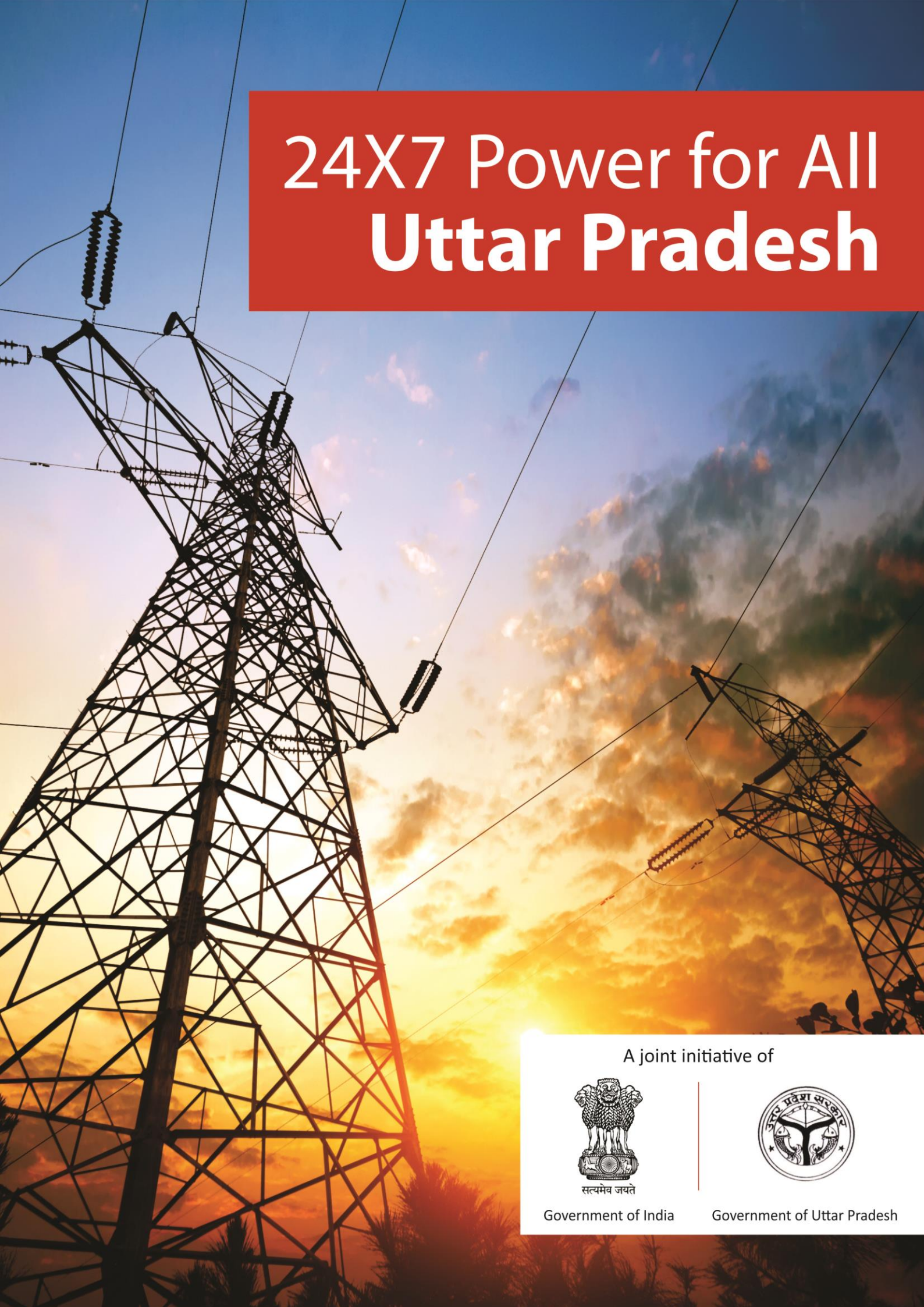


24X7 Power for All
Uttar Pradesh

A joint initiative of

सत्यमेव जयते

Government of India

Government of Uttar Pradesh

Government of
Uttar Pradesh

Shri Yogi Adityanath

Hon'ble Chief Minister of Uttar Pradesh

Foreword

विद्युत एक अति महत्वपूर्ण बुनियादी ढांचा है, जो कि समाज के प्रत्येक व्यक्ति को स्पर्श करता है। प्रदेश के विकास एवं सम्पन्नता को उर्जित करने हेतु एक दक्ष, समर्थ एवं वित्तीय रूप से चिरस्थाई पावर सेक्टर की आवश्यकता है। कृषि उद्योग सहित अर्थव्यवस्था के सभी अंगों के विकास के लिए विश्वसनीय, गुणवत्तापूर्ण एवं सस्ती विद्युत आवश्यक है। इसके दृष्टिगत "24X7 पावर फॉर ऑल" उत्तर प्रदेश सरकार का संकल्प है।

प्रदेश के दूरस्थ इलाकों में रहने वाला अंतिम व्यक्ति भी विकास प्रक्रिया में अपनी भागीदारी निभा सके, इसके लिए आवश्यक है कि विद्युत वितरण को लोकतांत्रिक बनाया जाए। इस स्वप्न को साकार करने के लिए हमें ग्रामीण एवं नगरीय क्षेत्रों में निर्बाध विद्युत आपूर्ति करने के साथ–साथ सभी को विद्युत प्रदान करने के लिए काफी कार्य करने की आवश्यकता है।

उत्तर प्रदेश सरकार विद्युत उत्पादन क्षमता में वृद्धि, मितव्ययी विद्युत क्रय, पारेषण एवं वितरण प्रणाली के सुदृढ़ीकरण, ऊर्जा संरक्षण, उपभोक्ता परक पहल, विभिन्न क्रियाशील योजनाओं में उत्कृष्ट–क्रिया पद्धति लागू करने, समुच्च तकनीकी एवं वाणिज्यिक हानियों को कम करने, टैरिफ पेटीशन ससमय प्रेषित करने एवं वितरण कम्पनियों को वित्तीय रूप से स्वावलम्बी बनाने हेतु सभी आवश्यक कार्यवाही कर रही है।

"24X7 पावर फॉर ऑल" योजना इन उद्देश्यों की प्राप्ति हेतु लक्ष्य निर्धारण में सहायता करती है। यह योजना वर्ष 2018–19 तक पावर सेक्टर के तीनों अंगों यथा–वितरण, पारेषण तथा विद्युत उत्पादन के समग्र विकास की वास्तविक आवश्यकताओं को आंकलित करने का सर्वोत्तम मंच है।

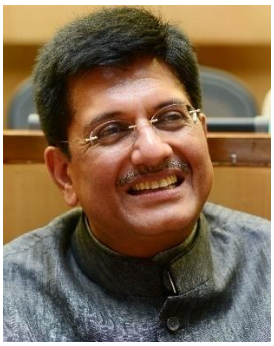
सभी के सहयोग से "24X7 पावर फॉर ऑल" योजना का सफल क्रियान्वयन सम्भव होगा, ऐसा मेरा विश्वास है। राज्य के विभिन्न विद्युत निगम समयबद्ध रूप से निर्धारित कार्य सफलतापूर्वक सम्पादित कर सकें, इसके लिए उत्तर प्रदेश सरकार की ओर से मेरी हार्दिक शुभकामनाएं।

सत्यमेव जयते

Government of India

Shri Piyush Goyal

Hon'ble Union Minister of State (Independent Charge)
Power, Coal, New & Renewable Energy



Foreword

Electricity consumption is one of the most important indices that decide the level of development of a nation. The availability of reliable, quality and affordable power can ensure growth of all sectors of the economy including agricultural, industrial and others. Under the leadership of Hon'ble Prime Minister, Shri Narendra Modi ji, the Government of India is committed to improving the quality of life of its citizens by providing 24x7 affordable and environment-friendly 'Power for All'.

Uttar Pradesh under its present leadership could be one of the driving States for the growth of the entire country. Under this programme, the Government of India and the Government of Uttar Pradesh aim to meet the aspirations of the people of the state. Ensuring adequate quality power at affordable prices for farmers, the poor, the middle class, businesses and industry will lead to new opportunities for a better quality of life. Our aim is to realise Pandit Deendayal Upadhyaya's vision of 'Antyodaya', where the poorest of the poor at the bottom of the pyramid have the first right on a nation's resources.

I am delighted that within one month of the formation of the new Government led by Hon'ble Chief Minister Shri Yogi Adityanath ji, the State is ready to execute the "24x7 Power for All" document, which lays out the roadmap for the power sector in Uttar Pradesh. We wish them all the best for the implementation of this programme. The Government of India will support the efforts of the Government of Uttar Pradesh in all possible ways to bring about transformational improvement in the power sector.

Government of
Uttar Pradesh

Shri Shrikant Sharma

Hon'ble Energy Minister of Uttar Pradesh

Foreword

प्रदेश के सर्वांगीण विकास एवं जनमानस हेतु आधारभूत अवस्थापनाओं की आवश्कताओं की पूर्ति हेतु प्रदेश सरकार कृत संकल्प है। प्रदेश के जन–जन को 24x7 गुणवत्तापरक विद्युत ऊर्जा उपलब्धता सुनिश्चित करना प्रदेश सरकार की सर्वोच्च प्राथमिकताओं में से एक है। अनवरत् विद्युत आपूर्ति जहां एक तरफ प्रदेश में औद्योगिकीकरण को बढ़ावा देगी वहीं दूसरी तरफ कृषि क्षेत्र एवं उसके फलस्वरूप ग्रामीण अंचलों के उत्तरोत्तर विकास में भी सहायक होगी। अनवरत् विद्युत आपूर्ति के इस संकल्प की पूर्ति के फलस्वरूप प्रदेश में ऊर्जा खपत् बढ़ेगी एवं प्रदेश के विकास का महत्वपूर्ण सूचकांक होगा।

इस लक्ष्य की पूर्ति हेतु प्रदेश सरकार विद्युत उत्पादन, पारेषण एवं वितरण के क्षेत्रों पर समान ध्यान देकर इनकी क्षमता के उच्चीकरण हेतु कटिबद्ध है। नये उत्पादन गृहों की स्थापना सुनिश्चित कर विद्युत उपलब्धता सुनिश्चित की जायेगी एवं पारेषण तंत्र का उच्चीकरण सुनिश्चित कर इस ऊर्जा की पारेषण एवं वितरण अन्तरपृष्ठ पर उपलब्धता सुनिश्चित की जायेगी। वितरण क्षेत्र में मुख्यतः वितरण कम्पनियों को घाटे से उबारने एवं उपभोक्ता सेवा एवं संतुष्टि पर विशेष ध्यान दिया जायेगा। वितरण क्षेत्र में प्रणाली का उच्चीकरण एवं सूचना प्रौद्योगिकी का समावेश भी सुनिश्चित किया जायेगा।

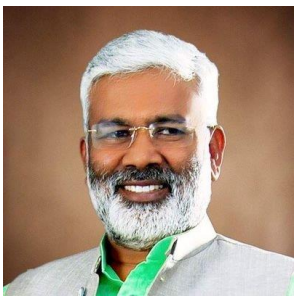
मुझे पूरा विश्वास है कि उत्तर प्रदेश के प्रत्येक घर को 24 घंटे विश्वसनीय विद्युत व्यवस्था उपलब्ध कराने में ऊर्जा विभाग के विभिन्न निगम कोई कमी नही रखेंगें तथा साथ ही केन्द्रीयकृत 1912 शिकायत निवारण प्रणाली द्वारा उपभोक्ताओं की विभिन्न समस्याओं, जैसे आनलाईन कनेक्शन हेतु आवेदन करना, आनलाईन लोड परिवर्तित कराना तथा क्षतिग्रस्त परिवर्तक का निर्धारित अवधि में बदलना आदि, के लिए वांछित सुविधा भी उपलब्ध करायेंगे।

प्रदेश के जन–जन को 24X7 गुणवत्तापरक विद्युत ऊर्जा उपलब्धता सुनिश्चित करने हेतु यह 24X7 पावर फॉर आल कार्ययोजना महत्वपूर्ण भूमिका निभायेगी।

Government of
Uttar Pradesh

Shri Swatantra Dev Singh

Hon'ble State Minister (Energy) of Uttar Pradesh



Foreword

प्रदेश के आर्थिक विकास में विद्युत का विशेष योगदान है। इस प्रयोजन हेतु ग्रामीण एवं शहरी क्षेत्रों में विश्वसनीय एवं गुणवत्ता पूर्ण विद्युत आपूर्ति सुनिश्चित करने के लिए प्रदेश के ऊर्जा क्षेत्र का समग्र एवं नियोजित विकास आवश्यक है।

