's signatures were not on record in respect of 30 SHLS in Vaishali district during the year 2010-11.
SSLS	Six districts[1]	9	Four were not working.
Chhattisgarh			
SWP	2004-05 to 2012-13	69	32 were not working due to theft of modules and other reasons.

[1] East Champaran, Gaya, Nalanda (Bihar Sharif), Patna, Vaishali (Hazipur), West Champaran (Bettiah).

Type of System	Location and year of installation	Number of systems inspected	Audit observation
Gujarat			
SHLS	Dhirkhadi (Taluka-Nandod) 2003-04	92	26 were not working.
SHLS	Ajamapat Nes (Taluka-Ranavav) 2006-07	42	22 were not working.
Haryana			
SSLS	Villages in five selected districts(Kurukshetra, Hisar, Panipat, Jhajjar and Bhiwani) During 9th,10thand 11th Five Year Plans	256	201 were not working
SHLS	-do-	59	24 were not working
SL	-do-	44	37 were not working
SWP	Hisar district	1	Water discharge capacity was very low
Himachal Pradesh			
SHLS, SL and SSLS	Batal	18	All the 18 SSLSs were found to be not working.
SHLS, SL and SSLS	Chail	30	All the 30 SSLSs were found to be not working.
SHLS, SL and SSLS	Dumehar	15	All the 15 SSLSs were found to be not working.
SL	Chamba 1997-98 to 2010-11	109	All the 109 SSLSs were found to be not working.
Jharkhand			
SPP	Deoghar district August 2011	4	As per guidelines, generation should have been 90 *per cent* of its capacity. But it was only between 13 to 24 *per cent* of capacity in the plants.
Jammu & Kashmir			
SSLS	Four hospitals in Jammu November 2011	40	All the 40 were not working. Batteries and other accessories of all the 40 systems were missing and no action was taken.
SSLS	Budgam district November 2011	20	One was not working.
Maharashtra			
SHLS	Miraj, ZP Sangli 2006-07	20	Five were not in the premises where they were to be installed. For other 15, subsidy was not given to beneficiary and training for use and care of SHLSs and AMC was not provided, which was mandatory. Supplier recovered excess amount

Type of System	Location and year of installation	Number of systems inspected	Audit observation
			ranging from ₹ 4,269 to ₹ 13,619 from the beneficiaries.
SL	Vidarbha[2] 2008-09	47	42 were not working.
Odisha			
SHLS, SL and SSLS		73 SSLS, 51 SHLS and 88 SL	33 SSLS, 28 SHLS and 44 SL were not working.
SL	Khurda district[3] 2000-01	45	45 were not working.
Mizoram			
SHLS and SL		35	28 were not working.
SPP	2003	4	One was not working and other three were working at 50 *per cent* efficiency due to damage of batteries.
Nagaland			
SPP	Kohima	10	Four were not working and one was yet to be commissioned.
SWHS	Kohima and Pfiitsero Town	7	Three were not working.
Punjab			
SL	Four sites in four[4] districts.	24	17 were not working. Four were stated to have been gifted to friends/ relatives.
SHLS	Five sites in four districts.	27	22 were not working. Two were stated to have been gifted to relatives and one was missing.
SL	Nine sites in four districts.	476	163 were not working. Two were missing. In Gurdaspur, 46 non-working lights were connected to regular electric supply.
SWP	Four sites in five[5] districts.	15	15 were not working Solar Panels were used for charging regular electric invertors.
SPP	Six sites in three[6] districts.	6	Four were not working. Plant installed at important place like Wagha border was not working. Three plants at Primary school, Lehal and Kalanaur and at Bus stand, Kalanaur were rectified at the instance of Audit.
Rajasthan			
SSLS	Village Silora, District Ajmer 2009	90	All 90 were not working.

[2] Khamgaon, Lonar, and Buldhana in ZP Buldhana, Dhamangaon in ZP Amaravati and Ner, Yavatmal and Babulgaon in ZP Yavatmal

[3] Damanibara and Niladriprasad Gram Panchayat of Banpur Block.

[4] Gurdaspur, Tarn Taran, Patiala and Ludhiana.

[5] Gurdaspur, Ludhiana, Patiala, Tarn Taran and Amritsar.

[6] Gurdaspur, Patiala and Amritsar.

Type of System	Location and year of installation	Number of systems inspected	Audit observation
SWP		6	Two water pumps were being utilised in commercial activities (roadside hotel and manufacturing of cement structures) as against agricultural use mentioned in the scheme.
SHLS	Seven villages	20	Eight were not working.
Uttarakhand			
SSLS	NIVH[7], Dehradun 2006	68	46 were not working.
SSLS	RAPV[8] Hostel. 2006	2	One was not working.
SHLS	Maldevta, Dehradun	--	Not found at the locations mentioned in the list of beneficiaries.
SHLS	Tehri	--	Physical verification could not be done as UREDA officials did not co-operate
SL	2002-03 to 2014	554	100 were not working
SHLS	Gurjarbasti, Bahadrabad, Haridwar May 2007	39	All 39 were not working. Systems became obsolete because of lack of monitoring by UREDA.
SSLS	Jaiti Bazar, Almora district September 2008	15	All 15 were not working properly.
Total		**3,959**	**1,868 systems were not working properly and 50 systems were missing.**

Note: Solar Home Lighting System (SHLS), Solar Street Lighting System (SSLS), Solar Power Plant (SPP), Solar Lantern (SL) and Solar Water Pump (SWP).

[7] National Institute for Visually Handicap.
[8] Rajikya Ashram Padhati Vidhyalaya.

Annexure XIV
(Refer to para 2.2 in Chapter VIII)

