

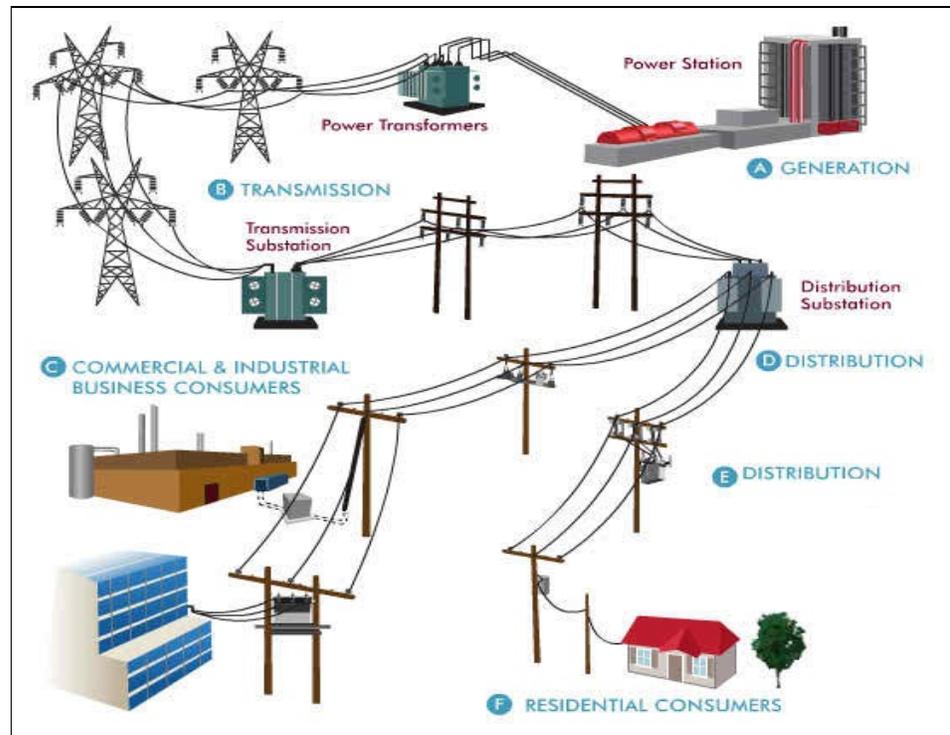
Chapter I

Introduction

1.1 The Uttar Pradesh Power Corporation Limited (Company) was created following the unbundling of the Uttar Pradesh State Electricity Board (UPSEB) under the First Reforms Transfer Scheme (January 2000), for discharging the function of distribution of electricity within the State. The Company was further unbundled¹ in 2003 into four² new distribution companies (DISCOMs). The Company, however, continues to be the holding Company for all the DISCOMs in the State and manages centralised IT-based revenue billing systems.

The process flow of electricity distribution from generation to distribution is depicted in **Chart 1.1**:

Chart 1.1: Flow chart of electricity distribution system



Source: Information provided by the Company

About the IT-based revenue billing systems

1.2 The Company has two IT-based revenue billing systems viz. Energy Distribution and Service Management System (EDSMS) implemented³ (June 2015) under Re-structured Accelerated Power Development and

¹ Uttar Pradesh Transfer of Distribution Undertaking Scheme, 2003.

² Madhyanchal Vidut Vitaran Nigam Limited (MVVNL, Lucknow), Purvanchal Vidut Vitaran Nigam Limited (PuVVNL, Varanasi), Pashchimanchal Vidut Vitaran Nigam Limited (PVVNL, Meerut) and Dakshinanchal Vidut Vitaran Nigam Limited (DVVNL, Agra).