"24X7 पावर फार आल" योजना के कियान्वयन हेतु प्रदेश सरकार का ऊर्जा विभाग प्रक्षेप–पथ तैयार कर निर्धारित उद्देश्यों की प्राप्ति के लिए कार्य करेगा, जिसमें ग्रामीण एवं शहरी क्षेत्रों के प्रत्येक घर को विद्युत तन्त्र से जोड़ना, कृषि क्षेत्र को निर्धारित घण्टों की विद्युत आपूर्ति सुनिश्चित करना तथा अन्य श्रेणी के वर्तमान एवं नये उपभोक्ताओं को 24 घण्टे विद्युत आपूर्ति सुनिश्चित करना सम्मिलित होगा।

इस लक्ष्य की प्राप्ति हेतु प्रदेश सरकार विद्युत उत्पादन की क्षमता बढ़ाने में कार्यरत है, साथ ही साथ पारेषण तन्त्र में अतिरिक्त लाइनें बनाकर उनकी क्षमता बढ़ाने का भी कार्य कर रही है तथा वितरण प्रणाली के विस्तारीकरण एवं सुदृढ़ीकरण के कार्य भी कर रही है। विद्युत आपूर्ति की गुणवत्ता सुधारने हेतु कैपेसिटर बैंक आदि उपकरणों को विद्युत तन्त्र से जोड़ने का कार्य किया जा रहा है तथा इस प्रणाली को स्वचालित करने की भी कार्यवाही की जा रही है। उपभोक्ताओं को बेहतर सेवा देने हेतु विभिन्न प्रकार के नये आयामों का विकास कर ससमय प्रणाली दोष दूर करने तथा ऑनलाइन बिल जमा करने के कार्य भी सम्मिलित हैं।

मैं स्टेट पावर सेक्टर के निगमों का आह्वान करता हूँ कि वह कार्यों में दक्षता बढ़ाने तथा उत्तम कार्य निष्पादन का प्रदर्शन करने के साथ–साथ साधनों का मितव्ययी प्रयोग व इष्टतम निवेश करते हुए इस योजना के उद्देश्यों की प्राप्ति हेतु प्रयासों में किसी प्रकार की शिथिलता नहीं आने देंगे।

मैं इस योजना की सफलता हेतु सभी हित–धारकों को शुभकामनाएं देता हूँ।

सत्यमेव जयते

Government of India

Government of Uttar Pradesh

Joint statement

'24x7 Power for All' (PFA) programme will be implemented by Government of Uttar Pradesh with active support of Government of India with the objective to connect all unconnected households in a phased manner by 2019 and to ensure 24x7 quality, reliable and affordable power supply to all domestic, commercial and industrial consumers within a fixed timeframe. Agriculture consumers will also be given supply as per requirement in a cost-effective manner.

Government of Uttar Pradesh is committed to accord the highest priority to the power sector and to provide full support to associated utilities for ensuring quality power supply.

Government of Uttar Pradesh, in synergy with Government of India, will take necessary steps for village electrification, capacity addition, power purchase planning, strengthening the required transmission and distribution network, encouraging renewable energy, undertaking customer-centric initiatives, reducing AT&C losses, bridging the gap between ACS and ARR, and following good governance practices in the implementation of electricity-related Central and State Government schemes.

Government of India would synergise and supplement the efforts of the Government of Uttar Pradesh through fast-track resolution of key issues pertaining to generation & transmission and by ensuring enhanced allocation in various distribution schemes.

The Ministry of Power, Government of India, will also endeavour to support the State in availing of concessional financing arrangements for power utilities in the State.

The Central and State Governments would meet regularly to review the progress of the programme over the next two years and would strive to achieve the objectives by taking necessary steps as envisaged in this Power for All document.

14/4/17

Shalini Prasad

Additional Secretary,

Ministry of Power, Government of India

Sanjay

Sanjay Agarwal

Additional Chief Secretary (Energy),

Government of Uttar Pradesh

Executive summary

The 24x7 Power for All programme is a joint initiative of the Government of India (GoI) and state governments, with the objective to provide 24x7 power to households, industry, commercial, and other consuming entities, and adequate power to the agricultural sector by 2019. This roadmap document aims to identify the requirements to meet the above objectives for Uttar Pradesh.

Uttar Pradesh is one of the largest states in the country. From 450 kWh in FY12 to 524 kWh in FY16, its per capita consumption of electricity has been steadily growing. However, the consumption remains well below the national average of about 1,075 kWh (FY16).

Connecting the unconnected: rural

Considering the projections as per census, there are 2.89 crore rural households in Uttar Pradesh. Of these, 0.92 crore rural households already exist in Discom records.

The State undertook a survey in FY15 to map habitations that have drinking water supply. This survey also captured the status of electrification and accordingly, was considered during finalisation of DDUGJY scheme. As per the survey, additional 0.25 crore households were being served through existing network. Also, under various ongoing rural electrification schemes, about 1.09 crore un-electrified households (or approximately 1,62,000 habitations) were targeted to be served through additional network being created.

Till FY17, necessary infrastructure works for approximately 88,000 habitations have already been completed, resulting in ready access of electricity to additional 0.59 crore households.

This implies that at end of FY17, 0.84 crore households have ready access to electricity but are yet to be formalised and metered. Hence, for drawing up this roadmap document, these 0.84 crore households are considered to be electrified as they are already contributing to the overall demand of the State. Accordingly the status of electrification in the State is tabulated below:

Particulars	Status (FY17)
Total rural households	2,89,46,089
Total electrified households as per discom records	92,72,706
Households **with** access to electricity and yet to be formalised	84,62,695
Balance to be electrified	**1,12,10,688**
Households to be electrified (already covered in the infrastructure being created in the ongoing schemes)	49,97,696
Balance households to be electrified	**62,12,992**

It is noted that in the past, money has been sanctioned under various rural electrification schemes including DDUGY for electrifying the households in the State. As detailed in above table, there are around 1.12 crore un-electrified households in the State. The State Government with the support of the Central Government shall endeavour to ensure that these households shall be electrified by 2019. Out of these un-electrified households, the State endeavours to electrify 0.50 crore households by October 2018 under the ongoing schemes. Further, the State will validate the balance 0.62 crore un-electrified households by undertaking a survey and formulate DPRs for electrification of the final verified un-electrified households by July 2017. For this purpose, State Government shall make efforts to tie up the necessary funds required from available sources including Government of India.

Connecting the unconnected: urban

Similarly, considering the projections as per census, there are 0.93 crore urban households in the State. Out of them, 0.78 crore urban households already exist in Discom's records. The State envisages to target the electrification of these remaining 0.15 crore urban households by 2019 after undertaking appropriate augmentation/ extension of the existing network of

urban areas. As these consumers are not covered under any existing scheme, the State needs to formulate a scheme to connect all urban un-electrified consumers within the target date.

24x7 power supply

Currently, the State is supplying power for 18 hours to rural areas, 20 hours in tehsil towns and Bundelkhand and 24 hours in district headquarters, cities and industries.

The State plans to supply for 24 hours across all areas and for 10 hours to agricultural consumers (whose feeder segregation is underway) by October 2018.

Feeder segregation

Of the 75 districts in the State, schemes for feeder separation for 73 districts, with a total cost of Rs 7,084.49 crore, was submitted for sanction under DDUGJY. Sanction was granted for 28 districts for complete works and 11 districts for partial works for an amount of Rs 3,257.69 crore; the works are underway and are targeted to be completed by early 2019. It is also observed that early implementation of feeder segregation will help in reducing and effectively managing the peak demand, which stands at 17,355 MW in FY17.

Metering

In FY17, almost 40% (i.e., 0.68 crore) of the total 1.70 crore registered domestic households are still unmetered. Further, another 0.84 crore connections are required to be formalised and metered. The work for converting these connections to metered connections by October 2018 is underway and needs to be carried out on war footing, being imperative for turnaround of Discoms.

Demand growth

To achieve the objective of 24x7 power supply, the State would need to meet the increase in demand. The broad approach for projection of demand is highlighted below:

1. The daily household consumption has been computed separately for rural and urban households for FY17 and escalated in line with the historical trend after considering an additional factor for increasing the number of supply hours in the rural areas.

2. The new consumer addition in rural as well as urban areas, due to the electrification of households is then multiplied by average household consumption in the respective areas.

3. The annual sales in the domestic category have been arrived at on the consideration that households in both rural and urban categories would be consuming electricity at their respective projected daily household consumption rates.

4. Sales in categories other than households have been considered to increase at the respective CAGRs over the past five years.

5. The supply hours in rural areas will be increased to 24 hours by 2019.

6. All agricultural connections, which have been identified under the DDUGJY scheme for feeder separation, will be segregated by early 2019. Average 10 hours of supply has been considered for these agricultural consumers and, for the remaining agricultural consumers, there will be round-the-clock supply.

The peak demand is expected to rise from 17,355 in FY17 to around 18,918 MW in FY19 (and 24,777 MW in FY22) after including electrification of all households as well as impact of energy efficiency measures.

Similarly, the energy requirement would increase from the current requirement of about 1,08,853 MU in FY17 to 1,22,856 MU in FY19 (and 1,60,903 MU in FY22) after including electrification of all households as well as impact of energy efficiency measures.

Considering the variations in peak demand within the day as well as across the year, CEA will assist the State

in formulating a strategy for flattening the load curve within next three months.

Generation capacity

In FY17, the total contracted capacity for the State is 22,602 MW.

Coal-based capacity constitutes about 79% of the total capacity, followed by hydro (10%), renewable (7%), gas-based (3%), and nuclear (2%).

To meet the increasing demand in the future, the State has planned an additional capacity of 11,282 MW from own generating stations and allocations from central generating stations, besides sourcing power from private generating stations under Case 1 competitive bidding and renewable energy sources in a phased manner by FY22. The State is also planning to enhance the capacity of its existing power plants through RM&U schemes.

With the planned capacity addition and achievement of the targeted loss, the State is expected to fully meet its requirement (in energy terms) through the contracted capacity. However, considering huge variations in demand for short durations in the day, the State needs to effectively strategise power purchase planning including setting up a mechanism for meeting short-term peaking requirement. The plan may also adequately explore all cheaper sources of short to medium-term power purchase through bilateral arrangements or through exchange, etc.

Further, to bring in more efficiency along with reduction of the overall power procurement costs, the Government of India and State of UP may explore:

- Coal swapping for Parichha (2x110 MW + 2 x 210 MW), Parichha (2x250 MW), Harduaganj TPS (2 x 250 MW), Rosa TPP (4 x 300 MW), Bajaj TPP (5 x 90 MW)
- Aggregation of linkage for different stations so as to save payment of additional charges on account of
  - ✓ *Commitment charges for lower offtake of coal due to lower operational performance of old stations*
  - ✓ *Incentive on account of higher procurement of coal for super critical stations*
- Accelerating development of coal block allotted to UPRVUNL

Transmission network

Commensurate capacity addition in the interstate and intrastate transmission systems have been planned based on an estimated peak demand of 18,918 MW in FY19, while keeping in view that around 40% of the power requirement of Uttar Pradesh is going to be met from plants connected to the interstate transmission network.

PGCIL has planned to increase the transformation capacity at 765/400 kV voltage level from 24,000 MVA to 30,500 MVA and at 400/220 kV voltage level from 9,615 MVA to 10,430 MVA. It also has a transmission capacity of 300 MVA at 220/132 kV voltage level. UPPTCL is also planning to substantially augment its transformation capacity levels. Between FY17 and FY19, the transmission capacities at 765/400 kV and 400/220 kV voltage levels are planned to go up from 9,000 MVA to 16,000 MVA and from 16,585 MVA to 24,585 MVA, respectively.

The capacity planned by UPPTCL, purely for the intrastate transmission system, at 220/132 kV in FY19 is projected to go up to 39,140 MVA from 29,750 MVA currently, while the capacity at 132/33 kV is projected to go up to 45,363 MVA from 37,221 MVA. Commensurate additions in transmission line capacities have been planned at voltage levels of 132 kV and above. The system has been planned with a view to relieve uncomfortable sectoral overloading of transformers and concurrently address the contingency issues to provide reliable power.

The challenges in transmission pertaining to congestion would require a detailed load flow study by UPPTCL (which should be verified by CEA within a total

timeframe of three months) and the addition of renewables would require a study of integration of the clean-energy grid. Based on requirement, the State will look for options for the construction of new lines through tariff-based competitive bidding (TBCB) route and invite more private participation.

Adequate capacity and line additions would enable the intrastate transmission system to adequately cater to the projected demand in FY19.