State wise target, achievement and installed capacity of Biogas

S.No.	State/ Union Territories	Estimated potential (in lakh)	Estimate shown by State	Target fixed by State 2007-14	Achievement as per State 2007-14	Shortfall (in percentage) w.r.t target of 2007-14	Cumulative achievements as per MNRE (31.03.2014)	Achievement (in percentage) over potential
1.	Andhra Pradesh	10,65,000	10,65,000	1,21,300	94,237	22.31	5,21,764	48.99
2.	Arunachal Pradesh	7,500	NA	700	690	1.43	3,472	46.29
3.	Assam	3,07,000	Not assessed	42,000	40,013	4.73	1,08,302	35.28
4.	Bihar	7,33,000	Not assessed	1,305	805	38	1,29,825	17.71
5.	Chhattisgarh	4,00,000	NA	28,100	24,332	13.40	48,509	12.13
6.	Goa	8,000	Not selected				4,086	51.08
7.	Gujarat	5,54,000	Nil	55,500	35,832	35.44	4,28,676	77.38
8.	Haryana	3,00,000	1500-2000 per year	11,500	9,259	19.48	59,868	19.96
9.	Himachal Pradesh	1,25,000	Not assessed	1,951	1,863	4.51	47,255	37.80
10.	Jammu & Kashmir	1,28,000	KVIC[1]: Not assessed	575	437	12.84	3,033	2.37
			JAKEDA[2]: Not assessed	500	500			
11.	Jharkhand	1,00,000	Not assessed	5,000	1,683	66	7,237	7.24
12.	Karnataka	6,80,000	Nil	87,029	72,033	17.23	4,69,671	69.07
13.	Kerala	1,50,000	Not assessed	22,519	18,504	17.83	1,41,378	94.25
14.	Madhya Pradesh	14,91,000	Not fixed	82,000	68,990	15.86	3,45,808	23.19
15.	Maharashtra	8,97,000	Nil	1,05,100	1,04,523	0.55	8,56,436	95.48
16.	Manipur	38,000	Not selected				2,128	5.60
17.	Meghalaya	24,000	Not estimated	3,000	3,000	Nil	10,046	41.86
18.	Mizoram	5,000	--	2,400	1,165	51.46	4,770	95.40
19.	Nagaland	6,700	Not Assessed	3,750	3,371	10.11	7,653	114.22
20	Odisha	6,05,000	6,05,000	42,500	33,244	22	2,61,830	43.28

[1] Targets & Achievements for the year 2013-14 were not available with the Khadi and Village Industry Commission.

[2] Records for the period 2007-14 were not available due to winding up of Integrated Rural Energy Programme (IREP) in April 2011. MNRE had not sanctioned any biogas plant under the programme except the target of 500 plants during 2010-11.

S.No.	State/ Union Territories	Estimated potential (in lakh)	Estimate shown by State	Target fixed by State 2007-14	Achievement as per State 2007-14	Shortfall (in percentage) w.r.t target of 2007-14	Cumulative achievements as per MNRE (31.03.2014)	Achievement (in percentage) over potential
21	**Punjab**	4,11,000	Not assessed	75,700	67,323	11.08	1,64,295	39.97
22.	**Rajasthan**	9,15,000	Nil	2,183	2,089	4.31	69,393	7.58
23.	**Sikkim**	7,300	Not selected				8,744	119.78
24.	**Tamil Nadu**	6,15,000	NA	13,812	10,068	27	2,21,704	36.05
25.	**Tripura**	28,000	Not selected				3,328	11.89
26.	**Uttar Pradesh**	19,38,000	Nil	26,900	16,204	40	4,37,360	22.57
27.	**West Bengal**	6,95,000	Not assessed	74,000	32,805	44.33	3,66,333	52.71
28.	**A&N Islands**	2,200	Not selected				137	6.22
29.	**Chandigarh**	1,400	Not selected				97	6.93
30.	**Dadra & Nagar Haveli**	2,000	Not selected				169	8.45
31.	**Delhi**	12,900	Not selected				681	5.28
32.	**Puducherry**	4,300	Not selected				578	13.44
33.	**Uttarakhand**	83,000		3,700	3,206		17,534	21.13
	Total	**1,23,39,300**		**8,13,024**	**6,46,176**	**20.52**	**47,52,100**	**38.51**

Source: MNRE and State Nodal Agencies.

NA – Not Available.

Annexure XV
(Refer to para 4.3 in Chapter VIII)

Details of State wise physical verification of Biogas plants by Audit

Location	When installed	Number inspected	Audit observation
Andhra Pradesh			
Khammam and Warangal districts	NA	70	Audit observed that out of 70 plants inspected five were not working. The reasons for non-functioning of Biogas Plant were: damage of main gate wall, not feeding of cow dung regularly by the beneficiary
Arunachal Pradesh			
Papumpare, West Siang, Lower Subansiri, East Siang districts	1998-99, 2003, 2007, 2011 and 2013	25	Audit observed that out of 25 plants inspected 23 were not working (seven in West Siang, four in Papumpare, four in Lower Subansiri and eight in East Siang districts were not working. two plants in Papumpare were not working). Reason for not working were that beneficiaries lacked interest in operating the plants as alternate fuel i.e. LPG, was readily available. None of the plants had serial/ identification number on a metal strip.
Assam			
	NA	36	Audit observed that out of 36 plants inspected seven were not working. Of these, two were not working since installation and two were found defective.
Bihar			
Five districts[1]	NA	8	Audit observed that out of eight plants inspected one was not working.
Haryana			
6 sites/villages in 5 selected districts (Kurukshetra, Hisar, Panipat, Jhajjar and Bhiwani)	During 9th,10th and 11th Five Year Plans	56	Audit observed that out of 56 plants inspected, 41 were not functional.
Jharkhand			
Deoghar district	2005-06 and 2008-09	7	Audit observed that out of seven plants inspected, six were not working due to the reason of non-formation of gas.
Jammu & Kashmir			
	NA	9	Audit observed that out of nine plants inspected two were not working due to breakage in drum and one plant faced some problem in gas pipe. Complaint for rectification was reportedly not attended by the technician though repeatedly informed about the problem on telephone.

[1] Ara, Jehanabad, Nalanda (Bihar Sharif), Patna and Vaishali (Hazipur).

Location	When installed	Number inspected	Audit observation
Karnataka			
Udupi, Shimoga and Tumkur	NA	50	Audit observed that out of 50 plants inspected 11 were not working and the beneficiaries were using LPG and firewood for cooking purposes as the above plants were not functioning for the last two to three years.
Mizoram			
Aizwal	NA	10	Audit observed that out of 10 plants inspected three were not working, as their tanks were damaged due to rusting. Of these, two were installed in 1994 and one in 2008.
Madhya Pradesh			
	NA	75	All working.
Nagaland			
Phek and Mokokchung	NA	5	Audit observed that out of five plants inspected four were not working and one was not commissioned.
Punjab			
11 site in 5 districts.	NA	74	Audit observed that out of 74 plants inspected five were not working;the five beneficiaries were also using LPG cylinders
Uttar Pradesh			
Barabanki	2010-11	2	Audit observed that two plants inspected were not operated, as the *Dhaba* where they were installed had closed down.
Lodhaan village, Varanasi	NA	2	Audit observed that two plants inspected were not working due to the non-availability of raw material.
Total		**429**	**112 not working.**

Note – NA – Not Applicable.