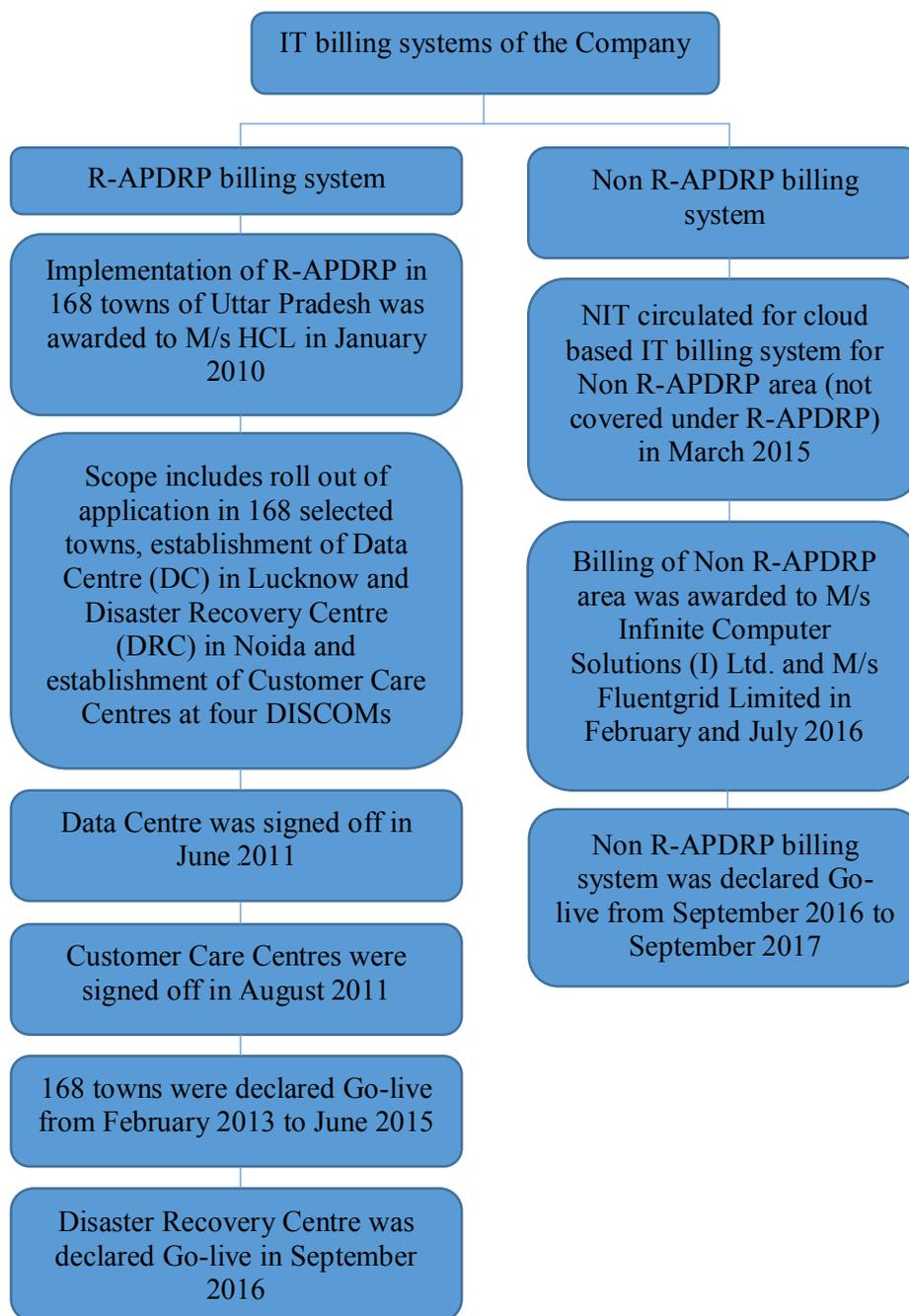
³ Last Go-live date of the towns out of total selected 168 towns has been considered as implementation date of EDSMS system.

Reforms Programme (R-APDRP) in 168 selected towns of the State and mPower implemented⁴ (September 2017) in non R-APDRP areas of the State.

EDSMS and mPower billing systems are commonly known as R-APDRP billing system and Non R-APDRP billing system, respectively within the Company.

The timeline for implementation of both the IT billing systems is depicted in **Chart 1.2:**

Chart 1.2: Time line of implementation of IT billing systems



⁴ Last Go-live date of Non R-APDRP division has been considered as implementation date of mPower system.

