



**Detailed Project Report for
Cloud Portal Consolidation
at Uttar Power Corporation
Limited (UPPCL)**

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Submitted to:

Uttar Pradesh Power Corporation Limited

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1 Background

1.1 Introduction

Uttar Pradesh being the one of the largest State in India is also one of the most populous state of the country with its administrative capital Lucknow. With the levels of literacy rate of around at 70 % the state has abundant availability of quality human resource. It has the abundance of potential as destination for investments in manufacturing, tourism and Infrastructure services.

Power sector is the critical infrastructure element required for the smooth functioning of the economy. Efficient, reliant and sustainable power is essential to stimulate growth and prosperity in the state. The availability of the reliable, quality and affordable power can ensure growth of all sectors of the economy being it agricultural, industrial and others. Towns of Kanpur, Varanasi, Allahabad, Gorakhpur, Meerut, Aligarh, Moradabad, Muzaffarnagar, Saharanpur and Jhansi are known for their industrial importance in the state as well as at the national level.

Uttar Pradesh was one of the first state to embark upon economic and structural reforms in power sector. GoUP had taken key structural reforms and created entities , Uttar Pradesh Power Corporation Limited (2000) , Kanpur Electricity supply Company , KESCO (2000) , Purvanchal Vidyut Vitran Nigam Limited , PuVVNL - Varanasi (2003) , Madhyanchal Vidyut Vitran Nigam Limited , MVVNL- Lucknow (2003) , Paschimanchal Vidyut Vitran Nigam Limited , PaVVNL - Meerut (2003) and Dakshinanchal Vidyut Vitran Nigam Limited , DVVNL- Agra (2003).

UPPCL has the following major online systems in place-

- **Urban Online Billing:** To bring efficiency and transparency in operations, an online system for billing and collection consisting 17 modules is deployed in 168 towns across UP for a consumer base of 7.5 Million. The web applications have been hosted at on-premise Data Centre (DC) with replicated data in the Disaster Recovery Centre (DRC), and are accessed by various divisions, circle, sub-division and other offices situated at different locations in 168 towns across the state over WAN environment.
- **Mobile Applications:** Various mobile applications (e-Nivaran, e-Sanyojan, FAME) for urban and rural consumers have been developed for improving efficiency, revenue and easy functioning. These apps are integrated with urban and rural online billing systems and various payment service providers.
- **Customer Care Centre for urban Consumers:** Customer Care Centres for consumers are established in 4 Discoms to take care of the grievances and faster redressal. Consumer complaints are registered/tracked/resolved through 1912 (Toll Free Number). This system is integrated with urban online system and rural online billing system.
- **Web Self Service:** To facilitate its consumers UPPCL provides online payment, trust billing and load enhancement features to its users.
- **Prepaid Meter Online Recharge-** Integration is in place to do online recharge prepaid meter installed.

- **GIS and Network Analysis Solution** - GIS system is in place which includes asset mapping and consumer indexing. UPPCL also keeps updating the GIS database through incremental surveys of consumers and assets to accurately carry out energy accounting. To complement the GIS, GIS based network analysis system is implemented to be able to accurately carry out network studies and optimise deployment of network elements.
- **Integrations with Other Government Portals/Apps** - Billing system has been integrated with Centre for E-Governance and (Customer service centers)CSCs for bill payment, Udyog Bandhu, CM Dashboard, Energy Audit Module etc
- **Other Integrations with UPPCL** - Official website of www.uppcl.org has various integrations such as Energy Accounting Directory, Commercial Statements, Personal Information System, Jansunwai, Disciplinary Proceedings, Feeder wise Supply Hours, Daily Supply Hours, Court Case Monitoring etc.

1.2 About UPPCL

Uttar Pradesh Power Corporation Limited (UPPCL), is a company registered under the provisions of Companies Act 1956 / 2013 and is a fully owned entity of Government of Uttar Pradesh.

Besides being the holding company for Power Generation and Transmission entities, UPPCL is also the holding company for five DISCOMS namely Paschimanchal Vidyut Vitaran Nigam Limited (PVVNL), Purvanchal Vidyut Vitaran Nigam Limited (PuVVNL), Madhyanchal Vidyut Vitaran Nigam Limited (MVVNL), Dakshinanchal Vidyut Vitaran Limited (DVVNL) and Kanpur Electricity Supply Company (KESCO). These DISCOMS are responsible for supplying of electricity to the consumers and to maintain the 33/11, 11/0.433 KV, substations, 33/11 kV/LT network of the area, receiving electricity supply from higher voltage system, distribute it to its consumers, record their consumption, issue electricity bills according to applicable tariff and realize the revenue. Various divisions of the DISCOMS are also responsible to release new connections and from time to time extend and improve its distribution network and control the line losses of electricity, technical as well as commercial and various other related activities.