Annexure XVI
(Refer to para 2.1 Chapter IX)

The State wise targets and achievements under Remote Village Electrification Programme for the period 2007-14

Sl No.	State	Number of villages/ hamlets verified by REC	Number of villages / hamlets sanctioned	Number of villages/ hamlets completed	Percentage of eligible hamlets/ villages covered	Percentage of target achieved	CFA released (in ₹ crore)
	(i)	(ii)	(iii)	(iv)	(iv) X 100/(ii)	(iv) X 100/(iii)	
1	Andhra Pradesh	112	13	13	12	100	0.31
2	Arunachal Pradesh	145	0	141	97	-	4.94
3	Assam	2,385	1,691	1,913	80	113	117.92
4	Bihar	80	NA	NA	NA	NA	NA
5	Chhattisgarh	1,621	314	243	15	77	16.21
6	Delhi	NA	NA	NA	NA	NA	0.25
7	Goa	0	19	19	-	100	0.10
8	Gujarat	49	0	0	Nil	-	0.35
9	Haryana	149	92	241	163	262	0.69
10	Himachal Pradesh	1	0	20	2,000	Nil	NA
11	Jammu & Kashmir	1,035	619	232	22	37	69.91
12	Jharkhand	832	251	206	25	82	44.25
13	Karnataka	173	59	30	17	51	1.26
14	Kerala	73	49	49	67	100	3.39
15	Madhya Pradesh	972	424	547	56	129	31.51
16	Maharashtra	362	82	230	64	280	22.20
17	Manipur	166	49	106	64	216	5.21
18	Meghalaya	158	66	124	78	188	2.30
19	Nagaland	11	8	8	73	100	0.83
20	Odisha	2,116	1,528	1,491	70	98	52.44
21	Sikkim	NA	NA	NA	NA	NA	0.08
22	Rajasthan	493	103	253	51	246	21.53
23	Tamil Nadu	130	32	30	23	94	0.67
24	Tripura	583	479	606	125	127	27.40

Sl No.	State	Number of villages/ hamlets verified by REC	Number of villages / hamlets sanctioned	Number of villages/ hamlets completed	Percentage of eligible hamlets/ villages covered	Percentage of target achieved	CFA released (in ₹ crore)
25	**Uttar Pradesh**	419	257	335	80	130	22.66
26	**Uttarakhand**	234	173	164	70	195	6.77
27	**West Bengal**	93	24	6	6	25	27.88
	Total	**12,392**	**6,332**	**7,007**	**57**		**481.06**

Source: MNRE.

Note: 1. Information was not available in respect of Bihar, Punjab and Mizoram.

2. Delhi, Goa, Manipur, Sikkim and Tripura were not part of audit scrutiny.

3. CFA – Central Financial Assistance, REC - Rural Electrification Corporation Limited.

Annexure XVII

(Refer to para 6 in Chapter IX)

Details of State wise physical verification of Remote Village Electrification systems by Audit

Type of System	Location	When Installed	Number inspected	Non-Functional	Reasons
Andhra Pradesh					
SHLS and SSLS	Suddakunta village	2008-09	284 SHLSs and 34 SSLSs	-	Out of five households electrified none was occupied, and one house holder was staying at Venkatadripalem village.
	Billagondi hamlet		37 SHLSs and 4 SSLSs	37 SHLSs and two SSLSs were not working	
Arunachal Pradesh					
Biomass Gasifier Power Plants	Rani and Balijan villages	2014	2 plants (328 beneficiaries)	2	Lack of interest from beneficiaries and availability of quality power supply from the local grid.
SHLS	Pusi Doke and Tabasora illages	2002-03 and 2005-06	132	-	122 were not available.
SHP	Panya	2009	1	1	Not working due to machinery defects.
SHLS	Taba Sora	2002-03 and 2005-06	73	63	After supply of electricity through local grid, APEDA did not monitor the functioning of systems.
	Pusi Doke		59	59	
Biomass Gasifier Power Plants		2004-2005	12 Villages (1,024 beneficiaries)	12	APEDA did not certify that hamlets/villages were un-electrified. However, these were covered under RGGVY. APEDA/State Govt. neither re-deployed the energy systems to other needy places nor connected the plants to local grid for continuous operation as per RVE Programme Guidelines. Expenditure of ₹ 87.14 lakh was rendered unfruitful.
Jharkhand					
SHLS	Jojogora, Potka, E. Singhbhum	Between November 2007 and August 2008	36	21	Not known.
			04	03	
	Papragaru, Potka, E. Singhbhum	Between November 2007 and August 2008	19	13	Not known.
			02	01	

Type of System	Location	When Installed	Number inspected	Non-Functional	Reasons
	Gamarkocha, Potka, E. Singhbhum	Between November 2007 and August 2008	13	05	Not known.
			01	Nil	
	Sirka, Angara, Ranchi	2003-04	286	13	Failure of battery.
			05	01	
	Bisha, Angara, Ranchi	2003-04	424	65	Failure of battery.
			06	06	
Kerala					
SHLS	Agali Gram Panchayat	Not Available	5	5	There were cases of lack of preventive maintenance. No arrangement was done to ensure functionality of systems after AMC.
Jammu & Kashmir					
SHLS	Five[1] villages of Poonch district.	Not Available	90	4	In 15 systems only one tube was working, in three systems only one tube was provided.
Maharashtra					
SPP (17.5 kW)	Ozarkhed village, district Nashik	March 2008	1	Not working since February 2013	Performance BG of ₹ 9.98 lakh was required to be forfeited, which was not done.
Madhya Pradesh					
SSLS	Salkanpur/ Sehore	December 2012	196	-	Poles damaged because of poor quality of GI pipes and delay in maintenance.
Odisha					
SHLS and SSLS	Jamudiha village of Keonjhar district	Not Available	925 SHLSs and 93 SSLSs.	177 SHLSs and 35 SSLSs	In 17 villages covering 909 households, 55 SHLSs and 6 SSLSs were missing. Defunct due to non-functioning of batteries.
Rajasthan					
SHLS	Five villages of Alwar district	Not Available	50	8	Supplier did not take care during AMC period. Beneficiaries repaired the systems on their own or got it repaired from the open market. Proper training for handling of systems was not given to the beneficiaries. Beneficiaries were not aware of the AMC and did not know the

[1] Ghani, Nangali, Bandi Chechian, Qusba and Khandi.

Type of System	Location	When Installed	Number inspected	Non-Functional	Reasons
					contact numbers of representative of the AMC providers. Under RVE, home lighting systems of only 37 watt was provided which was not sufficient according to the beneficiaries as informed during the physical verification.
Uttarakhand					
SHLS	Saibhar, Munsyar, Pithoragarh	Not Available	63	39	There were cases of non working of batteries. Further, beneficiary charges were not collected and proper training was also not given to beneficiaries.
West Bengal					
SHLS		Not Available	13	12	Due to non-maintenance and poor monitoring by WBREDA.
Total			**2,870**	**585**	**183 systems missing.**

Note - Solar Home Lighting System (SHLS), Solar Street Lighting System (SSLS), Solar Power Plant (SPP), Solar Lantern (SL) and Solar Water Pump (SWP).