Distribution network

The State has submitted a perspective distribution plan to CEA, envisaging substantial distribution capacity addition in the next few years. This would include augmentation of the existing network as well as expansion and provision of last-mile connectivity to un-electrified areas. Presently, distribution transformation capacity at 33 kV level is about 44,677 MVA, over and above which the Discoms are planning to add about 7,762 MVA, resulting in cumulative total capacity of 52,403 MVA by the end of FY19. At the DT level, huge capacity addition is planned which is expected to reach to 55,701 MVA by end of FY19.

The critical challenges in distribution include last-mile connectivity, illegal connections, high losses and quality of supply for which the State plans to take measures such as feeder separation, smart meter installation, and metering. Discoms aim to convert unmetered connections into metered connections by formulation of a suitable metering policy.

To improve voltage profile and reduce line losses, the State has planned to install 3,302 capacitor banks with total capacity of over 8,300 MVAr.

On overall basis, the capacity addition is considered adequate to meet the increased demand owing to addition of electrified households under various schemes on top of normal load growth. Funds of Rs 21,766.38 crore are available with the State under ongoing central schemes (IPDS, RAPDRP, and DDUGJY) and ongoing state schemes. To ensure 100% electrification in the State by 2019, the State shall undertake a survey and work out the additional fund requirement, if any. The source of such additional funding shall be separately explored.

AT&C losses

Under Ujwal Discom Assurance Yojana (UDAY), the State Government, Discoms and the Government of India have signed a tripartite agreement, under which the State has agreed to reduce AT&C loss to 19.36% by FY19 and 14.86% by end FY20, from current level of 34.22% in FY15. The trajectory of loss, as agreed under UDAY, has been taken into account for preparing this roadmap document. For NPCL, the projected AT&C and distribution loss targets for FY19 have been considered as 8.92% and 8.00%, respectively.

To achieve these targets, the State shall pursue implementation of ongoing schemes - i.e., IPDS, RAPDRP, DDUGJY, Vidyut Chori Roko Abhiyan (VICRA) - and will also take additional steps, including installation of prepaid meters, defective meter replacement, raids for checking thefts, replacement of mechanical meters, and metering of unmetered connections on a war-footing basis.

Clean-energy initiatives

The State has notified policies such as Solar Power Policy, 2013, and RPO Compliance Regulations, for the promotion of clean energy in the State. The State plans to add 2,767 MW of grid-connected renewable energy plants and around 58.6 MW through off-grid projects up to FY19.

A 440 MW solar park has been allotted to Uttar Pradesh for which MNRE would provide CFA of Rs 88 crore (i.e., Rs 20 lakhs/MW). However, as the Cabinet has increased the aggregate capacity of solar parks from 20,000 MW to 40,000 MW, the State Government can apply for higher capacity.

Investment in biomass is expected to be around Rs. 1,125 crore in next two years with total addition of 150 MW.

Energy conservation and efficiency

As per the report of National Productivity Council there is scope for 13-15% reduction in electricity usage through demand side measures, which translate into 15,000 MU of annual energy savings, resulting in around 1,500 MW of avoidable capacity.

In U.P., approximately 10 lakh pump-sets are used for agriculture. State Government may prioritise replacement of very old pumps with energy-efficient pumps with smart control panels.

State has vision to distribute 10 crore LED bulbs in Uttar Pradesh. EESL will supply LED bulbs through its distribution partners under UJALA scheme. EESL's regional officers will ensure frequent and high number of distribution kiosks at all places in U.P. Discoms will also hold necessary awareness programmes among common people on UJALA scheme for its success.

State Government may also sign agreement with EESL on replacement of entire state's conventional street lights with LED street lights, which will help in reduction of peak load during evening hours.

Financial turnaround

The Government of India, the Government of Uttar Pradesh and the Discoms in the State have signed a memorandum of understanding under UDAY on January 30, 2016, for operational and financial turnaround of Discoms. As envisaged in the scheme, the Government of Uttar Pradesh has taken over 75% of the total Discom debt outstanding as on September 30, 2015. Further, during FY16 and FY17, state bonds of Rs 39,133 crore and Discom bonds of Rs 10,376 crore have been issued.

As per the UDAY MoU, the State is expected to turn profitable by FY19.

Other initiatives

GOI has launched number of mobile applications and IT initiatives to enhance accountability and transparency in measuring and monitoring the power scenarios and project status at various state and central levels. UP state will also collaborate with GOI to effectively utilise these initiatives and applications. Major applications are:

- **Vidyut PRAVAH:** This app provides highlights of power availability, demand and market price in the exchange on real-time basis.
- **Tarang:** Monitors intra and inter-state transmission projects' status on pan-India basis for ensuring timely corrective actions.
- **DEEP:** Supports short and medium-term power procurement, in a uniform and transparent manner by utilities.
- **GARV – II:** App provides village-wise and habitation-wise baseline data of household electrifications of all states
- **URJA:** App provides outage information, addressing complaints and power reliability of urban IT-enabled towns.
- **National UJALA Dashboard:** App provides effective monitoring of distribution of LED to state utilities.
- **UDAY Monitoring Portal:** App provides effective monitoring of various parameters and reform measures signed under UDAY scheme.
- **URJA Mitra:** App provides effective monitoring of power outage and information dispensation to consumers.

The State Government will also adopt new technologies and measures on a large scale such as:

- Requirement of regional distribution control centres (RDCC) within the State will be identified in view of upcoming projected load. These will initially cater to the principal load centres, but would thereafter be expanded to all load centres of the State. This will be a key initiative, not only for effectively managing 24x7 power supply, but also thereafter for other functions like load forecasting.
- Project monitoring tools shall be incorporated in the PMU to ensure that progress on the investments in the State are monitored rigorously and bottlenecks identified.

- Establishment of IT-enabled Online Energy Metering, Billing & Collection System in state DISCOMs. Establishment of meter data acquisition system (MDAS), which will be integrated with all feeders and select consumers' meters. Integration of MDAS with Online Billing System will facilitate computation of feeder-wise AT&C losses. MDAS will also provide frequency and duration of power interruption and improve customer care centre services.
- Above online services may also be implemented in rural areas of the State using cloud computing-based, web-enabled IT system, which will provide metering billing and collection (MBC) and other consumer-centric services on internet. This system will facilitate setting up of mobile camps for consumer billing and collection services at 40,000 consumer service centres throughout the State.
- Implementation of various mobile applications for ease of business operation, to provide consumers on-the-go services and monitoring of KPIs of commercial activities.
- Mobile applications for the consumer (Consumer App), management (Management App) and field activities (Field App) shall be developed on priority basis with monitoring dash board.

Table of contents

1 Introduction

Power sector is a critical infrastructure element for an economy's growth. Availability of reliable, quality and affordable power is vital for rapid growth in agriculture, industry and for overall economic development of a state. An efficient, resilient and financially healthy power sector is an essential requirement for growth of a state and economic empowerment of the common man.

Under the Indian Constitution, electricity is a concurrent subject. As per Electricity Act 2003, it is the duty of a distribution licensee to develop and maintain an efficient, coordinated and economical distribution system in the mandated area of supply as well as to supply electricity in accordance with the provisions contained in the Act. The State Electricity Regulatory Commission (SERC), as per the provisions of the Act, specifies and enforces the standards with respect to quality and reliability of supply by licensees and also monitors the performance of distribution companies (licensees) on the basis of notified performance standards.

Objectives and key outcomes of the 24x7 Power for All joint initiative

The 24x7 Power for All (24x7 PFA) is a joint initiative of the Government of India (GoI) and the Government of Uttar Pradesh (GoUP) with the objective to make 24x7 power available to all households, industry, commercial, public needs, any other electricity-consuming entity, and adequate power to agriculture farm holdings.

Towards this goal, the 24x7 PFA initiative seeks to:

i. Ensure reliable 24x7 supply to consumers by 2019. The hours of supply for agriculture consumers will be decided by the State Government as per requirement.

ii. Ensure that all unconnected households are provided access to electricity in a time-bound manner by 2019.

iii. Ensure adequate capacity addition planning and tie-ups for power from various sources at affordable price to meet the projected power demand in future.

iv. Strengthen the transmission and distribution networks to cater to the expected growth in demand of existing as well as future consumers.

v. Assess financial measures including optimisation of investments and undertaking of necessary balance sheet restructuring measures to ensure liquidity in the finances of the utility.

vi. Put in place a strategy to ensure reduction of AT&C losses as per agreed loss reduction trajectory and methodology and chalk out measures required at every level of distribution.

vii. Identify steps for implementation and adoption of modern technologies to monitor reliability of supply. Identify steps for monitoring and timely commissioning of various generating plants and transmission and distribution infrastructure to meet the expected growth in demand.

viii. Take measures for meeting the performance standards, as laid down by UPSERC.

This document is an action plan drawn to achieve the above aims and objectives. The plan will be executed by the Government of Uttar Pradesh with the support of Government of India, wherever necessary, as per their approved plans, schemes and policies.

Methodology for preparation of the action plan for 24x7 Power for All

The plan aims at the following:

1) Bridging the gap between demand and supply for the already identified/registered consumers and other consuming entities

2) Connecting the unconnected households and unconnected farm holdings

Accordingly the methodology adopted to prepare the 'Action Plan' for 24x7 PFA includes, inter-alia:

1) Project average per day consumption of rural and urban households based on respective historical compounded annual growth rates (CAGR) during the past five years.

2) Project the demand of commercial, industrial and agriculture consumers based again on past data and historical CAGR recorded during the past five years.

3) Assess the power requirement of un-electrified households and draw up a time-bound plan for electrification of all households.

4) Project the annual energy requirement and maximum demand by aggregating the requirement of all consumer categories and applying an appropriate load factor.

5) Draw up a broad plan to meet power demand in future through:

   - ✓ *State's own upcoming generation resources*
   - ✓ *Allocation from upcoming central sector power plants*
   - ✓ *Quantum of additional procurement required*

6) Assess the additional energy requirement for providing 24x7 power supply to all households in the State as well as to other consumer categories and determine financial implications on utilities for procuring additional energy and its implications on tariff.

7) Assess the adequacy of the network - both inter-state and intra-state transmission as well as distribution so as to meet the increased / expected / projected power requirement of all consumer categories of the State.

8) Conduct sensitivity analysis for cost of service and resulting financial gap under multiple scenarios, namely, tariff hike, reduction in power procurement cost and increase in interest and moratorium period and AT&C loss reduction, etc.

9) Set measurable targets to achieve the goal of 24x7 Power for All in a cost-effective manner for consumers of the State.

2 Facts about Uttar Pradesh

Key facts	
Constituted on	April 1, 1937 (renamed Uttar Pradesh in 1950)
As per 2011 census	
Total area *- Rural areas* *- Urban areas*	**2,40,928 sq km** *2,33,366 sq km (96.86%)* *7,562 sq km (3.14%)*
Administrative districts	75
Population *- Rural* *- Urban*	**19,98,12,341** *-15,53,17,278 (77.73%)* *-4,44,95,063 (22.27%)*

Facts

Uttar Pradesh is the most populous state of the country, with Lucknow being its administrative capital. Ghaziabad, Kanpur, Moradabad, Aligarh, Meerut, Bareilly, Gorakhpur, Noida, Allahabad, Jhansi and Varanasi are known for their industrial importance, both at the State and national level. On November 9, 2000, a new state, Uttarakhand, was carved out from the Himalayan hill region of Uttar Pradesh.