The Company is engaged primarily in the business of distribution of Electricity. It has been vested with the distribution assets, interest in property, rights and liabilities of the erstwhile UPSEB necessary for the business of distribution in its area of distribution comprising of all districts of Uttar Pradesh.

The above 5 Companies have been given the status of a Distribution licensee as per Section 14 of the Electricity Act 2003. In order to fulfil the obligations of the Distribution licensee as mandated under the provision of Uttar Pradesh State Electricity Reforms Transfer Scheme 2012 and Electricity Act 2003, the main objects to be pursued by the company are:

- To undertake the activities of distribution to all consumers irrespective of the voltage, provision, supply, wheeling, purchase, sale, import, export and trading of electricity,

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introduce open access in distribution as per the Electricity Act 2003 and/or the directions of the regulator.

- To plan, develop, acquire, establish, construct, erect, lay, hire, lease, buy, sell, operate, run, manage, maintain, enlarge, alter, renovate, modernize, work and use a power distribution system network in all its aspects including amongst others various voltage lines and associated sub -stations, including distribution centers, cables, wires, accumulators, plants, motors, meters, apparatus, computers and materials connected with sub-transmission, distribution, supply of electrical energy, ancillary services, telecommunication and telemetering equipment.
- To tender, finalize and execute Power Purchase Agreements and other agreements for sale or purchase of electricity with generating companies, trading companies, other distribution companies, Central and State generating authorities, departments or companies, societies, other States, utilities, Independent Power Producers and other Persons.
- To undertake Rural Electrification schemes in the licensed area.
- Any other work incidental to the objectives & functions of the company.

The details of 5 DISCOMS are as follows;

DISCOMS	RAPDRP PART A		Non-RAPDRP	
	No. of Consumer Served *	District Served	No. of Consumer Served*	District Served
Dakshinanchal Vidyut Vitran Nigam Ltd (DVVNL)	1093589	19	3286962	21
Madhyanchal Vidyut Vitran Nigam Ltd (MVVNL)	1815243	17	4126303	19
Purvanchal Vidyut Vitran Nigam Ltd (PuVVNL)	1229043	19	5573860	20
Paschimanchal Vidyut Vitran Nigam Ltd (PVVNL)	2421582	13	3321032	12
Kanpur Electric Supply Company (KESCO)	601819	1	Not in scope	
Total	7161276	69	16308157	72

Table 1 : Details of Consumers and Districts

*As per 2018 data

Discoms	Zone	Circle	Distribution Division	SDO	Test Division
Dakshinanchal Vidyut Vitran Nigam Ltd (DVVNL)	6	28	77	190	23
Madhyanchal Vidyut Vitran Nigam Ltd (MVVNL)	6	29	105	205	27
Purvanchal Vidyut Vitran Nigam Ltd (PuVVNL)	6	30	96	194	22
Paschimanchal Vidyut Vitran Nigam Ltd (PVVNL)	6	29	96	195	28
Total	24	116	374	784	100

Table 2 - Details of RAPDRP PART-A and Non-RAPDRP Offices

1.3 Mission of UPPCL

Uttar Pradesh Power Corporation Ltd. (UPPCL), with a vision to provide, uninterrupted power supply to every consumer of the state is now looking forward to increasing the consumer base as well as increasing the revenue by incorporating new technology, process and procedure. The mission of Uttar Pradesh Power Corporation Limited (UPPCL) is to ensure reliable quality of power to its customers at competitive prices. The UPPCL is committed to achieving this mission through:

- Provide cost efficient good quality electricity to all categories of consumers for economic development/social uplift of the State.
- Make the energy sector commercially viable so that it ceases to be burden on the state budget; and
- Protect the investment of the consumers.