Annexure XVIII
(Refer to para 2.6 Chapter XII)

Solar Photovoltaic Division

Fabrication of CU (In Ga) Se-2/Cds thin film solar cells on large area glass and flexible substrate using sputtering selenization technique

The project was sanctioned (May 2009) to Kalinga Institute of Industrial Technology University, Bhubaneswar with a financial outlay of ₹ 57.07 lakh and expenditure of ₹ 56.85 lakh was incurred. The project proposal envisaged filing of patents and publication of research papers. However, no patent was filed and no research paper was published in any Indian/foreign journals as an outcome of this project.

There was delay of nine months in completion of project. Project completion report (PCR) was not evaluated by the Ministry's scientists or external experts. In the absence of proper evaluation of PCR by the experts, it could not be concluded that the objectives of the project were achieved. Further, the project was not monitored by experts/Institutions as stipulated in the sanction. MNRE stated (May 2015) that constraints like manpower and infrastructural facilities led to the deficiencies.

Novel Doped 3-D Nanoporous oxides for Dye-Sensitized Solar Cells

The project was sanctioned (March 2009) to Indian Institute of Petroleum, Dehradun with a financial outlay of ₹ 38 lakh and expenditure of ₹ 25.30 lakh was incurred. The progress of the project was not reviewed after September 2012. PCR had still not been submitted (July 2015).

The project proposal envisaged filing of patents and publication of research papers. However, no patent was filed and no research paper published in any Indian/foreign journals as an outcome of this project.

Development of an improved electrical-optical model for the simulation of Hetero junction with Intrinsic Thin Layer (HIT) Solar Cells

The project was sanctioned (February 2011) to Indian Association for Cultivation of Science, Kolkata with a financial outlay of ₹ 25.30 lakh and expenditure of ₹ 5.18 lakh was incurred. The project scheduled to be completed by February 2013 was still ongoing. The project was last reviewed by Project Monitoring Committee in September 2012. Thereafter, the progress of the project was not reviewed. No efforts were made by the Ministry for early completion of the project. Quarterly reports mandated by the sanction were not received in timely manner. MNRE stated (May 2015) that Project Investigator had not responded even after many reminders.

Exploitation of Unique Properties of Quantum Dots for Efficient Energy Harvesting in Solar Cells

The project was sanctioned (May 2011) to Center for Emerging Technology, Jain University, Bangalore with a financial outlay of ₹ 37.16 lakh and expenditure of ₹ 25.34 lakh was incurred. The project scheduled to be completed by May 2014 was still ongoing. No efforts were made by the MNRE for early completion of the project. Quarterly monitoring

mandated by the sanction was not done. MNRE stated (May 2015) that extension of the project would be considered in next RDD&D Sectoral Project Appraisal Committee meeting.

Design and Development of Organic Solar Cell Sub-Modules

The project was sanctioned (March 2011) to Indian Institute of Technology, Kanpur with a financial outlay of ₹ 18.05 crore and expenditure of ₹ 4.64 crore was incurred. The project scheduled to be completed by March 2014 was granted extension upto March 2015 without proper justification. The progress of the project was not reviewed by the experts on the quarterly basis as mandated by the sanction. As per sanction, a minimum of 10 research papers and 10 patents were the likely outcome of the project. However, none was found on record as of September 2014. MNRE stated (May 2015) that the project has further been extended upto September 2015.

Solar Thermal Division

Development of testing of 3TR liquid desiccant based solar multi-utility heat pump

The project was sanctioned (September 2008) to Indian Institute of Technology, Mumbai with a financial outlay of ₹ 61.98 lakh and expenditure of ₹ 47.90 lakh was incurred. MNRE sanctioned this project with specific deliverable objectives in terms of output and were to extent of setting the target commercial cost of the unit between ₹ 2.75 lakh to ₹ 3.25 lakh. The project was to be completed in September 2011 and final PCR including the field test report was to be submitted by August 2011. IIT Mumbai also assured of first phase of commercialization to start by June/July 2012 with help of the industry partner M/s Mech World Echo, Nashik. A total of ₹ 48.85 lakh was released by MNRE. In February 2012, MNRE requested Project Investigator (PI) to submit final PCR as committed. The final PCR had not yet been received (May 2015). Further, field testing data about the deliverable objectives and proposed commercialization had not taken place for reasons not on record. In absence of receipt of final PCR and its vetting by independent expert it could not be assured that the project objectives were achieved. The details of monitoring exercise by MNRE on the project were not available on record.

MNRE stated (May 2015) that field data takes some time and accounts of the project are yet to be settled.

Development and demonstration of automatic two axis tracking paraboloid Solar Thermal concentrator

The project was sanctioned (September 2011) to M/s Clique Developments Limited, Mumbai with a financial outlay of ₹ 55.83 lakh and expenditure of ₹ 51.53 lakh was incurred. The project scheduled to be completed by September 2012 was still ongoing beyond the scheduled date of completion (May 2015). No efforts were made by the Ministry for early completion of the project. The project proposal envisaged filing of patents. However, no patent was filed.

Integrating and Hybridizing a-2 Axis tracking Parabolic Dish Based concentrated Solar Thermal with Bio-mass based Thermic Fluid Heating System in a process industry

The project was sanctioned (May 2013) to M/s Megawatt Solutions Private Limited, Noida with a financial outlay of ₹ 1.64 crore and expenditure of ₹ 95.72 lakh was incurred. The project scheduled to be completed by August 2014 was still ongoing beyond the scheduled date of completion. No efforts were made by the Ministry for early completion of the project. MNRE stated (May 2015) that performance monitoring of the project is yet to commence.

Hydrogen Energy and Fuel Cell Division

Lean limit extension for spark ignited direct injection engine through on board Non-Thermal Plasma conversion

The project was sanctioned (February 2010) to Annamalai University, Tamil Nadu with a financial outlay of ₹ 39.25 lakh and expenditure of ₹ 29.32 lakh was incurred. The project scheduled to be completed by February 2013, was still not completed (October 2014) even after grant of extension upto 31 December 2013. The audited UCs were still awaited. The project envisaged transfer of technology developed. However, no technology was transferred under this project. MNRE stated (July 2015) that PCR has now been accepted by Project Monitoring Committee in its meeting held on November 2014.