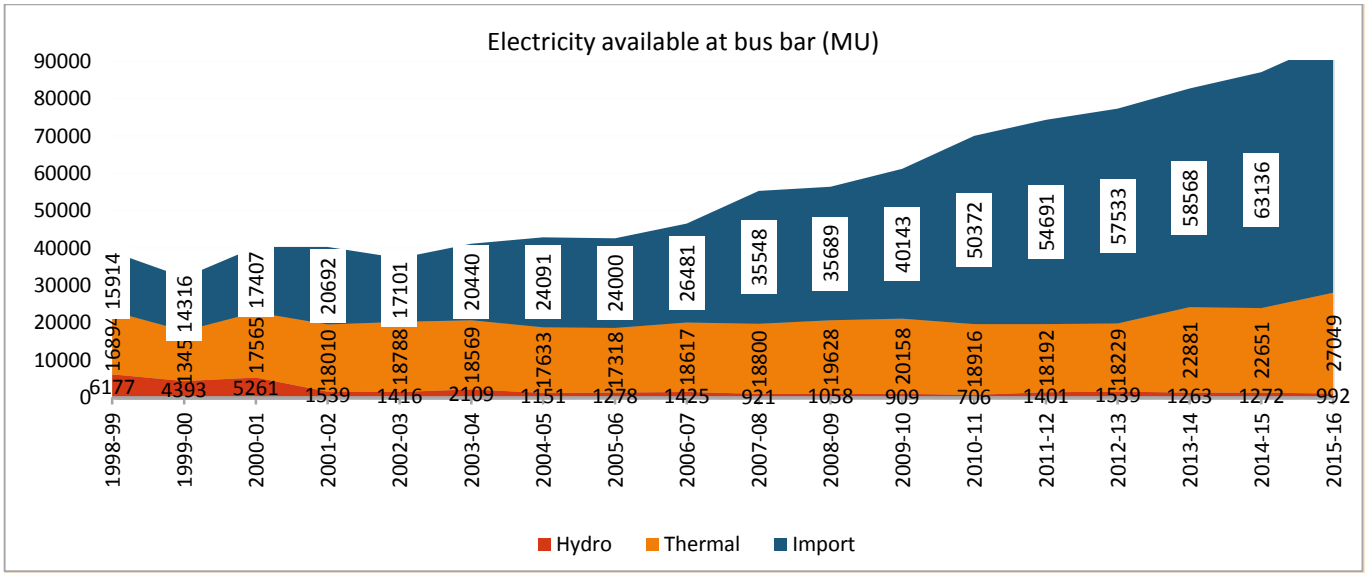
With a literacy rate of around 70%, the State has abundant availability of quality human resources. Uttar Pradesh is a significant destination for investments in the manufacturing, tourism and infrastructure sectors.

Growth of power sector in Uttar Pradesh

Growth of the power sector in Uttar Pradesh is a part of the larger growth story of the country. The installed capacity has grown from 1,362 MW in 1947 to 22,602 MW in 2017.

Much of the increase in capacity for meeting the ever-increasing demand has taken place over the past two decades, for which reliable official data is available.

Energy available at the output bus bars of power plants has increased from 38,985 MU in FY99 (1998-99) to 93,099 MU in FY16, an increase of 139% in 18 years, implying 5% CAGR. The graph belowh illustrates this growth curve.

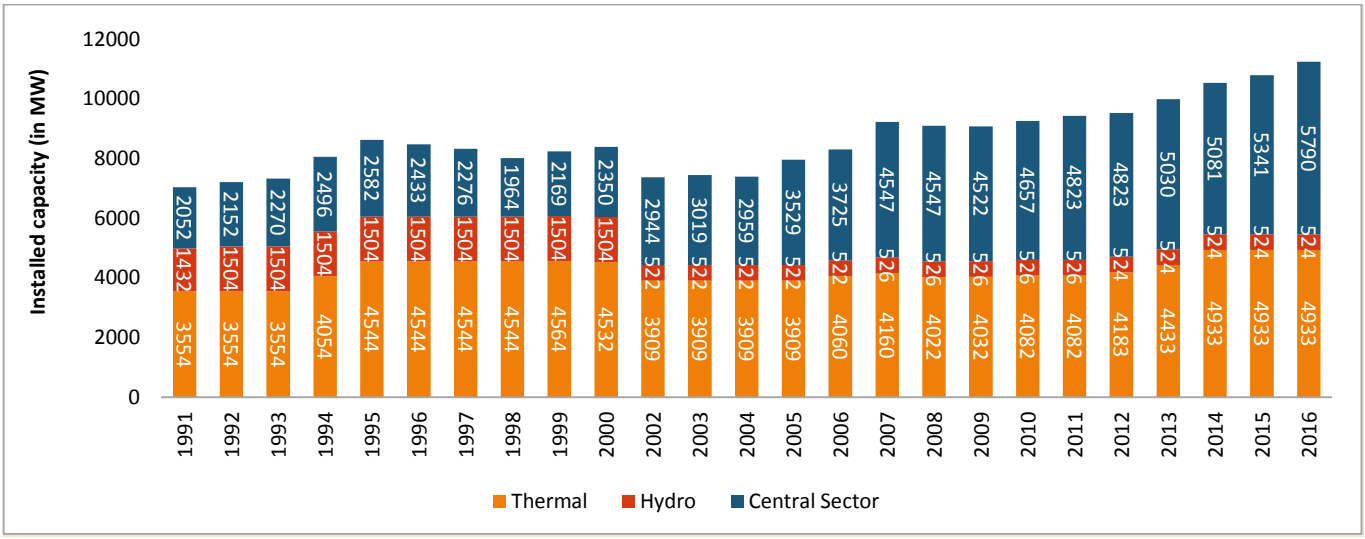


Generation mix

Over the past quarter of a century, the share of hydro generation (UPJVNL-UP Jal Vidyut Nigam Ltd.) has declined steadily, from 1432 MW in FY91 to just 525 MW in FY16. The contribution of state's thermal generation plants (UPRVUNL-UP Rajya Vidyut Utpadan Nigam Ltd.) has increased from 3,554 MW in FY91 to 4,933 MW in FY16, an increase of just 39% in 25 years.

The contribution of the Central sector plants, which was 2052 MW in FY 91, surpassed the contribution of the state's thermal generation plants in FY 07, and is now the highest among the three major sources meeting the state's electricity demand at 5,790 MW, signifying an increase of 182% in 25 years.

The graph below shows source-wise change in the generation mix in the past 25 years.



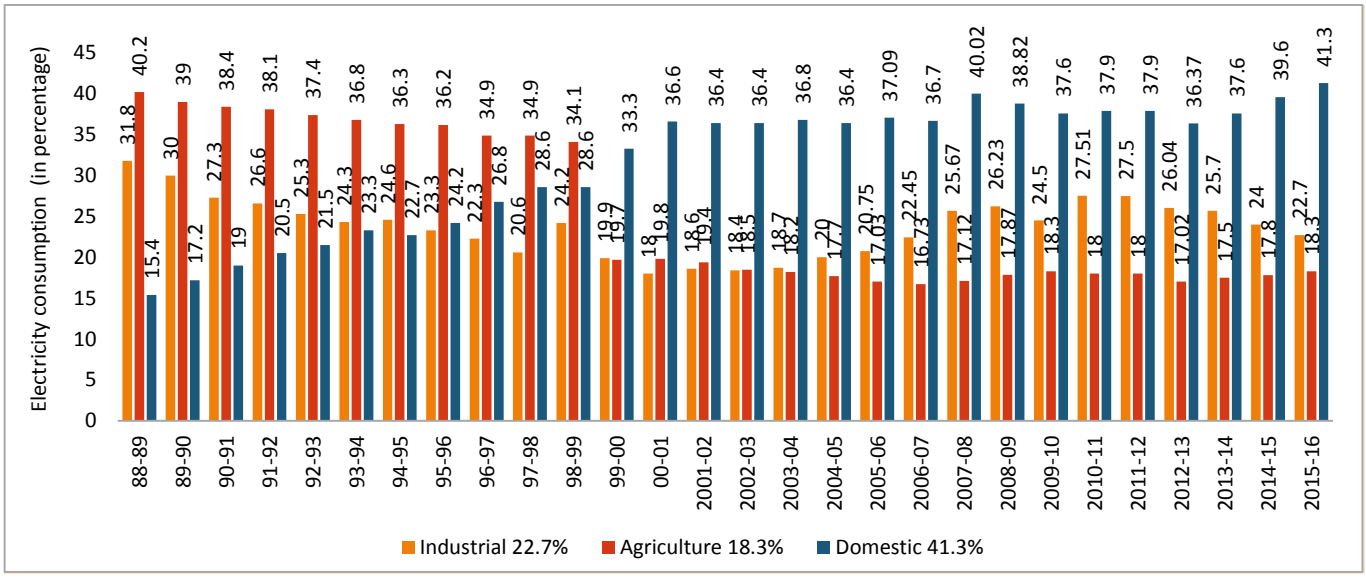
Consumer category-wise consumption

The consumer profile, which means the share of different consumer categories in energy consumption, is very important, as it determines the element of cross-subsidy in tariff design. In the past 28 years, for which data is readily available, the consumer mix has radically changed.

While the share of domestic consumption was the lowest among the three major consumer classes in FY 89 at 15.4%, it now accounts for the largest share of consumption at 41.3%.

The agricultural sector accounted for the largest consumption in FY 89 at 40.2%; it now stands at the lowest, with just 18.3% share of consumption. The share of industry has come down from 31.8% in FY16 to 22.7%.

The graph below shows the consumer category-wise percentage share of consumption in past 28 years.



Reforms in the power sector (creation of the utilities and regulatory commission)

The erstwhile UPSEB was unbundled into the following three separate entities through the UP Reforms Transfer Scheme, 2000, dated January 14, 2000:

- **Uttar Pradesh Power Corporation Limited** (UPPCL) for transmission and distribution within the State
- **Uttar Pradesh Rajya Vidyut Utpadan Nigam Limited** (UPRVUNL) for thermal generation
- **Uttar Pradesh Jal Vidyut Nigam Limited** (UPJVNL) for hydro generation

After the enactment of the Electricity Act, 2003, the following four new distribution companies were created, vide the Uttar Pradesh Transfer of Distribution Undertaking Scheme, 2003:

- **Dakshinanchal Vidyut Vitran Nigam Limited** (Agra discom, or DVVNL)
- **Madhyanchal Vidyut Vitran Nigam Limited** (Lucknow discom, or MVVNL)
- **Paschimanchal Vidyut Vitran Nigam Limited** (Meerut discom, or PVVNL)
- **Purvanchal Vidyut Vitran Nigam Limited** (Varanasi discom, or PuVVNL)

Kanpur Electricity Supply Company (KESCO) is another state-owned distribution licensee responsible for distribution and supply of electricity in Kanpur city.

M/s Noida Power Company Limited (NPCL) is a private distribution utility, supplying electricity in the Greater Noida area.

In 2009, electricity supply in Agra has been given to Torrent Power, under the input-based franchisee model.

The transmission function in the State is undertaken by Uttar Pradesh Power Transmission Corporation Limited (UPPTCL), which was incorporated in 2006.

Uttar Pradesh Rajya Vidyut Utpadan Nigam Limited (UPRVUNL) and Uttar Pradesh Rajya Jal Vidyut Nigam Limited (UPJVNL) look after thermal and hydro generation in the State, respectively.

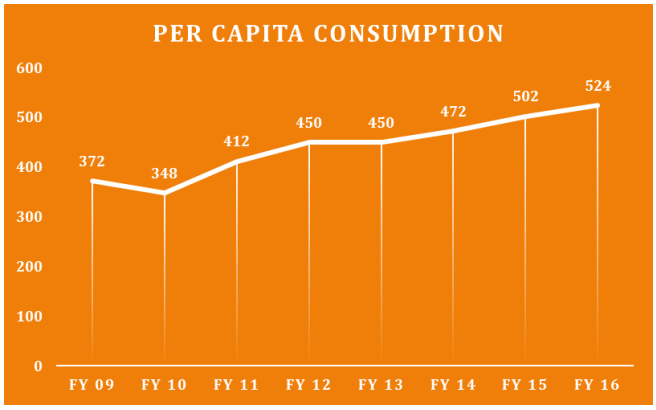
The enactment of the UP Electricity Reform Act, 1999, also resulted in setting up of Uttar Pradesh Electricity Regulatory Commission (UPERC), an autonomous body corporate.

3 Consumption pattern and electrification status

Electrification status and per-capita consumption

Based on annual energy consumption from FY09 to FY16, the trajectory of per-capita consumption of electricity is shown below:

Figure 1: Per-capita consumption of electricity (kWh per person) in recent years



- **The per-capita consumption has shown an increasing trend from FY10 with CAGR of 5.01%, due to higher industrial sales as well as increased availability of power over the years.**

Status of electrification

District-wise electrification in urban and rural areas is detailed in Annexure 1.

A summary of electrified and un-electrified households, as per the 2001 and 2011 Census, and projections for FY17 based on a CAGR for the past 10 years, are tabulated below:

Table 1: Projection of households based on Census 2001 and 2011

Particulars	Total households
Total	
2001	*2,57,60,601*
in %	100.00%
2011	*3,29,24,266*
in %	100.00%
CAGR	2.48%
FY17 (projected households)	**3,82,19,811**
Rural	
2001	*2,05,90,074*
in %	79.93%
2011	2,54,75,071
in %	77.37%
CAGR	2.15%
FY17 (projected households)	**2,89,46,089**
Urban	
2001	*51,70,527*
in %	20.07%
2011	74,49,195
in %	22.63%
CAGR	3.72%
FY17 (projected households)	**92,73,722**

From the above, it is observed that:

- **More than 75% of households are in rural areas.**
- **Overall, the number of households has grown in the past decade, at a CAGR of 2.48% (urban 3.72% and rural 2.15%).**

Various schemes of rural electrification under X/XI/XII/DDG/ DDUGJY plans are underway and substantial part of these schemes has closed in recent years. Further, rapid urbanisation has taken place in last few years. Since the Discoms' records are more authentic, their figures have been taken to reflect the present electrification level of the State.