2 Objective

For hosting applications which are running in silos in a seamless manner, UPPCL intends to select "Supplier" from empanelled cloud service providers to provide cloud services and optionally, cloud managed services for hosting various software and applications of the UPPCL

Following are the key challenges faced by UPPCL:

- DC DR drill was not conducted timely owing to lack of preparedness. In the RFP, DR was envisaged to be 50% of DC. During operations (owing to exponential consumer growth), the load on DC was reaching ~50%. Hence, DR cloud infrastructure could only take the load of critical applications and not the entire application stack and that also without high availability.
- When the revenue system was envisaged, bi-monthly billing was in practice in UPPCL for rural consumers, however, during implementation, the regulatory commission of the state mandated change of billing cycle to monthly, which doubled the number of consumers from approximately 5 million to 10 million.
- During the launch of One-time settlement scheme, the load on the database server was increased substantially and the utilization was breaching 85%, during which time the department complained about drastic decrease in response time of the application.
- It was also challenging to ascertain resource allocation for application usage during events of application slowness faced by users.
- The System integrator was generating Service level reports manually and not in an automated fashion through tools which made it difficult to analyse the authenticity of the data collated.

To overcome the above challenges, UPPCL is looking for the following objectives to be derived by opting for Cloud Services:

- Successful migration of all On-Premises / Other Public Cloud applications over to Cloud Computing environment keeping all functionalities intact
- Achieving Higher Availability (uptime of 99.95%)

- Faster Provisioning: “IT infrastructure on request” for hosting all of its Applications.
- Greater reliability: No operational issues due to hardware failures
- Cost Optimization: Aggregation of IT infrastructure (Hardware, Storage and Networking) and management resources at reduced price.
- Optimal utilization of resources to meet individual peak loads
- Higher Security
- Standardization of systems: Auto-scalability, Faster implementation cycle time and Stable and predictable physical and technical environment
- Reduced administrative burden for UPPCL by avoiding necessity of procurement, vendor management etc.
- Cost based on actual usage, thus leading to reduced cost of infrastructure creation, monitoring, management for UPPCL
- Efficient and effective management of information security issues across cloud environment.

3 Scope of Work

UPPCL wishes to appoint a Bidder (MSP) for providing Cloud Services for a period of 5 years (including application migration & stabilization period). The MSP together with CSP shall provide the Cloud services during the contract period.

a. Project Management

The Agency shall deploy a team of experienced and skilled professionals with relevant experience during the development and operational phase. The Agency shall assign a dedicated qualified and experienced Cloud Engineer as single point of contact for UPPCL, at Lucknow for coordination. The cloud Engineer shall be assisting UPPCL for:

- i. Working in tandem with UPPCL’s IT team and agencies to identify and implement the most optimal cloud utilization.
- ii. Planning, designing and deploying cloud-based applications.
- iii. Managing cloud environments in accordance with company security guidelines.
- iv. Deploying and debugging cloud initiatives as needed in accordance with best practices throughout the development lifecycle.
- v. Educating teams on the implementation of new cloud-based initiatives, providing associated training as required.
- vi. Employing exceptional problem-solving skills, with the ability to see and solve issues.
- vii. Using extensive knowledge of APIs to design RESTful services, and integrate them with existing data providers, using JSON or XML as needed.
- viii. Lead and develop best practices for UPPCL IT Cloud Team.
- ix. Stay current with industry trends, making recommendations as needed.

The Cloud Engineer must be on agencies regular roll and agency shall certify the authenticity of his regular employment. Minimum qualifications for Cloud Engineer shall be as follows: -

- i. Bachelor's Degree in Computer Science or Engineering.
- ii. Certification as Cloud Solutions Architect, Cloud Security Certification. (Other cloud-related certification also a plus.
- iii. Five years' experience in developing software using languages such as Java, Python, C++ or Ruby.
- iv. Experience with SOA applications and cloud-based services.
- v. Five years' experience in a Cloud Engineer role or related position.
- vi. Knowledge of web services, API, REST and RPC.
- vii. Strong awareness of networking and internet protocols, including TCP/IP, DNS, SMTP, HTTP and distributed networks.
- viii. Database experience, including knowledge of SQL and NoSQL, and related data stores.
- ix. Extensive experience with open-source technology, software development and system engineering.
- x. Excellent communication and organizational skills, and the ability to stay focused on completing tasks and meeting goals within a busy workspace.