Use of Hydrogen (upto 30 *per cent*) as fuel blended with compressed natural gas in internal combustion engine

The project was sanctioned (September 2007) to Society of Indian Automobile Manufacturers, New Delhi with a financial outlay of ₹ 6.34 crore and expenditure of ₹ 5.10 crore was incurred. The project scheduled to be completed by September 2009 was still not complete. A sum of ₹ 1.94 crore was released by the Ministry on this project. The project was granted extension upto December 2013. The progress of the project was last reviewed in June 2013 and the project was not reviewed thereafter by the Ministry. The audited UCs were awaited in the Ministry. The project proposal envisaged transfer of technology developed under the project and filing of patent. However, no technology was transferred under this project and no patent filed. MNRE stated (July 2015) that PCR has now been accepted by Project Monitoring Committee in its meeting held on November 2014.

Design and development of Hydrogen Gas Burner for Industrial Application

The project was sanctioned (February 2010) to Indian Institute of Technology, Kanpur with a financial outlay of ₹ 23.90 lakh and expenditure of ₹ 21.55 lakh was incurred. The project scheduled to be completed by February 2013 was completed in November 2013 after a delay of nine months. PCR submitted in November 2013 was not evaluated by external experts. Further, in the project proposal, industry participation was proposed. However, this was not visible in the project.

Development of the prototype photo reactor for the hydrogen production from hydrogen sulphide under natural sun light

The project was sanctioned (December 2011) to Centre for Materials for Electronics Technologies, Pune with a financial outlay of ₹ 22.40 lakh and expenditure of ₹ 22.40 lakh was incurred. The project scheduled to be completed by December 2013 was granted extension upto July 2014 and further upto July 2015 without justification.

Theoretical Investigation on likely to be favorable factors of helical Carbon Nanotubes for Enhanced Hydrogen absorption

The project was sanctioned (February 2008) to Thiagarajar College of Engineering, Madurai with a financial outlay of ₹ 24.72 lakh and expenditure of ₹ 24.24 lakh was incurred. The project scheduled to be completed by August 2009 was completed in October 2010 after a delay of 14 months. PCR was submitted in October 2010 was not evaluated by external experts.

CNT Doped Polymeric Membranes for Hydrogen Purification

The project was sanctioned (February 2008) to University of Rajasthan, Jaipur with a financial outlay of ₹ 30 lakh and expenditure of ₹ 27.25 lakh was incurred. PCR was not evaluated by the external experts.

Numerical and Experimental Analysis for the development of a metal Hydride based Hydrogen Energy Storage device

The project was sanctioned (August 2008) to Indian Institute of Technology, Guwahati with a financial outlay of ₹ 33.45 lakh and expenditure of ₹ 26.31 lakh was incurred. The project scheduled to be completed by August 2011 was competed in August 2012 after a delay of one year. The PCR submitted in August 2012 was not evaluated by external experts. The project proposal envisaged transfer of technology and filing of patents. However, no patent was filed as an outcome of the project, nor was there transfer of technology.

Generation of Hydrogen from bio-mass derived glycerol

The project was sanctioned (February 2008) to Indian Institute of Chemical Technology, Hyderabad with a financial outlay of ₹ 46.43 lakh and expenditure of ₹ 46.43 lakh was incurred. The project scheduled to be completed by February 2010 was competed in March 2011 after a delay of more than one year. The project was extended upto August 2010 and further upto February 2011 without any justification. The PCR submitted in March 2011 was not evaluated by external experts. Further, project proposal envisaged filing of patents and publication of research papers. However, no patent was filed and no research paper was published in any Indian/Foreign journals.

Survey on inventory and quality of by product Hydrogen potential in selected major sectors in India

The project was sanctioned (February 2008) to University of Petroleum and Energy Studies, New Delhi with a financial outlay of ₹ 15.27 lakh and expenditure of ₹ 17.56 lakh (which included ₹ 2.29 lakh contributed by the University) was incurred. The project scheduled to be completed by November 2008 was completed in January 2010 after a delay of 14 months. Progress of the project was not reviewed by the Ministry's committee and PCR was not evaluated by external experts.

Non-thermal Plasma Assisted Direct Decomposition of Hydrogen Sulphide into Hydrogen and Sulphur

The project was sanctioned (February 2009) to National Institute of Technology, Tamil Nadu with a financial outlay of ₹ 31.48 lakh and expenditure of ₹ 25.78 lakh was incurred. The project scheduled to be completed by February 2012 was completed in February 2013 after a delay of one year. The PCR was not evaluated by external experts. The project proposal envisaged transfer of technology and filing of patents. However, no patent was filed as an outcome of the project, nor was there transfer of technology.

Synthesis of Magnesium based Hydrogen Storage Alloys with Lower Absorption Temperatures

The project was sanctioned (July 2010) to Non-Ferrous Materials Technology Development Centre, Hyderabad with a financial outlay of ₹ 82.66 lakh and expenditure of ₹ 82.66 lakh was incurred. The project scheduled to be completed by July 2013 was still ongoing (October 2014) even after extension upto March 2014. No efforts were made by the Ministry for early completion of project even after release of ₹ 82.66 lakh on the project. MNRE stated (July 2015) that PCR has now been accepted by Project Monitoring Committee in its meeting held on September 2014.

Development of Transition Metal tantalates and oxynitrides for water splitting and pollution abatement

The project was sanctioned (February 2008) to Institute of Minerals and Materials Technology, Bhubaneswar with a financial outlay of ₹ 35.54 lakh and expenditure of ₹ 32.54 lakh was incurred. The project scheduled to be completed by February 2011 was competed in May 2012. The project proposal envisaged filing of patents, however, no patent was filed. The PCR was not evaluated by external experts.

Development of Semiconductor Nano-Composites for photo catalytic water splitting into hydrogen and oxygen under solar light irradiation

The project was sanctioned (January 2011) to Indian Institute of Chemical Technology, Hyderabad with a financial outlay of ₹ 59.66 lakh and expenditure of ₹ 49.58 lakh was incurred. The cost of the project was revised from ₹ 47.86 lakh to ₹ 59.66 lakh due to increase in cost of equipment without proper justification. The project scheduled to be completed by January 2014 was still ongoing. MNRE stated (July 2015) that PCR has now been received and would be placed for consideration by Project Monitoring Committee.

Establishment of Hydrogen Production and Utilization facility through Photovoltaic-Electrolyser system

The project was sanctioned (February 2011) to University of Petroleum and Energy Studies, New Delhi with a financial outlay of ₹ 14.02 crore and expenditure of ₹ 7.20 crore was incurred. The cost of the project was revised from ₹ 11.15 crore to ₹ 14.02 crore due to addition of items viz equipment and civil work. The project scheduled to be completed by February 2014 was still ongoing even after extension upto October 2014. No efforts were

made by the Ministry for early completion of project. MNRE stated (July 2015) that it was the first project of its kind implemented in the country and therefore took more time in its implementation than originally envisaged.