Rural un-electrified households for FY17

Considering the projections as per the last Census, there are 2.89 crore rural households in the State. Out of them, 0.92 crore rural households already exist in Discom's records.

The State undertook a survey in FY15 to map habitations that have drinking water supply. This survey also captured the status of electrification and accordingly, was considered during finalisation of DDUGJY scheme. As per the survey, additional 0.25 crore households were being served through existing network. Also, under various ongoing rural electrification schemes, about 1.09 crore un-electrified households (or approximately 1,62,000 habitations)

were targeted to be served through additional network being created.

Till FY17, necessary infrastructure works for approximately 88,000 habitations have already been completed, resulting in ready access of electricity to additional 0.59 crore households.

This implies that at end of FY17, 0.84 crore households have ready access to electricity, but are yet to be formalised and metered. Hence, for drawing up this roadmap document, these 0.84 crore households are considered to be electrified as they are already contributing to the overall demand of the State. Accordingly, the status of electrification in the State is tabulated below:

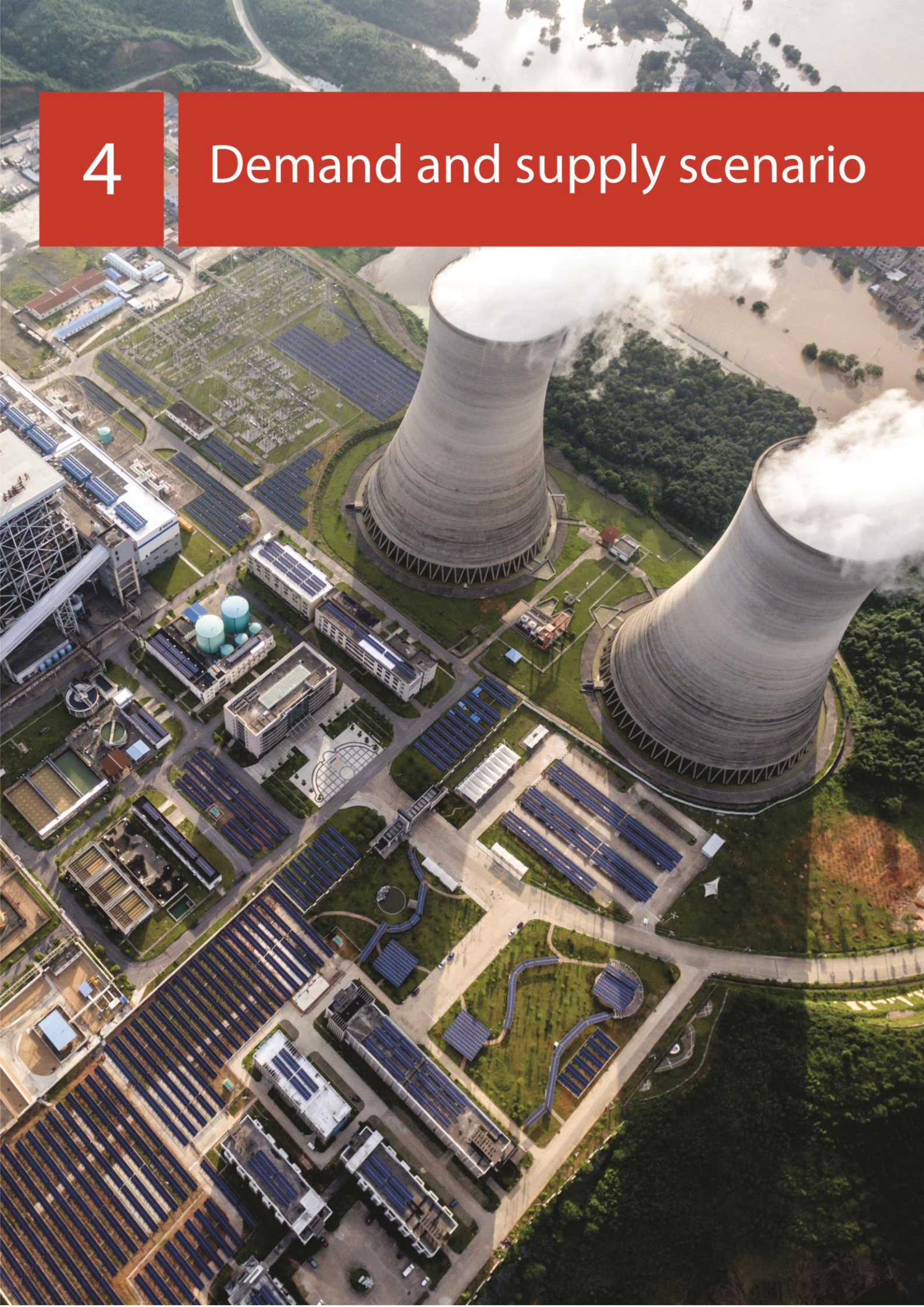
Particulars	Status (FY17)
Total rural households	2,89,46,089
Total electrified households on Discom records	92,72,706
Households **with access** to electricity (old + newly created) and yet to be formalised	84,62,695
Balance to be electrified	**1,12,10,688**
Households to be electrified (already covered in the infrastructure being created in the ongoing schemes)	49,97,696
Balance households to be electrified	**62,12,992**

It is noted that in the past, money has been sanctioned under various rural electrification schemes including DDUGY, for electrifying the households in the State. As detailed in above table, there are around 1.12 crore un-electrified households in the State. The State Government with the support of the Central Government shall endeavour to ensure that these households are electrified by 2019. Out of these un-electrified households, the State endeavours to electrify 0.50 crore households by October 2018 under the ongoing schemes. Further, the State will validate the balance 0.62 crore un-electrified households by undertaking a survey and formulate DPRs for electrification of the final verified un-electrified households by July 2017. For this purpose, State Government shall make efforts to tie up the necessary funds required from available sources including Government of India.

Urban un-electrified households for FY17

Similarly, considering the projections as per Census, there are 0.93 crore urban households in the State. Out of them, 0.78 crore urban households already exist in Discom's records. The State envisages to target the electrification of these remaining 0.15 crore urban households by 2019 after undertaking appropriate augmentation/ extension of the existing network of urban areas. As these consumers are not covered under any existing scheme, the State needs to formulate a scheme to connect all urban un-electrified consumers within the target date.

4 Demand and supply scenario



Current power supply position

The actual energy and demand scenario during the past eight years is shown below:

Figure 2: Energy requirement versus availability (in MU)

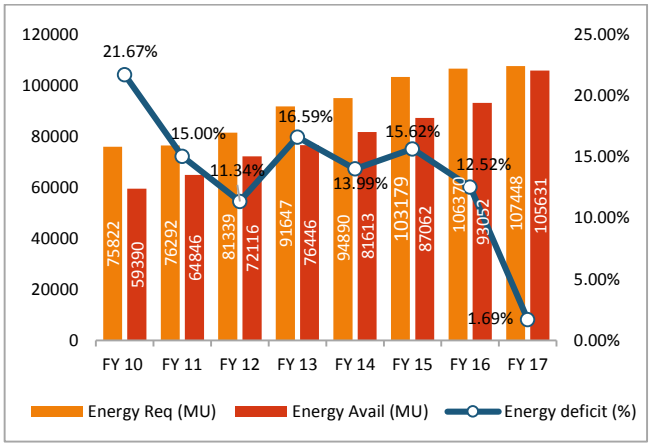
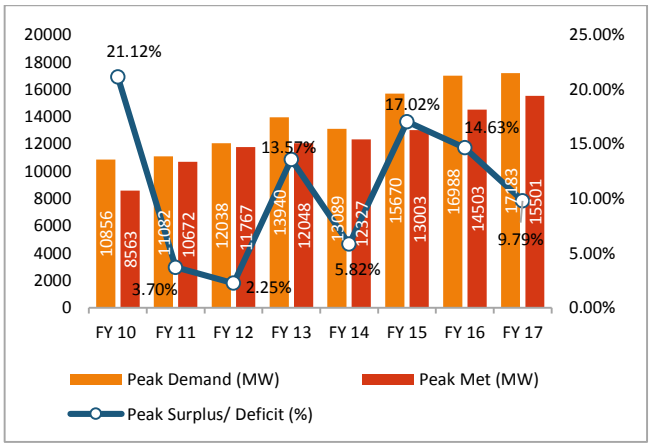


Figure 3: Peak demand versus peak met (in MW)



Demand has been steadily increasing over the years. Indeed, the supply hours have increased considerably, from October 2016, as shown in the table below:

Table 2: Average number of supply hours for FY17 (as on date)

Description	Avg number of supply hours
Rural	18 Hours
Tehsil towns and Bundelkhand	20 Hours
District HQ and cities	24 Hours

Demand projections

The energy requirement and peak demand of the State in FY17 were 1,07,448 MU and 17,183 MW respectively, in comparison to which energy supplied and demand met were 1,05,631 MU and 15,501 MW respectively. With complete electrification as well as 24x7 power supply envisaged across the State, demand is likely to increase.

Accordingly, the demand is estimated after considering the phased implementation of electrification levels as well providing 24-hour supply of power to the existing and newly electrified consumers by 2019. The state also plans to have a 10-hour supply schedule to all the agricultural consumers, whose connections have been segregated under the ongoing feeder-segregation works. Demand can be classified into following broad categories:

a) Demand on account of 24x7 power supply to electrified and newly built domestic households

b) Demand from the electrification of un-electrified domestic households

c) Change in demand on account of metering of existing unmetered consumers

d) Change in demand on account of formalisation of connections where infrastructure is created

e) Change in demand on account of the ongoing feeder-segregation activities with a 10-hour supply to segregated consumers

f) Demand on account of 24x7 power supply to other than domestic category

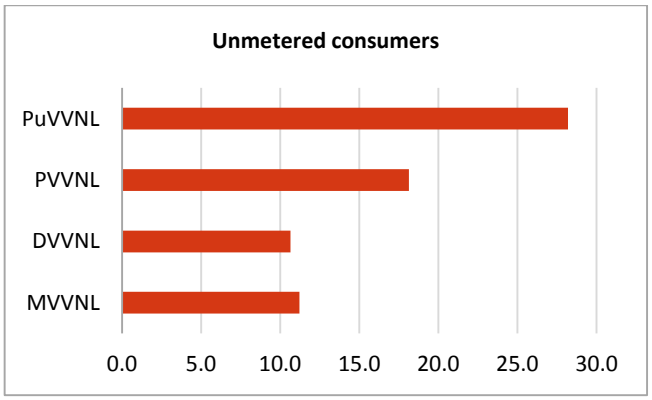
Determination of average growth rate in daily household consumption

Daily household consumption is 3.40 kWh in rural areas and 6.87 kWh in urban areas in FY17.

As stated above, apart from a large number of un-electrified households, another major issue in the State is the large number of unmetered connections.

Following figure shows the status of unmetered domestic connections in FY17 in the State:

Figure 4: Unmetered domestic consumers



In FY17, there were almost 68 lakh unmetered domestic consumers in the State, accounting for 40% of total 170 lakh domestic consumers. Discom-wise details are as shown in the table below:

Table 3: Discom-wise details of unmetered consumers (Lakh)

Discom	Total domestic consumers	Metered consumers	Unmetered consumers
MVVNL	40.2	29.0	11.2
DVVNL	34.3	23.6	10.7
PVVNL	44.0	25.8	18.2
PuVVNL	46.1	17.9	28.2
KESCO	5.4	5.4	0.0
NPCL	0.6	0.6	0.0
Total	**170.6**	**102.4**	**68.3**

To achieve the target of providing 24x7 power to all by 2019 and effectively monitor the same, it is important to achieve 100% metering as well. The state has targeted to convert all unmetered household connections to metered connections by 2019.

The broad approach for projection is highlighted below:

a) The daily household consumption has been computed separately for rural metered, rural unmetered and urban households for FY17 and escalated in line with the historical trend after considering an additional factor for increasing the number of supply hours in the rural areas.

b) The new consumer addition in rural as well as urban areas, due to electrification of households is then multiplied by average household consumption in the respective areas.

c) The annual sales in the domestic category have been arrived at, on the consideration that households in both rural and urban categories would be consuming electricity at their respective projected daily household consumption rates.

d) Sales in categories other than households have been considered to increase at the respective CAGRs over the past five years.

e) The supply hours in rural areas will be increased to 24 hours by 2019.