b. Migration of existing applications

- **Migration Planning:** Comprehensive planning for migration of the application suite and data to the cloud including developing the migration roadmap identifying the constraints and inhibitors to cloud migration. The migration plan should also include plan for co-existence of non-cloud and cloud architectures during and after migration and test plans for verifying successful migration
- **Modifications to the applications based on:**
 - i. Complete architectural understanding of the existing applications and processes necessary for successful migration of the applications and data as well as continued operation and maintenance of the services
 - ii. Analysis of the interdependencies such as application dependencies and affinities to servers, server configuration etc.
 - iii. Dependencies between applications and data
 - iv. Requirement of any up gradation of OS & DB to latest version available in market
 - v. Design the TO BE architecture for deployment on Cloud
 - vi. Provision the necessary compute & storage infrastructure on the cloud including the underlying software licenses to host the Application Suite that meet or exceed the day-1 minimum capacity
 - vii. Setup of Development, Quality, Production and Disaster Recovery Environments by provisioning the necessary compute & storage infrastructure on the cloud along with the underlying software licenses to host the Application Suite.
 - viii. Configuring external connections to the hosted infrastructure required to upload database backups and virtual machine (VM) images to the hosting environment
 - ix. Migration of the Application Suite from the existing infrastructure to the cloud infrastructure as per the defined TO BE architecture. The migration shall also include the migration of underlying data & files from the current database(s) / storage into the database(s) / storage on the cloud.

c. Operations & Maintenance Services

• **Resource Management**

- i. Adequately size the necessary compute, memory, and storage required, building the redundancy into the architecture (including storage) and load balancing to meet the service levels
- ii. While the initial sizing & provisioning of the underlying infrastructure may be carried out based on the information provided in the RFP, subsequently, it is expected that the SYSTEM INTEGRATOR, based on the growth in the user load (peak and non-peak periods; year-on-year increase), will scale up or scale down the compute, memory, and storage as per the performance requirements of the solution and meet the SLAs using the auto-scaling features provided by the CSP
- iii. In addition to auto-scaling, for any major expected increase in the workloads, carry out the capacity planning in advance to identify & provision, where necessary, the additional capacity to meet the user growth and / or the peak load requirements to support the scalability and performance requirements of the solution
- iv. The scaling up / scaling down (beyond the auto-scaling limits or whenever the auto-scaling limits have to be changed) has to be carried out with prior approval by the Government Department / Agency. The Service Provider shall provide the necessary details including the sizing calculations, assumptions, current workloads & utilizations, expected growth / demand and any other details justifying the request to scale up or scale down

• **Patch & Configuration Management**

- i. Manage the instances of storage, compute instances, and network environments. This includes department-owned & installed operating systems and other system software that are outside of the authorization boundary of the CSP. Service Provider is also responsible for managing specific controls relating to shared touch points within the security authorization boundary, such as establishing customized security control solutions. Examples include, but are not limited to, configuration and patch management, vulnerability scanning, disaster recovery, and protecting data in transit and at rest, host firewall management, managing credentials, identity and access management, and managing network configurations

• **User Administration**

- i. Implement Identity and Access Management (IAM) that properly separates users by their identified roles and responsibilities, thereby establishing least privilege and ensuring that users have only the permissions necessary to perform their assigned tasks.
- ii. Administration of users, identities and authorizations, properly managing the root account, as well as any Identity and Access Management (IAM) users, groups and roles they associated with the user account

- iii. Implement multi-factor authentication (MFA) for the root account, as well as any privileged Identity and Access Management accounts associated with it.
- **Security Administration**
 - i. Appropriately configure the security groups in accordance with the Government Department / Agency's networking policies
 - ii. Regularly review the security group configuration and instance assignment in order to maintain a secure baseline.
 - iii. Secure and appropriately segregate / isolate data traffic/application by functionality using DMZs, subnets etc.
 - iv. Ensure that the cloud infrastructure and all systems hosted on it, respectively, are properly monitored for unauthorized activity.
 - v. Properly implementing anti-malware and host-based intrusion detection systems on their instances, as well as any required network-based intrusion detection systems in accordance with the Government Department / Agency's policies.
 - vi. Conducting regular vulnerability scanning and penetration testing of the systems, as mandated by their Government Department / Agency's policies.
 - vii. Review the audit logs to identify any unauthorized access to the government agency's systems.
- **Monitoring Performance and Service Levels**
 - i. Provide and implement tools and processes for monitoring the availability of assigned applications, responding to system outages with troubleshooting activities designed to identify and mitigate operational issues
 - ii. Reviewing the service level reports, monitoring the service levels and identifying any deviations from the agreed service levels
 - iii. Monitoring of service levels, including availability, uptime, performance, application specific parameters, e.g. for triggering elasticity, request rates, number of users connected to a service
 - iv. Detecting and reporting service level agreement infringements
 - v. Monitoring of performance, resource utilization and other events such as failure of service, degraded service, availability of the network, storage, database systems, operating Systems, applications, including API access within the cloud service provider's boundary
 - vi. SI should provide service to have dedicated connectivity (Direct Connect) from on premise data centre to cloud
 - vii. Direct Connect service should have flexibility to integrate/leverage ISPs MPLS connectivity
 - viii. The storage service should (File Storage) should not have limitation of bandwidth
 - ix. CSP should have provision to host site to site VPN connectivity
- **Usage Reporting and Billing Management**
 - i. Track system usage and usage reports