Hydrogen Storage Properties of complex hydrides

The project was sanctioned (February 2008) to Indian Institute of Technology, Mumbai with a financial outlay of ₹ 40.48 lakh and expenditure of ₹ 40.48 lakh was incurred. The cost of the project was revised from ₹ 36.00 lakh to ₹ 40.48 lakh due to revision in cost of manpower without any justification. The project scheduled to be completed by February 2011 was completed in March 2012 after a delay of more than one year. The project proposal envisaged transfer of technology. However, no technology was transferred after completion of the project. The PCR submitted in March 2012 was not evaluated by external experts.

Design and development of functional hybrid nano structures for photo electro-chemical water splitting

The project was sanctioned (May 2010) to Institute of Minerals and Materials Technology, Bhubaneswar with a financial outlay of ₹ 55.09 lakh and expenditure of ₹ 52.96 lakh was incurred. The project scheduled to be completed by May 2013 was completed in February 2014 after a delay of nine months. The PCR submitted in May 2014 was not evaluated by external experts. Further, project proposal envisaged filing of patents. However, no patent was filed as an outcome of the project.

Development of Methanol Electrolyser

The project was sanctioned (February 2008) to Southern Petrochemicals Industries Corporation Science Foundation with a financial outlay of ₹ 25.02 lakh and expenditure of ₹ 22.02 lakh was incurred. The project scheduled to be completed by February 2009 was completed in May 2009 after a delay of three months. PCR was not evaluated by external experts. The project proposal envisaged filing of patents and publication of research papers. However, no patent was filed and no research paper was published in any Indian/foreign journals as an outcome of this project.

Bio Fuel Division

Design development and evaluation of pilot scale ethanol production from cassava starch

The project was sanctioned (September 2008) to Tamil Nadu Agriculture University with a financial outlay of ₹ 35 lakh and expenditure of ₹ 30.45 lakh was incurred. A third party monitoring mechanism was to be introduced and a provision of two *per cent* of project cost (capped at ₹ 10 lakh) was also made. It was observed that though PI kept sending regular progress reports but neither an expert committee was identified for monitoring as per guidelines nor the project was ever monitored or visited by MNRE scientists as mandated by the sanction.

Project proposal envisaged participation of two industries for help in establishing/ demonstration of the pilot plant and to popularize the technology for wider adoption. Further, transfer of technology to entrepreneur/ line departments was proposed. From the record, it could not be ascertained whether the technology was actually transferred as proposed. Further, contribution of participating industries to popularize the pilot plant could not be substantiated. MNRE stated (May 2015) that involvement of industry was not mandatory and was optional only. Reply contradicts the MNRE's broader vision of including industry participation, wherever possible.

Demonstration of Modular Pyrolysis Unit to produce Bio Oil from Agro-Industrial Biomass Wastes and Methodology for Analysis, Use and Upgradation of Bio Oil

The project was sanctioned (October 2010) to The Energy and Resources Institute, New Delhi with a financial outlay of ₹ 1.70 crore and MNRE has released ₹ 1.55 crore. As per RDD&D guidelines of MNRE, for all project proposal with cost exceeding ₹ one crore, an expert committee would be deputed to have on the spot assessment of capabilities and capacity of project team and available technical and administrative setup at the Institution and submit a report to the Ministry. However, no such committee was constituted.

Project sanction mandated an expert committee for monitoring the progress at half yearly intervals. Though annual progress reports were received from Project Investigator (PI), MNRE did not constitute/monitor the progress at mandated half yearly intervals. Indian Oil Corporation Limited was stated to be a 'partner in kind' for the project for analytical activities for characterization, use and upgradation of bio oil. The project completion report indicated non availability/susceptibility of Indian industry to test the oil in combustion applications and as transport fuel. In light of this bottleneck, contribution of IOCL towards the project could not be ascertained and industry participation in the project remained merely on paper.

Design and development of dual operating pilot scale bio-reactor system for comparative simulations studies on algal cultivation

Project was sanctioned (September 2011) to M/s Abellon Clean Energy Limited, Gujarat, with a financial outlay of ₹ 21.38 lakh, after receiving comments from three subject experts. Comments of one expert required modification of the proposal and response to the comments were received from the PI in June 2011. Such response should have been forwarded to the concerned expert and revised acceptance obtained. However, the same was not available on record.

In midterm monitoring report of 30 July 2012, it was indicated that the reactor was defective in designing and modifications were suggested for implementation. The project was completed in October 2012 and second installment of ₹ 4.30 lakh was released in December 2012. MNRE after accepting the project completion report and releasing ₹ 9.30 lakh, intimated the adverse comments in system design to PI in May 2013, which was procedurally incorrect.

Bio Energy Division

Addressing Novel Applications of Current Generation Using Micro Organisms

The project was sanctioned (February 2008) to Central Electrochemical Research Institute, Tamil Nadu with a financial outlay of ₹ 24.69 lakh and expenditure of ₹ 26.03 lakh (which included ₹ 1.32 lakh contributed by the Institute) was incurred. The project scheduled to be completed by February 2011 was completed in September 2011 after a delay of seven months. PCR was submitted in April 2012. Progress of the project was not monitored by any committee of experts. Further, project proposal envisaged filing of patents. However, no patent was filed as an outcome of the project.

State of the Art Review of Global Research and Development in Polygeneration Facilities for the production of Liquid Fuels & Chemicals for Cogeneration of Power

The project was sanctioned (December 2007) to Indian Institute of Technology, Mumbai with a financial outlay of ₹ 1.50 lakh and expenditure of ₹ 0.75 lakh was incurred. There was delay of three years in submission of PCR by PI. The project was completed in June 2008 and PCR was submitted in June 2011. Progress of the project was not monitored by any committee of experts.

Biogas Refrigerator for Urban, Semi Urban and Rural Area Applications

The project was sanctioned (August 2008) to Annamalai University, Tamil Nadu with a financial outlay of ₹ 11 lakh and expenditure of ₹ 2.50 lakh was incurred. The project was not completed as the participating industry failed to fabricate the refrigerator system as per design mentioned in the project proposal. The progress report submitted upto February 2009 was accepted as final report. The project was abandoned midway without achieving the objectives. The expenditure of ₹ 2.50 lakh incurred by the MNRE remained unfruitful.

High Efficiency Biogas Gensets

The project was sanctioned (September 2008) to Indian Institute of Science, Bangalore with a financial outlay of ₹ 33 lakh and expenditure of ₹ 26.53 lakh was incurred. There was delay of eight months in submission of PCR by PI. The project was completed in September 2011 and PCR was submitted in June 2012. The project proposal envisaged filing of patents. However, no patent was filed as an outcome of this project.