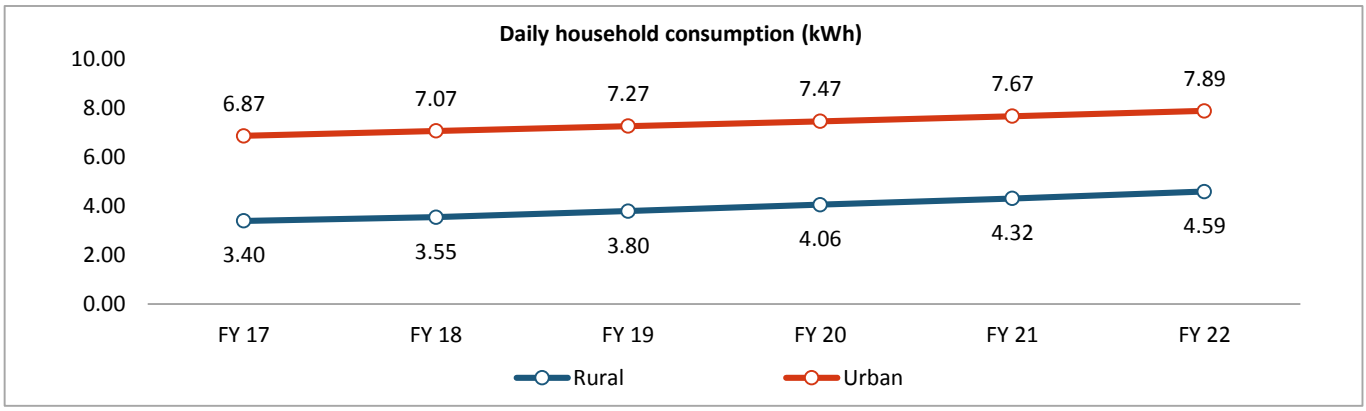
f) All agricultural connections, which have been identified under the DDUGJY scheme for feeder separation, will be segregated by early FY19. Average 10 hours of supply has been considered for these agricultural consumers; for the remaining agricultural consumers, there will be round-the-clock supply.

Determination of consumption of households (electrified and un-electrified)

Average daily household consumption of the existing electrified rural and urban households in FY17 has been arrived at by dividing the actual sales in rural and urban areas (as per the information provided by Discoms) by the actual number of electrified rural and urban households in FY17, respectively.

The projected daily household consumption in urban and rural areas is shown below:

Figure 5: Projected daily household consumption of electricity (kWh) until FY22



Accordingly, the annual consumption of the domestic households is tabulated below:

Table 4: Projected sales from existing and newly electrified households

Particulars	S No.	FY17	FY18	FY19	FY20	FY21	FY22
Rural - Electrified consumers (existing + projected growth)							
Rural metered consumers (in nos)		24,50,165	63,19,929	97,13,817	1,01,99,508	1,07,09,483	1,12,44,957
Daily household consumption (in kWh) - Rural M		3.40	3.55	3.80	4.06	4.32	4.59
Projected annual consumption (in MU) - Rural M	**A**	3,028	5,681	11,105	14,760	16,471	18,403
Rural unmetered consumers (in nos)		68,25,147	30,77,891				
Rural UM - transferred to metered			37,47,256	30,77,891			
Daily household consumption (in kWh) - Rural UM		3.39	3.67	3.99			
Projected annual consumption (in MU) - Rural UM	**B**	7,888	6,624	2,243			
Rural - electrification of un-electrified consumers							
Targeted annual addition (in nos)		42,31,348	52,40,755	59,69,933			
Cumulative annual addition (in nos)		84,62,695	1,37,03,450	1,96,73,383	1,96,73,383	1,96,73,383	1,96,73,383
Projected annual consumption (in MU)	**C**	7,057	13,116	21,009	26,447	28,318	30,348
Total projected rural consumption (MU)	**D=A+B+C**	**17,973**	**25,421**	**34,357**	**41,207**	**44,790**	**48,751**
Urban - electrified consumers (existing + projected growth)							
Electrified consumers (in nos)		77,87,675	80,89,431	84,04,677	87,34,056	90,78,240	94,37,933
Daily household consumption (in kWh) – Urban		6.87	7.07	7.27	7.47	7.67	7.89
Projected annual consumption (in MU)	**E**	17,455	20,484	21,870	23,355	24,946	26,652
Urban - electrification of un-electrified consumers							
Targeted annual addition (in Nos.)			2,97,209	11,88,838			
Cumulative annual addition (In Nos.)			2,97,209	14,86,047	14,86,047	14,86,047	14,86,047
Projected annual consumption (in MU)	**F**		187	1,196	2,128	2,273	2,431
Total projected domestic consumption (In MU)	**G=D+E+F**	**35,427**	**46,092**	**57,423**	**66,690**	**72,009**	**77,834**

Determination of consumption of other consumers

For projection of sales from FY17 to FY22, the CAGR of previous five years has been considered for all categories. Based on this, the category-wise sales are tabled below:

Table 5: Projected category-wise sales (In MU)

Categories	FY17	FY18	FY19	FY20	FY21	FY22
LMV-1 (Domestic)	35,427	46,092	57,423	66,690	72,009	77,834
LMV-2 (Commercial)	5,762	6,354	7,010	7,739	8,547	9,445
LMV-3 (Public lamps)	937	1,003	1,076	1,156	1,244	1,341
LMV-4 (Public & private institutions)	1,601	1,699	1,807	1,928	2,063	2,214
LMV-5 (Small private tube well)	10,199	10,709	10,849	11,391	11,943	12,540
LMV-6 (Small industries)	3,244	3,433	3,636	3,854	4,087	4,337
LMV-7 (Public water works)	1,900	2,098	2,324	2,582	2,877	3,216
LMV-8 (State tube wells)	3,249	3,411	3,582	3,761	3,949	4,147
LMV-9 (Temporary connections)	261	316	384	468	572	700
LMV-10 (Departmental employees)	555	606	663	726	797	876
HV-1 (Non-industrial bulk load)	2,877	3,236	3,644	4,112	4,647	5,262
HV-2 (Large & heavy industries)	12,849	13,698	14,621	15,627	16,723	17,919
HV-3 (Railway traction)	1,051	1,148	1,265	1,407	1,583	1,801
HV-4 (Medium & large pumped canals)	1,021	1,068	1,117	1,170	1,227	1,287
Extra & bulk sales	2,855	2,858	2,862	2,866	2,870	2,874
Energy efficiency	0	-2,598	-9,092	-9,092	-9,092	-9,092
Total	**83,789**	**95,131**	**1,03,173**	**1,16,385**	**1,26,046**	**1,36,700**

Energy and demand requirement

AT&C loss reduction had been agreed to by the State with the Ministry of Power under UDAY. Uttar Pradesh has agreed to reduce AT&C loss to 19.36% and 14.86% by the end of FY19 and FY20, respectively, from 34.22% in FY15. The loss trajectory as agreed by the State under UDAY has been taken into account for preparing this roadmap document. For NPCL, the projected AT&C and distribution loss targets for FY19 have been considered as 8.92% and 8.00%, respectively:

Table 6: AT&C loss reduction trajectory

Discom	FY17	FY18	FY19	FY20	FY21	FY22
MVVNL	27.80%	23.20%	19.45%	14.89%	14.89%	14.89%
DVVNL	30.30%	24.83%	20.44%	15.35%	15.35%	15.35%
PVVNL	22.99%	20.63%	17.53%	14.01%	14.01%	14.01%
PuVNNL	34.19%	26.92%	20.65%	15.49%	15.49%	15.49%
KESCO	29.44%	24.11%	19.37%	14.45%	14.45%	14.45%
NPCL	9.49%	9.21%	8.92%	8.92%	8.92%	8.92%
Total	**28.27%**	**23.63%**	**19.36%**	**14.86%**	**14.86%**	**14.86%**

Table 7: Distribution loss reduction trajectory

Discom	FY17	FY18	FY19	FY20	FY21	FY22
MVVNL	18.31%	14.71%	12.17%	11.99%	11.99%	11.99%
DVVNL	21.49%	16.81%	13.47%	12.47%	12.47%	12.47%
PVVNL	20.48%	18.02%	14.79%	11.08%	11.08%	11.08%
PuVNNL	19.84%	14.04%	9.77%	12.62%	12.62%	12.62%
KESCO	23.76%	18.73%	14.42%	11.54%	11.54%	11.54%
NPCL	8.00%	8.00%	8.00%	8.00%	8.00%	8.00%
Total	20.16%	16.18%	12.89%	11.88%	11.88%	11.88%

The intra-state transmission losses have been considered at the current level, i.e., 3.59%.

Based on the loss-reduction trajectory, the projections of energy and demand requirement for the State are tabulated below:

Table 8: Energy requirement (In MU) and peak demand (in MW) for state

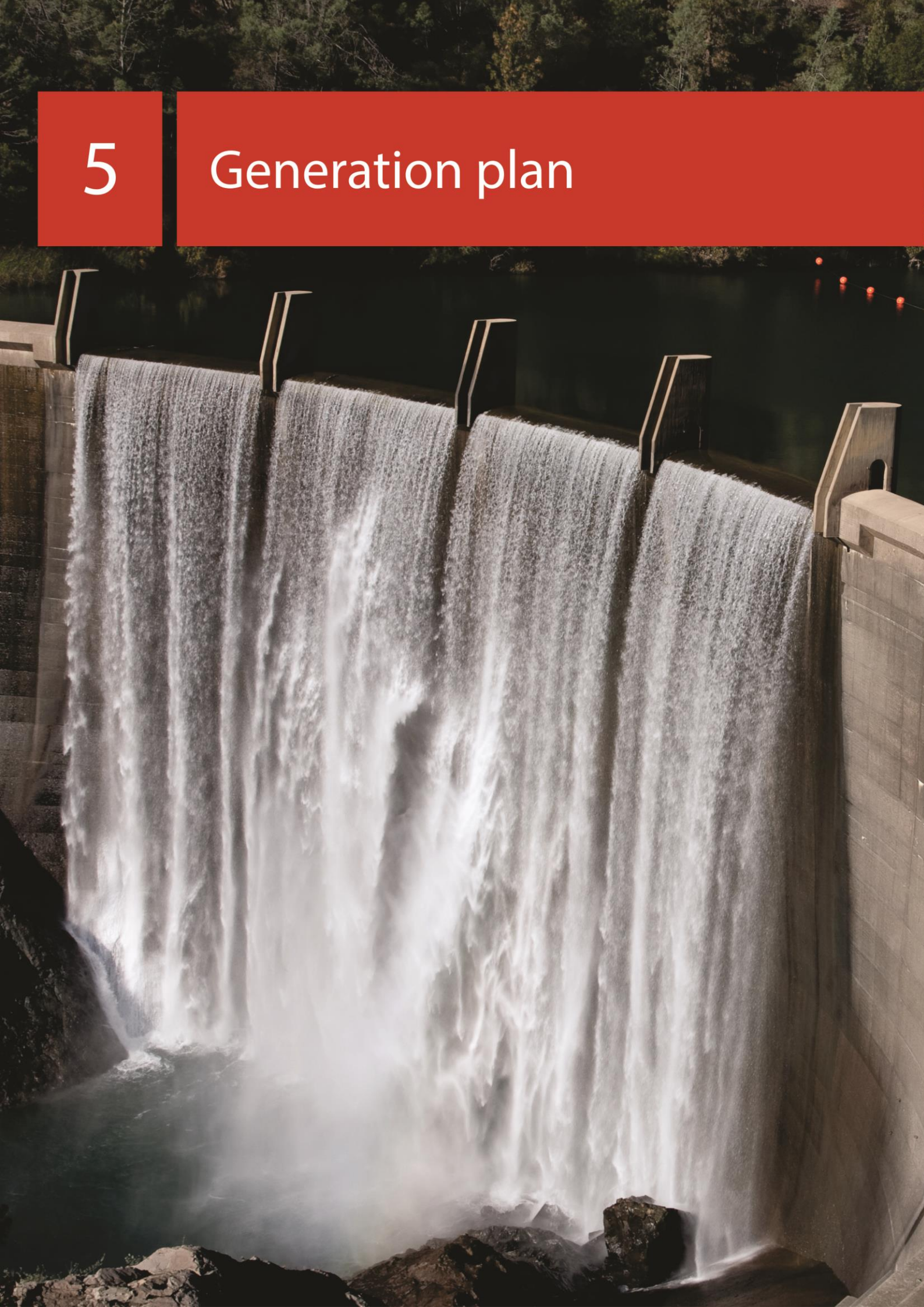
Particulars	FY17	FY18	FY19	FY20	FY21	FY22
Total Sale (MU)	**83,789**	**95,131**	**1,03,173**	**1,16,385**	**1,26,046**	**1,36,700**
Distribution loss	20.16%	16.18%	12.89%	11.88%	11.88%	11.88%
Energy Input at Distribution Interface	1,04,945	1,13,496	1,18,445	1,32,072	1,43,036	1,55,126
Intra State Transmission losses	*3.59%*	*3.59%*	*3.59%*	*3.59%*	*3.59%*	*3.59%*
Total Energy Requirement of the State (MU)	**1,08,853**	**1,17,722**	**1,22,856**	**1,36,990**	**1,48,363**	**1,60,903**
Load Factor	71.60%	74.93%	74.13%	74.13%	74.13%	74.13%
Maximum Demand (MW)	**17,355**	**17,934**	**18,918**	**21,095**	**22,846**	**24,777**

The load factor has been taken as 71.60%, as per the actual load factor of FY17. For FY18 and FY19, it has been taken as per 19th EPS and for remaining years it has been considered constant. Demand for FY19 is projected to be 18,918 MW considering the impact of 100% electrification as well as energy efficiency. The 19th EPS, on the other hand, has projected a maximum demand of 18,816 MW.