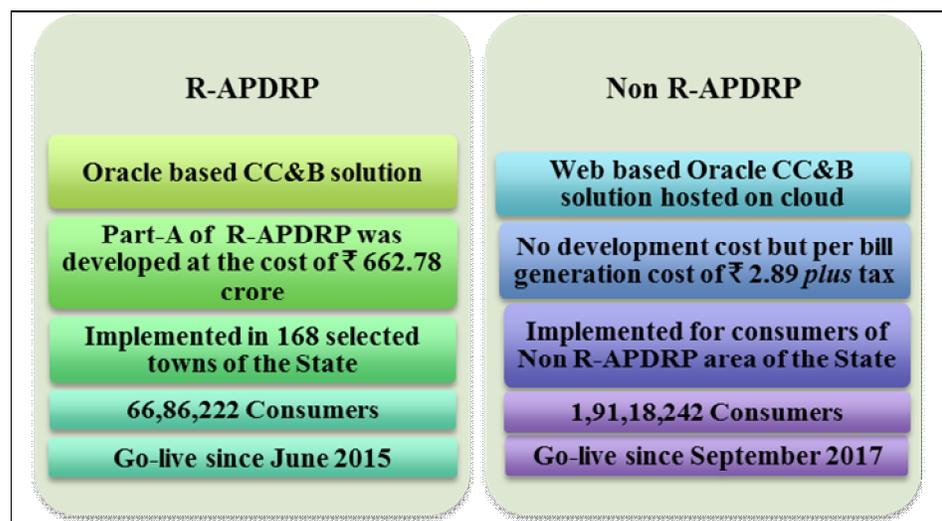
A brief description of the IT-based revenue billing systems (*viz.* R-APDRP and Non R-APDRP) being used by the Company is given below:

(i) The EDSMS solution (R-APDRP billing system) is bundled with Oracle⁵ CC&B 2.3.1 version. The centralised database for EDSMS is Oracle 11g running on Sun Solaris Server Cluster⁶ in Active-Active mode⁷. The R-APDRP billing system (Part-A of the R-APDRP) was implemented at a total cost of ₹ 662.78 crore. The R-APDRP towns were made Go-live⁸ from February 2013 to June 2015.

(ii) mPower suite (Non R-APDRP billing system) is a centralised Web-based Oracle CC&B solution hosted on the cloud. mPower suite is running on version 3.6 with database running on Oracle 12c. It is based on operating cost model at the rate of ₹ 2.89 (*plus* applicable taxes) per consumer per month basis. The non R-APDRP divisions were made Go-live from September 2016 to September 2017.

Key facts of both IT billing systems are depicted in **Chart 1.3**.

Chart 1.3: R-APDRP and Non R-APDRP



The DISCOMs of the Company serve bills to the consumers on the basis of meter reading done through various modes. A flow chart of the entire billing process is depicted in **Chart 1.4**:

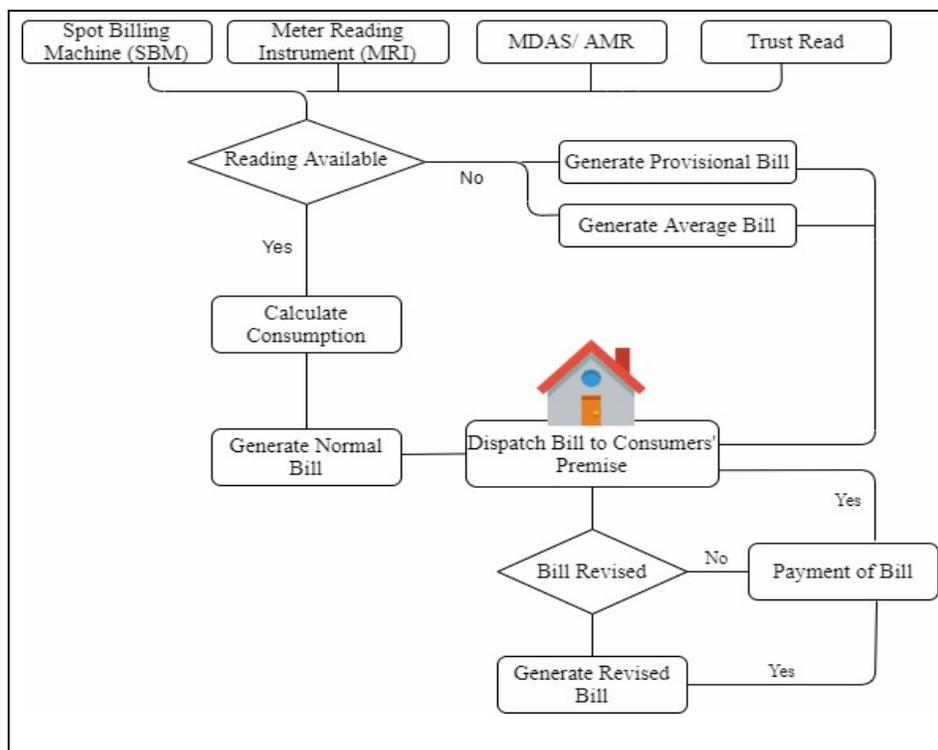
⁵ Oracle database (Oracle DB) is a relational database management system (RDBMS) from the Oracle Corporation.