- ii. Monitoring, managing and administering the monetary terms of SLAs and other billing related aspects
 - iii. Provide the relevant reports including real time as well as past data/information/reports for the Government Department / Agency to validate the billing and SLA related penalties
- **Backup**
 - i. Configure, schedule, monitor and manage backups of all the data including but not limited to files, images and databases as per the policy finalized by Government Department / Agency
 - ii. Restore from the backup where required
- **Business Continuity Services**
 - i. Provide business continuity services in case the primary site becomes unavailable
- **Support for third party audits**
 - i. Enable the logs and monitoring as required to support for third party audits
- **Miscellaneous**
 - i. Advise the Government Department / Agency on optimal operational practices, recommend deployment architectures for cloud infrastructures, design and implement automated scaling processes, day-to-day and emergency procedures, deploy and monitor underlying cloud services, performance reporting and metrics, and ensure the overall reliability and responsive operation of the underlying cloud services through both proactive planning and rapid situational response.
 - ii. Interface with the Cloud Service Provider(s) on behalf of the Government Department / Agency for all activities including monitoring the reports (e.g., usage, security, SLA,), raising (or escalating) tickets / incidents and tracking the same to resolution.
 - iii. Prepare a comprehensive O&M plan for managing the cloud services and keep it updated with any changes during the course of the project.
 - iv. Create and maintain all the necessary technical documentation, design documents, standard operating procedures, configurations required to continued operations and maintenance of cloud services.

4 Benefits of Cloud Services

UPPCL derived considerable benefits from adoption of cloud;

S.No.	KPI	Benefits
1.	Cost	The model adopted for implementing this system is Capital expenditure free "Cloud Computing" model on pay-per use basis which helps UPPCL in avoiding initial huge investment in capital cost.
2.	Time	Owing to the benefits of cloud technology such as scalability, security, and reliability, deployment times were substantially reduced. Cloud deployment was initiated in the 6 th month of implementation and completed in the 9 th month of implementation.
3.	Security	UPPCL enforced strict security compliances during the tender stage which helped them have a solution which was secure. There have been no instances of any hacks or breach on this revenue system dealing with consumer data of appx. 25 million consumers.
4.	Scalability	When the revenue system was envisaged, bi-monthly billing was in practice in UPPCL for rural consumers, however, during implementation, the regulatory commission of the state mandated change of billing cycle to monthly which doubled the number of consumers from approximately 5 million to 10 million. During the project, the consumer base increased to 13 million. Subsequently, additional semi-urban areas and rural areas were added to the consumer base thereby increasing it to approximately 25 Million. Although the billing load increased at an unprecedented rate, UPPCL can realize the benefits of scalability cloud solution with high scalability and save upon substantial capital expenditure and multi-fold increase in revenue.
5.	Elasticity	UPPCL provides its consumers various services such as OTS (One-time Settlement) option, which is to pay out pending arrears without any additional charges once a year. Besides these, there are additional government schemes, drives etc. which impact the system load due to increase in collection of revenue. UPPCL can realize the benefits of cloud elasticity to ensure that application continue to perform highly during such load times.
6.	Accessibility	Web based billing solution hosted on cloud which can be accessed through internet for facilitating collection agencies to collect and operate from remote locations. The system enabled consumers to deposit their monthly bills from diversified locations and mediums including Online mode of bill payments. Also, data Migration of all the consumers into Central Data Base reduces the dependencies on small Billing agents.

5 Estimated cost

Part A: Total Benefits from the Projects (Rs. Crs) *	
Date of Start of Project	2020
Scheduled Date of Completion	2025
Estimated Cost (Rs. Crs) at start of project	27.00
Cost Escalation / variation with reasons, if any	NA
Proposed Funding (Equity, Loan, Grant details)	Equity
Scheduled Date of Completion	2025
Delay & reasons, if any	NA

6 Duration

The estimated time period to complete the activity is by 2025 i.e. the duration is for **60 Months**.