Considering the variations in peak demand within the day as well as across the year, CEA will assist the State in formulating a strategy for flattening the load curve within next three months.

An assessment of the adequacy of generation, transmission and distribution infrastructure for meeting the projected annual energy demand and peak demand has been made, which is covered in the subsequent chapters.

5 Generation plan



Cumulative generation availability

The distribution utilities of Uttar Pradesh procure power centrally at UPPCL level which buys power for the five state-owned Discoms, i.e., MVVNL, DVVNL, PVVNL, PuVVNL and KESCO. The private distribution utility NPCL undertakes its own power purchase planning and tie-ups on long-term as well as short-term basis. They have also entered into a long-term PPA with M/s Dhariwal Infrastructure Ltd on September 26, 2014 for 15 years for supply of 187 MW power.

As per the Power Supply Position Report of CEA, the peak demand for the State in FY16 was 16,988 MW, out of which only 14,503 MW had been met. In terms of energy (MU), the demand for the State in FY16 was 1,06,370 MU, out of which only 93,052 MU was met. Thus, in FY16, the State faced peak deficit and energy shortage of around 2,485 MW (14.6%) and 13,318 MU (12.5%) respectively. Peak deficit and energy shortage in FY17 have reduced to 1,682 MW and 1,817 MU respectively.

Total installed capacity for Uttar Pradesh including its firm share from CGS as on March 31, 2017 (allocated capacity in State, private, joint and CGS) is 22,602 MW as detailed in table below:

Table 9: Firm share of allocations from various sources (in MW)

S. No.	Source	FY17
Within state		
A	State sector thermal-generating stations	5679.0
B	State sector hydel-generating stations	455.3
C	NTPC generating stations	3609.2
D	Stations (IPP / JV)	5,918.0
E	Captive, cogeneration & other renewable sources	2022.0
Subtotal within state		**17683.5**
Outside state		
F	NHPC generating stations	773.0
G	NTPC generating stations	1,324.0
H	NPCIL generating stations	360.9
I	IPP/JV	2,239.0
J	Renewable energy sources	222.0
Subtotal outside state		**4,918.8**
Grand total		**22,602.3**

Station-wise details are shown in Annexure -2 of this report.

Coal-based capacity constitutes about 79% of the total, followed by hydro (10%), renewable (7%), gas-based (3%), and nuclear (2%).

The maximum demand and annual energy requirement in FY19 is estimated to go up to 18,918 MW and 1,22,856 MU, respectively.

Planned capacity addition

Power procurement from number of generating sources (hydro, coal, renewable, etc.) are planned in the next five years. Additional contracted capacity from various sources (along with the expected years of availability) is summarised below:

Table 10: Summary of additional capacity from various sources

Sr. no.	Source	Type	Capacity (MW)	Latest firm entitlement		Year
				%	MW	
A	**New stations - own & private**					
	Meja(UPRVUNL & NTPC)	Coal	1320	69%	916	FY22
	Ghatampur TPP	Coal	1980	64%	1275	FY22
	Case I second	Coal	1169	100%	1169	FY18
	Bara (JP Group)	Coal	1980	30%	594	FY18
	Retirement	Coal	-210	100%	-210	FY19
Subtotal	**Upcoming - own & private**		**6239**		**3744**	
B	**Upcoming – CGS**					
	Visnugarh Pipal Kothi	Hydro	444	37%	166	FY20
	Subansiri Lower (NHPC)	Hydro	2000	9%	182	FY21
	Tapovan Vishnugarh	Hydro	520	20%	102	FY20
	Lata Tapovan HEP (NTPC)	Hydro	171	20%	34	FY22
	Parbati-II HEP	Hydro	800	19%	155	FY19
	Tanda-II	Coal	1320	63%	832	FY19
Subtotal	**Upcoming –CGS**		**5255**		**1470**	
C	**Upcoming –State**					
	Harduaganj Extn. St. II	Coal	660	100%	660	FY20
	Obra C	Coal	1320	100%	1320	FY22
	Jawaharpur	Coal	1320	100%	1320	FY22
	UPJVNL Hydro	Hydro	1.5	100%	1.5	FY18
Subtotal	**Upcoming - State projects**		**3302**		**3302**	
D	**Upcoming renewable**					
	Solar	Renewable	2610	100%	2610	FY22
	SHP	Renewable	6	100%	6.0	FY19
	Biomass	Renewable	400	100%	400	FY19
Subtotal	**Upcoming renewable**		**3016**		**3016**	
Total	**Upcoming**		**17812**		**11532**	

Note: Currently 200 MW and 94 MW units of Obra TPS and 110 MW unit of Parichha TPS are under RM&U and 94 MW unit of Obra TPS & 60 MW of Harduaganj TPS are closed for deletion

The table below summarises the availability of power from various sources keeping in view existing and upcoming capacity availability till FY22:

Table 11: Projected firm share allocations from various sources (in MW)

S. No.	Source	FY17	FY18	FY19	FY20	FY21	FY22
Within state							
Existing							
A	State sector thermal generating stations	5,679	5,679	5,679	5,679	5,679	5,679
B	State sector hydel generating stations	455	455	455	455	455	455
C	NTPC generating stations	3,609	3,609	3,609	3,609	3,609	3,609
D	Stations (IPP / JV)	5,918	5,918	5,918	5,918	5,918	5,918
E	Captive, cogeneration & renewable sources	2,022	2,022	2,022	2,022	2,022	2,022
Subtotal	**Within state (existing)**	**17683**	**17683**	**17683**	**17683**	**17683**	**17683**
Upcoming#							
F	State sector generating stations	0	2	2	662	1982	3302
G	Central generating stations	0	0	832	832	832	832
H	Stations (IPP / JV)	0	2221	2679	2679	2679	2679
I	Renewable	0	50	156	156	156	156
Subtotal	**Within state (upcoming)**	**0**	**2273**	**3669**	**4329**	**5649**	**6969**
Subtotal	**Within state**	**17683**	**19956**	**21352**	**22012**	**23332**	**24652**
Outside state							
J	NHPC Generating Stations	773	773	928	928	1110	1110
K	NTPC Generating Stations	1324	1324	1114	1216	1216	1250
L	NPCIL Generating Stations	361	361	361	361	361	361
M	IPP/JV	2239	2239	2239	2405	3255	3680
N	Renewable Energy Sources	222	527	2832	2832	2832	2832
Subtotal	**Outside state**	**4919**	**5224**	**7474**	**7741**	**8773**	**9232**
Grand total		**22602**	**25180**	**28826**	**29753**	**32105**	**33884**

 # considering base year as FY17.

It may be observed that substantial capacity addition is projected by FY19 and then by FY22, both within and outside the State.

Projected energy availability from the above-mentioned sources is summarised in table below:

Table 12: Projected energy requirement and availability from firm share/long-term tie-ups

Source	Adequacy of energy availability					
	FY17	FY18	FY19	FY20	FY21	FY22
Total energy requirement within state	108853	117722	122856	136990	148363	160903
Energy availability from long-term firm tie-ups (MU)	105700	128257	140709	146157	161654	173725
Energy availability from long-term firm tie-ups (%)	*97.10%*	*108.95%*	*114.53%*	*106.69%*	*108.96%*	*107.97%*
Target energy availability from long-term firm tie-ups (%)	*90.00%*	*90.00%*	*90.00%*	*90.00%*	*90.00%*	*90.00%*
Targeted energy availability from long-term firm tie-ups (MU)	97967	105950	110570	123291	133526	144812
Adequacy of power supply	**Adequate**	**Adequate**	**Adequate**	**Adequate**	**Adequate**	**Adequate**

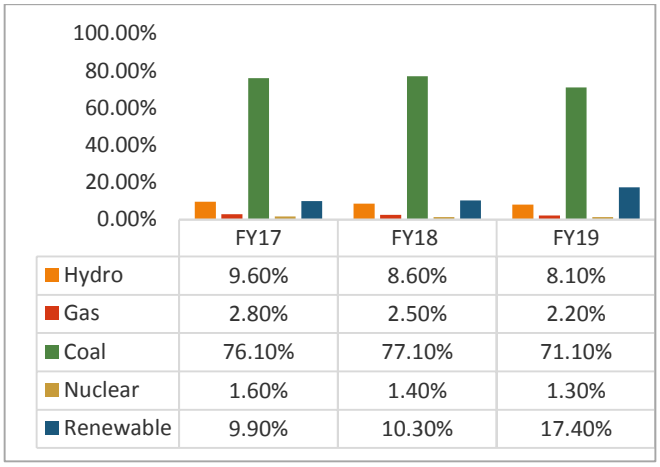
While determining the adequacy of energy availability, it is considered that existing projects would continue to perform at the same level, whereas upcoming projects would perform at normative levels, i.e., thermal projects at an average PLF of 85%, hydro projects at 40%, solar at 19% and co-generation projects at 40%.

It may be seen from the above table, with considerable capacity addition planned till FY22 along with efficiency improvement in terms of reduced distribution losses, the situation in the State will likely improve.

Availability mix

The availability mix from various sources (firm tie-ups only) for FY17 and FY19 is shown below:

Figure 6: Availability mix from various sources (firm tie-ups only)



	FY17	FY18	FY19
Hydro	9.60%	8.60%	8.10%
Gas	2.80%	2.50%	2.20%
Coal	76.10%	77.10%	71.10%
Nuclear	1.60%	1.40%	1.30%
Renewable	9.90%	10.30%	17.40%

- **The State is largely dependent on coal-based generation sources, i.e., around 71% of total contracted capacity is estimated from coal-based generation in FY19.**
- **Renewable capacity is also expected to increase from current level of 10% to 17% by FY19.**

Fund requirement

The fund requirement for various state projects is summarised below:

Table 13: Fund requirement for state projects (Rs crore)

	FY17	FY18	FY19	FY20	Total
Harduaganj Extn II (660 MW)					
Grant	*0*	*0*	*0*	*0*	*0*
Equity	*200*	*300*	*350*	*103*	*953*
Loan	*450*	*1546*	*1608*	*589*	*4193*
Total	*650*	*1846*	*1958*	*692*	*5146*
Panki extn. (660 MW)					
Grant	*0*	*0*	*0*	*0*	*0*
Equity	*47*	*100*	*200*	*300*	*647*
Loan	*0*	*207*	*450*	*1546*	*2203*
Total	*47*	*307*	*650*	*1846*	*2850*
Obra C (2 x 660 MW)					
Grant	*0*	*0*	*0*		*0*
Equity	*100*	*900*	*509*	*692*	*2201*
Loan	*251*	*198*	*633*	*2606*	*3688*
Total	*351*	*1098*	*1142*	*3298*	*5889*
Hydro stations (New & RMU)					
Grant	*0*	*0*	*0*	*0*	*0*
Equity	3	7	0	0	*10*
Loan	0	0	*0*	*0*	*0*
Total	*3*	*7*	*0*	*0*	*10*
Total					
Grant	***0***	***0***	***0***	***0***	***0***
Equity	***350***	***1307***	***1059***	***1095***	***3811***
Loan	***701***	***1951***	***2691***	***4741***	***10084***
Total	***1051***	***3258***	***3750***	***5836***	***13895***

**Excluding funds for renewable energy sources, which are detailed in the subsequent chapter.*

Action points for the State

Power purchase planning

CHALLENGE: The cost of power purchase in UP is considerably high. As per data for FY17, Uttar Pradesh purchases substantial quantum of power at high variable cost from stations like Tanda, Rosa, Parichha, Dadri Thermal, Dadri Gas, Bajaj, Anta, Auriya, etc.). Higher level of AT&C losses results in additional power purchase requirement and cost.