⁶ Sun Cluster operates by having redundant computers or nodes where one or more computers continue to provide service if another fails.

⁷ An active-active cluster is typically made up of at least two nodes, both actively running the same kind of service simultaneously. The main purpose of an active-active cluster is to achieve load balancing. Load balancing distributes workloads across all nodes in order to prevent any single node from getting overloaded. Because when there are more nodes available to serve, there will also be a marked improvement in throughput and response times.

⁸ Go-live is a date on which the IT system becomes operational.

Chart 1.4: Billing process



Source: Information provided by the Company

Organisational set up

1.3 The Management of the Company is vested with a Board of Directors comprising Chairman, Managing Director (MD) and five other Directors⁹ appointed by the State Government. Further, the management of the DISCOMs is vested with a Board of Directors each comprising Managing Director (MD) and four other Directors appointed by the State Government.

Nodal Officers (of the level of Superintending Engineers) at the Company and in each DISCOM's Headquarters are responsible to monitor the implementation of the IT systems and coordinate with all stakeholders. The organisational set up is shown in **Appendix-1.1**.

Outcomes intended to be achieved

1.4 The intended outcomes which were to be achieved by using IT billing systems in energy distribution are:

- Reduction in the reported Aggregate Technical & Commercial (AT&C) losses¹⁰; and
- Minimum human intervention in the entire billing process leading to elimination of errors and improved billing efficiency and improved revenue collection.

⁹ Director (P&M), Director (Commercial), Director (Distribution), Director (Technical) and Director (Finance).

¹⁰ AT&C loss is the combination of technical loss (transformation losses and losses on distribution lines due to inherent resistance and poor power factor) & commercial loss (theft, defective meter reading, default in payment and inefficiency in collection).

Audit Objectives

1.5 The objectives of the audit were to examine whether:

- The process of development and acquisition of IT system was transparent, economic and competitive.
- Business rules were properly mapped and all required functionalities provided in the IT application. This will include examination of
 - (i) IT system development
 - (ii) Outsourcing
 - (iii) Information security including IT security plans; and
- The implementation of IT system led to achievement of organisational objectives.

Scope of Audit

1.6 The Performance Audit covered a period of five years *i.e.* from 2014-15 to 2018-19. Audit examined the records maintained by the Company and DISCOMs at their Headquarters related to the IT billing systems being operated by them. Further, for examination of basic records of consumers, 38 divisions (10.24 *per cent*) of four DISCOMs, out of total 371 divisions were selected through Stratified Random Sampling Method. During the audit, the electronic data of IT billing systems (R-APDRP and Non R-APDRP) for the period April 2018 to March 2019 was analysed.

The total number of in-service¹¹ consumers under R-APDRP and non R-APDRP billing systems were 66,86,222 and 1,91,18,242, respectively, with an aggregate contracted load of 51,148.31 megawatt (R-APDRP: 20,372.89 megawatt & non R-APDRP: 30,775.42 megawatt) as on March 2019. Further, 1,35,102 consumers were billed manually as of March 2019. The category-wise consumers billed through respective IT billing system vis-à-vis connected loads are detailed in **Table 1.1**:

Table 1.1: Statement showing system-wise, category-wise consumers and connected load of both IT billing systems

Category of Consumer	No. of Consumers	Connected load (in MW)	No. of Consumers	Connected load (in MW)
	R-APDRP billing system		Non R-APDRP billing system	
LMV 1-Domestic	56,20,367	12,857.82	1,73,76,374	20,362.09
LMV 2-Non-Domestic	9,46,078	2,568.76	4,27,394	1,228.84
LMV 3-Public Lighting	701	20.99	492	5.33
LMV 4-Institutional	17,544	221.40	62,257	180.93
LMV 5-Private Tube wells	4,438	22.35	11,71,004	6,323.52
LMV 6-Small & Medium Power	78,739	981.23	62,068	586.98