Development of Household Wastes and Sanitation Device with biogas recovery

The project was sanctioned (September 2008) to National Institute for Interdisciplinary Science and Technology, Kerala with a financial outlay of ₹ 19.89 lakh and expenditure of ₹ 24.89 lakh (which included ₹ five lakh contributed by the Institute) was incurred. The project, scheduled to be completed by September 2010, was completed in December 2012 after a delay of more than two years. Progress of the project was not monitored by any committee of experts. The project proposal envisaged filing of patents. However, no patent was filed as an outcome of this project. Further, the modular household wastes sanitation device with biogas recovery system, which was one of the objectives was not developed.

Comparative Evaluation of Performance and Mass Emissions of an Automotive Passenger Vehicle fuelled with the Enriched Biogas using Field Trial Tests

The project was sanctioned (March 2011) to Indian Institute of Technology, Delhi with a financial outlay of ₹ 18.09 lakh and expenditure of ₹ 11.71 lakh was incurred. The project scheduled to be completed by March 2013 was completed in July 2013 after a delay of more than four months. There was further delay of one year in submission of PCR. The PCR was submitted in June 2014. The comments of experts on PCR were awaited. The Ministry did not pursue the matter in this regard with the experts.

Biogas Slurry Handling and Biomanure Management

The project was sanctioned (March 2011) to Indian Institute of Technology, Delhi with a financial outlay of ₹ 16.91 lakh and expenditure of ₹ 8.45 lakh was incurred. The project scheduled to be completed by March 2013 was completed in December 2013 after a delay of more than nine months. Progress of the project was not monitored by any committee of experts. The project proposal envisaged filing of patents. However, no patent was filed as an outcome of this project.

Development of Humic Acids Extraction Lab Scale Plant for Biogas Spent Slurry and its dissemination for Industrial Application

The project was sanctioned (November 2011) to Maharana Pratap University of Agriculture and Technology, Rajasthan with a financial outlay of ₹ 55.55 lakh and expenditure of ₹ 27.83 lakh was incurred. The project proposal envisaged filing of patents and publication of research papers. However, no patent was filed and no research paper was published in any Indian/Foreign journals as an outcome of this project.

Development of integrated ultrasonically aided biomethanation plant

The project was sanctioned (February 2008) to Institute of Minerals and Material Technology, Bhubaneswar with a financial outlay of ₹ 33 lakh and expenditure of ₹ 12.50 lakh was incurred. The project scheduled to be completed by August 2010 was completed in October 2012 after a delay of more than two years. Progress of the project was not monitored by any committee of experts.

Development of a Thermophillic Biodigester for Decentralized Treatment of Organic Wastes

The project was sanctioned (October 2008) to The Energy and Resources Institute, New Delhi with a financial outlay of ₹ 14.73 lakh and expenditure of ₹ 9.53 lakh was incurred. The project scheduled to be completed by October 2010 was completed in January 2011 after a delay of more than three months. Progress of the project was not monitored by any committee of experts. The project proposal envisaged publication of research papers. However, no research paper was published in any Indian/Foreign journals as an outcome of this project.

Wind Division

Experimental Characteristics of Wind Turbine Blading

The project was sanctioned (July 2010) to Park College of Engineering and Technology, Tamil Nadu with a financial outlay of ₹ 15.80 lakh and expenditure of ₹ 9.30 lakh was incurred. Project scheduled to be completed by June 2012, was completed in May 2014, after a delay of 23 months. UCs for ₹ 7.75 lakh were not submitted. Industries were not involved in the project. PCR was not evaluated by external experts.

Everybody's battery charger

The project was sanctioned (June 2009) to RMK Engineering College, Tamil Nadu with a financial outlay of ₹ 5.10 lakh and expenditure of ₹ 1.62 lakh was incurred. Project scheduled to be completed by December 2010, was completed in December 2013, after a delay of three years. Industries were not involved in the project. PCR was not evaluated by external experts.

Wind Energy Centre at Amrita University, Coimbatore to conduct Diploma Course

The project was sanctioned (August 2010) to Amrita Viswa Vidya Peetham, Tamil Nadu with a financial outlay of ₹ 1.53 crore and expenditure of ₹ 93 lakh was incurred. Project scheduled to be completed by August 2013, was discontinued midway in March 2013 after incurring expenditure of ₹ 93 lakh. UCs for ₹ 17.01 lakh were not submitted.

Health/conditions maintaining at experimental Wind farms

The project was sanctioned (June 2010) to Centre for Wind Energy Technology, Tamil Nadu with a financial outlay of ₹ 40.89 lakh. Project was to be completed in two phases. First phase of Project scheduled to be completed by June 2011, was still not completed as of March 2014 even after expenditure of ₹ 36.22 lakh was incurred. Industries were not involved in the project and PCR was not submitted.

Capacity Building in Wind Mill Sector for conducting Certificate and Diploma Course

The project was sanctioned (August 2010) to PSG College of Technology, Tamil Nadu with a financial outlay of ₹ 1.67 crore. Project scheduled to be completed by August 2013, was discontinued midway in March-2013 after expenditure of ₹ 55.66 lakh was incurred. UCs for ₹ 6.22 lakh were not submitted, Industries were not involved in the project and PCR was not submitted.

Power quality issues in Grid connected Wind farms

The project was sanctioned (July 2009) to RMK Engineering College, Tamil Nadu with a financial outlay of ₹ 37.38 lakh. Project scheduled to be completed by June 2012, was completed in December 2013, after a delay of 18 months. UCs for ₹ 10.34 lakh were not submitted by the implementing agency. Industries were not involved in the project. PCR was not evaluated by external experts.

Power evacuations studies for Grid Integrated Wind Energy conversion system

The project was sanctioned (June 2009) to Anna University, Tamil Nadu with a financial outlay of ₹ 16 lakh and expenditure of ₹ 11.86 lakh was incurred. Project scheduled to be completed by December 2011, was completed in November 2013, after a delay of 23 months. UCs for ₹ 5.53 lakh were not submitted. Industries were not involved in the project nor was the PCR evaluated by external experts.