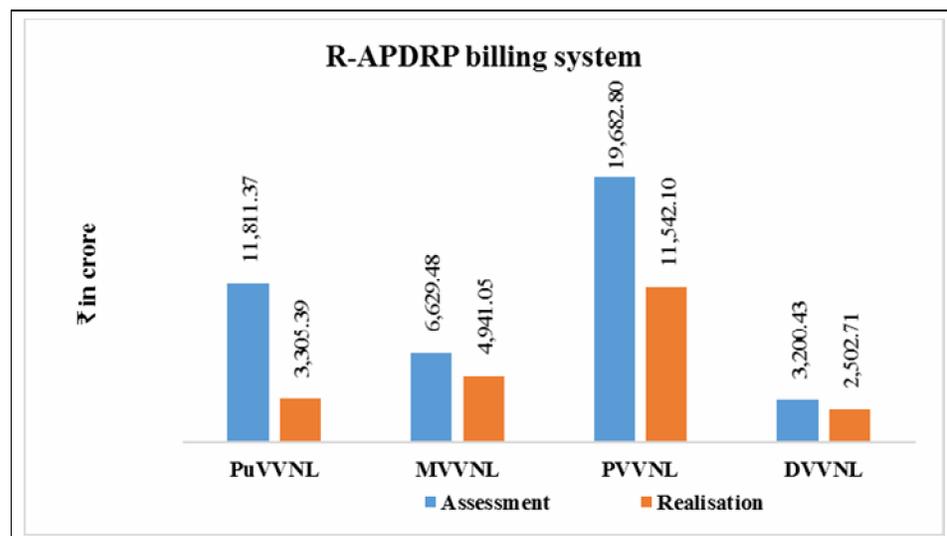
¹¹ In-service consumers are billable consumers of both the IT billing systems which is shown under the status of in-service in R-APDRP billing system and live in Non R-APDRP billing system.

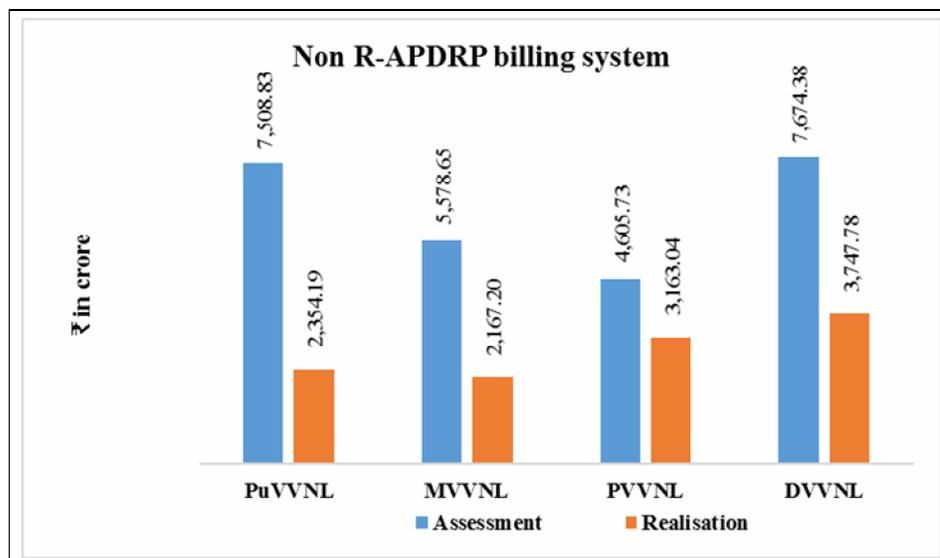
Category of Consumer	No. of Consumers	Connected load (in MW)	No. of Consumers	Connected load (in MW)
	R-APDRP billing system		Non R-APDRP billing system	
LMV 7-Public water works	5,603	184.28	7,297	66.79
LMV 8-State Tube wells	78	2.80	5,989	107.70
LMV 9-Temporary Supply	2,032	3.40	195	1.69
LMV 10-Departmental Employees	126	0.32	-	-
HV 1-Non-industrial Bulk Load	4,000	1,429.34	461	156.80
HV 2-Large and Heavy Power	6,504	2,075.51	4,628	1,594.20
HV 3- Railway Traction	3	1.93	5	40.50
HV 4-Lift Irrigation Works	9	2.78	78	120.06
Total	66,86,222	20,372.89	1,91,18,242	30,775.42
Grand Total	2,58,04,464	51,148.31		

Source: Based on data provided by the Company

Further, the revenue assessment and realisation of the four DISCOMs for the year 2018-19 were ₹ 66,691.67 crore and ₹ 33,723.47 crore (50.56 per cent), respectively. The IT billing system-wise assessment and realisation of all the four DISCOMs are depicted in **Chart 1.5**:

Chart 1.5: Assessment and realisation of four DISCOMs during 2018-19





Source: Based on analysis of data provided by the Company

Audit Methodology

1.7 The Performance Audit was conducted from January 2019 to December 2019. The methodology adopted for attaining the audit objectives with reference to audit criteria consisted of explaining the audit objectives to the Government and the Management of the Company in the Entry Conference held on 3 July 2019. The electronic billing data for the period April 2018 to March 2019 were collected from the Company and analysed through Computer Assisted Audit Techniques, Tableau and Microsoft Excel tools. With a view to assess the implementation of IT billing systems, the existence of general controls, adequacy of operational controls and mapping of business rules in IT billing systems by the Company and DISCOMs, documents were examined and discussions with the Management of the Company were conducted.

The Draft Performance Audit Report was issued to the Management in February 2020 and reply was received in July 2020. After incorporating replies of the Management, the Draft Performance Report was issued to the Government/Management for obtaining their comments (9 February 2021). The reply is awaited. The Exit Conference was held on 16 March 2021. The Government has accepted seven recommendations (out of a total of eight recommendations) in the Exit Conference, whereas their response to one recommendation is awaited. Considering the comments/views put forth by the Government/Management in the Exit Conference, the Draft Report has been finalised.

Audit Criteria

1.8 The audit criteria for assessing the achievements of audit objectives were:

- the Electricity Act, 2003;
- the Information Technology Act, 2000;
- Electricity Supply Code, 2005 (the Code), Rate Schedule, Cost Data Book and orders issued by Uttar Pradesh Electricity Regulatory Commission (UPERC);

- agenda and Minutes of Board of Directors' meeting (BoD), circulars and orders of the Company and DISCOMs;
- system documentation: (i) System Requirement Specification (SRS) and (ii) Request for Proposals (RFP);
- Service Level Agreement (SLA) entered into with outsourced agencies;
- Circulars issued by Central Vigilance Commission (CVC);
- User Manuals/operation manual of the IT systems; and
- the Company's IT Policy including access controls.

Limitations of the Audit

1.9 During the course of the audit, the Company/DISCOMs failed to produce the following records/information to Audit:

- Records related to establishment of Data Centre (DC) and augmentation therein, Facility Management Services (FMS), Annual Maintenance Contract/Annual Technical Support (AMC/ATS) of DC and end locations, closure report of R-APDRP maintained by MVVNL;
- Details of electrical assets of R-APDRP town as on Go-live date and subsequent additions thereon upto March 2019 along with its GIS database of prior and post Go-live periods;
- Consumer Indexing against the electrical assets/network of R-APDRP towns for prior and post Go-live periods;
- AT&C report of the Company, all four DISCOMs (R-APDRP and Non R-APDRP area-wise) for the period 2014-15 to 2018-19;
- Copy of service level agreement (SLA) reports for facility management services (FMS) of R-APDRP system of DC, Disaster Recovery Centre (DRC) and towns of MVVNL;
- Files of net connectivity at modems installed on meters at sub-station, feeder, DT and HT/LT consumers; and files of Network Bandwidth Service Provider (NBSP), SLA reports and document related to payment to NBSP of both the IT billing systems;
- Cost benefit analysis of IT billing system to be deployed in non R-APDRP area;
- Complete documentation of topic-wise training scheduled by the Company for both the IT billing systems along with the details of participants who attended the training.
- Complete documentation of change management, problems and incident management, documentation of R-APDRP billing systems for the period 2014-15 to 2018-19 and non R-APDRP billing system for the period 2017-18 to 2018-19;
- Billing logic/mapping of rules (Rate Schedule, Cost Data Book etc.) of both the IT billing systems as on Go-live date and subsequent changes therein during April 2014 to March 2019;

- Details of the database of the batch process initiated due to revision of Rate Schedule of R-APDRP billing system for the period 2014-15 to 2018-19 and non R-APDRP billing system for the period 2017-18 to 2018-19;
- Billing component-wise break-up of consumers' billing data for the period prior to December 2017 of R-APDRP system; and
- Details of manpower deployed for handling the IT billing systems at the Company and DISCOMs Headquarters and at field level along with their stream of specialisation.

Audit Findings

1.10 The audit findings are based on the scrutiny of records of billing data and review of IT-based revenue billing systems. The significant audit findings have been discussed hereafter under separate chapters.