Abbreviations		
1.	AD	Accelerated Depreciation
2.	AEDA	Assam Energy Development Agency
3.	ANERT	Agency for Non-conventional Energy and Rural Technologies (Kerala)
4.	APEDA	Arunachal Pradesh Energy Development Agency
5.	AMC	Annual Maintenance Contract
6.	BPL	Below Poverty Line
7.	BREDA	Bihar Renewable Energy Development Agency
8.	BSPHCL	Bihar State Power Holding Corporation Limited
9.	CDM	Clean Development Mechanism
10.	CEA	Central Electricity Authority
11.	CER	Certified Emission Reduction
12.	CERC	Central Electricity Regulatory Commission
13.	CFA	Central Financial Assistance
14.	CFL	Compact Fluorescent Lamp
15.	CoP	Conference of Parties
16.	CREDA	Chhattisgarh Renewable Energy Development Agency
17.	CUF	Capacity Utilization Factor
18.	C-WET	Centre for Wind Energy Technology
19.	DDC	Deputy Development Commissioner
20.	DGS&D	Directorate General of Supplies and Disposals
21.	DHPD	Department of Hydro Power Development
22.	DNRE	Department of New and Renewable Energy (Nagaland)
23.	DPR	Detailed Project Report
24.	EA 2003	Electricity Act 2003
25.	EPC	Engineering, Procurement and Construction
26.	ESCOM	Electricity Supply Company
27.	FI	Financial Institution
28.	FoR	Forum of Regulators
29.	FYP	Five Year Plan
30.	GBI	Generation Based Incentive
31.	GEDA	Gujarat Energy Development Agency
32.	GERC	Gujarat Energy Regulatory Commission
33.	GFR	General Financial Rules
34.	GHG	Green House Gas
35.	GRIDCO	Grid Corporation of Odisha Limited
36.	GoI	Government of India
37.	GW	Giga Watt
38.	HAREDA	Haryana Renewable Energy Development Agency
39.	Himurja	Himachal Pradesh Energy Development Agency
40.	HPSEB	Himachal Pradesh State Electricity Board
41.	IA	Implementation Agreement
42.	IIT	Indian Institute of Technology

Abbreviations		
43.	IPP	Independent Power Producer
44.	IREDA	Indian Renewable Energy Development Agency
45.	JAKEDA	Jammu & Kashmir Energy Development Agency
46.	JNNSM	Jawaharlal Nehru National Solar Mission
47.	JREDA	Jharkhand Renewable Energy Development Agency
48.	KL	Kilo Litre
49.	KREDA	Kargil Renewable Energy Development Agency
50.	KREDL	Karnataka Renewable Energy Development Limited
51.	KSEB	Karnataka State Electricity Board
52.	kW	Kilo Watt
53.	LAHDC	Ladakh Autonomous Hill Development Council
54.	LC	Letter of Credit
55.	LED	Light Emitting Diode
56.	LoA	Letter of Acceptance
57.	LPD	Litre per day
58.	LPG	Liquified Petroleum Gas
59.	LREDA	Ladakh Renewable Energy Development Agency
60.	LREI	Ladakh Renewable Energy Initiative
61.	LTA	Long Term Access
62.	MEDA	Maharashtra Energy Development Agency
63.	MERC	Maharashtra Energy Regulatory Commission
64.	MSEB	Maharashtra State Electricity Board
65.	MHP	Mini Hydel Power
66.	MNRE	Ministry of New and Renewable Energy
67.	MNREDA	Meghalaya Non-Conventional and Rural Energy Development Agency
68.	MoEF	Ministry of Environment and Forests
69.	MoP	Ministry of Power
70.	MoU	Memorandum of Understanding
71.	MPUVNL	Madhya Pradesh Urja Vikas Nigam Limited
72.	MSEDCL	Maharashtra State Electricity Distribution Company Limited
73.	MSETCL	Maharashtra State Electricity Transmission Company Limited
74.	MW	Mega Watt
75.	NABARD	National Bank for Agriculture and Rural Development
76.	NAPCC	National Action Plan on Climate Change
77.	NBMMP	National Biogas and Manure Management Programme
78.	NIT	National Institute of Technology
79.	NREDCAP	New and Renewable Energy Development Corporation of Andhra Pradesh Limited
80.	NGO	Non Governmental Organisation
81.	NISE	National Institute of Solar Energy
82.	NIWE	National Institute of Wind Energy
83.	NLDC	National Load Dispatch Centre

Abbreviations		
84.	NVVN	NTPC Vidyut Vyapar Nigam Limited
85.	OREDA	Odisha Renewable Energy Development Agency
86.	PAC	Project Appraisal Committee
87.	PEDA	Punjab Energy Development Agency
88.	PCR	Project Completion Report
89.	PGCIL	Power Grid Corporation of India Limited
90.	PI	Project Investigator
91.	PLF	Plant Load Factor
92.	POSOCO	Power System Operation Corporation Limited
93.	PPA	Power Purchase Agreement
94.	PSA	Power Sale Agreement
95.	PSPCL	Punjab State Power Corporation Limited
96.	RDD&D	Research, Design, Development and Demonstration
97.	RE	Renewable Energy
98.	REC	Renewable Energy Certificate
99.	REC	Rural Electrification Corporation Limited
100.	RED	Renewable Energy Department
101.	RGGVY	Rajiv Gandhi Grameen Vidyutikaran Yojana
102.	RPO	Renewable Purchase Obligation
103.	RPSSGP	Rooftop Photovoltaic and Small Solar Power Generation Plants
104.	RRECL	Rajasthan Renewable Energy Corporation Limited
105.	RVE	Remote Village Electrification
106.	SADP	Special Area Demonstration Programme
107.	SEB	State Electricity Board
108.	SEC	Solar Energy Centre
109.	SERC	State Electricity Regulatory Commission
110.	SHP	Small Hydro Power
111.	SLEC	State Level Empowered Committee
112.	SNA	State Nodal Agency
113.	SND	State Nodal Department
114.	SoE	Statement of Expenditure
115.	SHLS	Solar Home Lighting System
116.	SL	Solar Lantern
117.	SPP	Solar Power Plant
118.	SSLS	Solar Street Lighting System
119.	SWHS	Solar Water Heating System
120.	SWP	Solar Water Pump
121.	SPD	Solar Power Developer
122.	SPSA	Solar Payment Security Account
123.	SPV	Solar Photovoltaic
124.	SRRA	Solar Radiation Resource Assessment
125.	SSS-NIRE	Sardar Swaran Singh National Institute of Renewable Energy

Abbreviations		
126.	ST	Solar Thermal
127.	TANGEDCO	Tamil Nadu Generation and Distribution Corporation Limited
128.	TANTRANSCO	Tamil Nadu Transmission Corporation Limited
129.	TEDA	Tamil Nadu Energy Development Agency
130.	TNERC	Tamil Nadu Energy Regulatory Commission
131.	UC	Utilisation Certificate
132.	UJVNL	Uttarakhand Jal Vidyut Nigam Limited
133.	UNFCCC	United Nations Framework Convention on Climate Change
134.	UPNEDA	Uttar Pradesh New and Renewable Energy Development Agency
135.	UREDA	Uttarakhand Renewable Energy Development Agency
136.	VEC	Village Energy Committee
137.	WBGEDCL	West Bengal Green Energy Development Corporation Limited
138.	WBREDA	West Bengal Renewable Energy Development Agency
139.	WMS	Wind Monitoring Station
140.	WRA	Wind Resource Assessment
141.	ZEDA	Zoram Energy Development Agency (Mizoram)