Further, since all Discoms buy power at a centrally pooled cost, i.e., bulk supply tariff (BST) from UPPCL, the incremental power purchase cost is averaged equally among all the Discoms. This results in passing on the inefficiencies of one utility to another with no incentive to the better-performing utilities to reduce their losses.

It is also difficult for the State to plan peaking power procurement efficiently.

ACTION PLAN: For enabling independent power procurement by each of the utilities, it is important to *allocate the existing PPAs to each utility*.

To efficiently manage peak and base load, it is critical that the State has a plan for long / short-term PPAs. ***Proper power procurement management*** would help meet the peak/ base load in a cost-effective manner. The State may assist towards *institutionalising and strengthening the power purchase planning and procurement system with a dedicated cell* for each distribution utility which would work on short/medium/long-term power purchase planning.

The Discoms may also take a considered view to procure power, strictly as per merit order, with the current prices in the power exchange dropping. *UPPCL may explore options to lower power purchase cost through a mix of long-term and short-term contracts, especially for peaking power.*

Old and inefficient plants

While RM&U improves the life as well as the PLF of the plants, new RM&U schemes may not be carried out without a ***cost benefit analysis***. The ongoing projects should be completed and focus may be given on setting up new super-critical thermal power plants or solar power plants.

Coal swapping

Government of India has allowed flexibility of utilisation of domestic coal among different power plants. Coal for following stations may be allowed to the State as well as private IPPs.

Stations	Swapping details
Parichha (2x110 MW + 2 x 210 MW)	WCL to BCCL & CCL in June to Sep
Parichha (2x250 MW)	BCCL (18.63 Lakh MT) to NCL
Harduaganj TPS (2 x 250 MW)	CCL (20.57 Lakh T) to NCL
Rosa TPP (4 x 300 MW)	To CCL
Bajaj TPP (5 x 90 MW)	To NCL

Aggregation of coal linkage for state sector IPPS

Aggregation of linkage for different stations may be allowed to the State's generating stations, to save payment of additional charges, on account of following:

1. Commitment charges for lower offtake of coal due to lower operational performance of old stations
2. Incentive on account of higher procurement of coal in for super-critical stations

Coal off-take	Commitment charges / incentive
<80%	Commitment charges
>90%	Incentive (10%)
>95%	Incentive (20%)
>100%	Incentive (40%)

Rationalisation of coal linkage allocation:

Exploration of coal transportation options from different mines to power plants in a way that results in the least transport cost. Detailed study may be carried out to work out the actual savings.

Impact of new environmental norms:

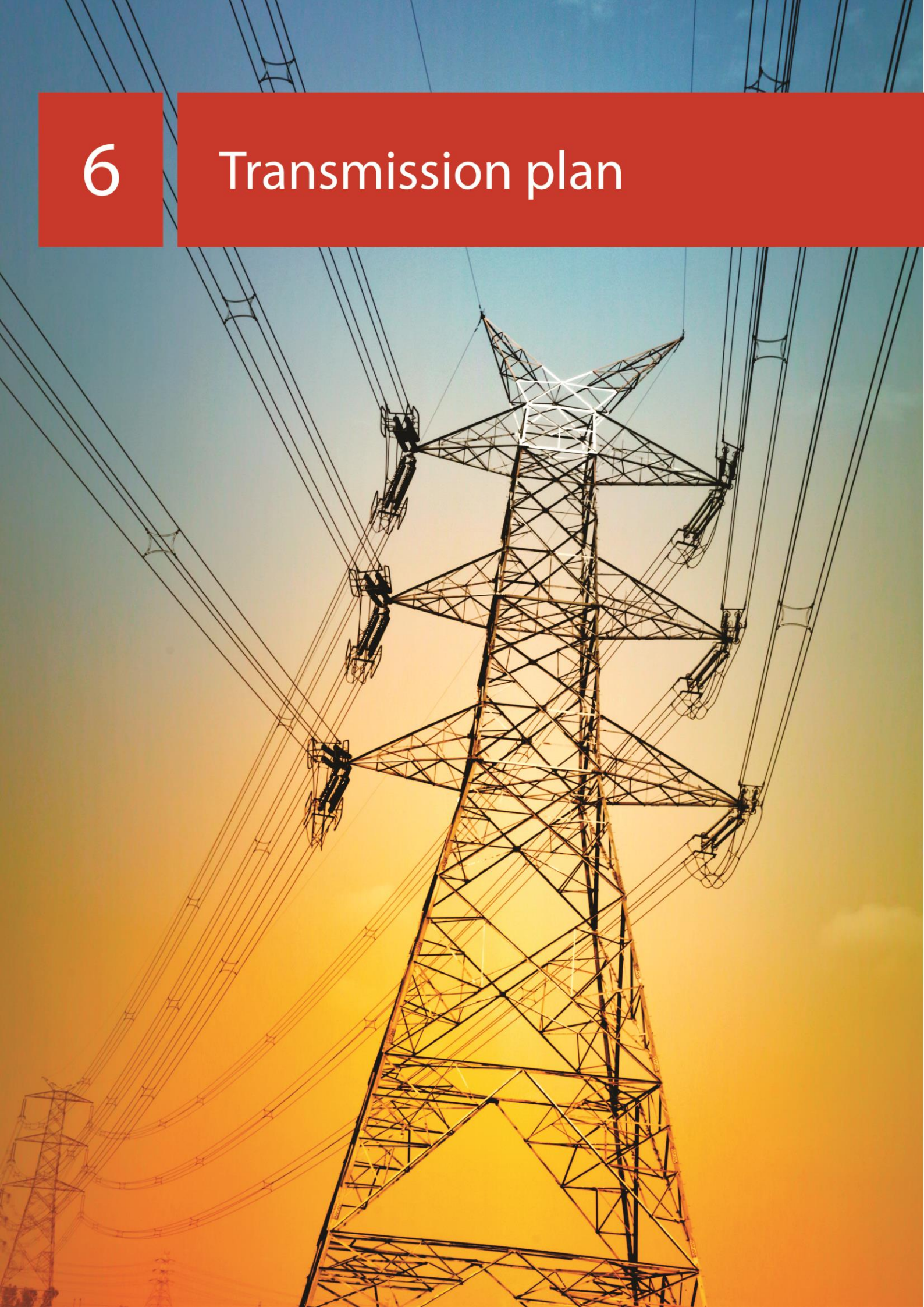
Around 17,000 MW capacity in northern region could get impacted by new environmental norms, of which UP has substantial share of about 4000 MW.

A detailed plan shall be formed to shut down these stations in phased manner, based on cost benefit analysis.

Rollout plan

Sl. No.	Category	Base year scenario (FY17)	Rollout plan		Total	Total expected capacity FY19
			FY18	FY19		
A	**Contracted capacity (MW):**					
	State sector					
1	Hydro	455	2	0	2	457
2	Thermal	5679	0	0	0	5679
3	Renewable – UPNEDA + private	2244	396	2452	2849	5093
	Grid	2244	355	2411	2766	5010
	Off grid	0	41	41	83	83
	Central sector					
4	Thermal (gas + coal)	4839	0	622	622	5461
5	Hydro + free power share	867	0	155	155	1022
6	Nuclear	361	0	0	0	361
	Private, JV & others					
7	Private, JV & others (including competitive bid projects)	8157	2221	458	2679	10836
	Total (MW)	**22602**	**2619**	**3688**	**6307**	**28909**
B	**Peak deemand (MW):**					
1	Peak demand (MW)	**17355**	**17934**	**18918**	**18918**	**18918**

6 Transmission plan



Existing inter-state transmission system

For reliable transfer of power from Central power plants and various IPPs, Uttar Pradesh is well-connected with the national grid. The Uttar Pradesh grid is connected with various states of the northern grid as well as directly connected with eastern and western grids. A summary of transmission facilities established by POWERGRID to transmit power to load centres across the State is given in the following table:

Table 14: A summary of the existing POWERGRID network

Particulars	Details	Figures	Units
Line length	HVDC line	6700	ckt kms
	765kV lines	5280	ckt kms
	400kV lines	15460	ckt kms
	220kV lines	1350	ckt kms
	Total	**28,790**	ckt kms
	Substation name	**765/ 400 kV**	**400/220 kV**
Substations 19 nos (33,615 MVA)	Agra	3000	315
	Balia	3000	-
	Meerut	3000	1445
	Allahabad		945
	Mainpuri		630
	Kanpur		630
	Lucknow		815
	Lucknow(new)	3000	
	Gorakhpur		630
	Bareilly	--	--
	Fatehpur	3000	630
	Shahjahanpur		1000
	Rae Bareilly*		
	Sohawal		630
	Kanpur(new)	3000	
	Varanasi	3000	
	Bareilly(new)	3000	
	Saharanpur		630
	Bagpat		1000
	Muzaffarnagar		315
	Total (UPPTCL)	24,000	9,615
HVDC substation (8500MW)	Dadri	1500	MW
	Rihand	1500	MW
	Balia	2500	MW
	Agra	3000	MW

** Raibareli 220/132 kV 300 MVA*

Planned inter-state transmission system

For improving the reliability of transmission of electricity to the State, various transmission schemes have been undertaken. These are at various stages of implementation.

i. Northern Regional System Strengthening –XXX

- Singrauli - Allahabad 400kV S/c
  - ✓ *Expected by **March 2018***
- Allahabad - Kanpur 400kV D/c
  - ✓ *Expected by **October 2017***

Right of way (ROW) problems are being faced in both of these lines at certain locations. Also, frequent incidences of thefts of conductor / tower parts etc. are being encountered in Allahabad – Kanpur line.

ii. NRSS XXXIV : Expected by November 2017

- LILO of Agra – Bharatpur 220 kV S/c line at Agra (PG) - Expected by **November 2017**

Issue – Severe RoW problem at around 20 locations (5.5km) near Agra end due to high demand of compensation. POWERGRID could not do the survey work since the award was placed in February 2015.

- 1X315 MVA, 400/220 kV ICT at Agra (PG) along with associated bays (ICT shall be from the spared ICTs available after replacement of ICTs at Ballabhgarh / Mandaula) – Expected by **May 2017**.

iii. Northern region system strengthening NRSS-XXXII

- 400 kV Lucknow (PG) – Kanpur (New) (PG) D/c line – 320 ckt kms – Expected by **May 2017**

Issue – Serious RoW problems at 4-5 locations, which are being addressed.

iv. Dynamic compensation (STATCOM) of 300 MVAR with 2 x 125 MVAR reactor, 1 x 125 MVAR capacitor at Lucknow: Expected by February 2019

v. Augmentation of transformation capacity at Raebareli 220/132kV Substation – by July 2017

- Replacement of 2x100 MVA ICTs with 2x200 MVA ICTs at Raebareilly 220/132 KV substations

vi. Augmentation of transformation capacity at Mainpuri

- 1x500 MVA ICT augmentation at Mainpuri (PG) 400/220kV substation along with associated bays and additional two 220 kV line bays – Expected by **June 2017**

vii. 220kV line bays at Fatehpur (765kV)

- 220 KV substation Sarh of UPPTCL is likely to be ready for commissioning/energisation by September 2017. Hence, PGCIL is requested to complete this work by September 2017.

viii. Northern region system strengthening NRSS – XXXVIII

- Creation of 400kV level at Aligarh (PG) by adding 2x1,500 MVA 765/400kV ICTs. Expected by **March 2019**, matching with TBCB line schedule.

UP interconnections with other regions

To facilitate procurement of power from the pit-head generating stations, the State has direct connectivity with the western region through two Gwalior–Agra 765 kV lines, and with the eastern region through 10 400 kV and three 765 kV transmission lines and HVDC links. With the commissioning of Champa–Kurukshetra HVDC Pole (1,500 MW), inter-regional capacity of the northern Region from the western region is now 10,600 MW. This is likely to be enhanced to 12,600 MW with the commissioning of another 1,500 MW Champa–Kurukshetra HVDC capacity. This shall facilitate Uttar Pradesh to procure power from pit head generating stations located in western and eastern regions. In addition to the above, the following two high-capacity transmission corridors are under implementation:

i. Inter-regional System Strengthening Scheme for NR and WR: April 2018

- Jabalpur pooling station - Orai 765kV D/c line: (804 ckt. Km).
- Orai – Aligarh 765kV D/c line (664 ckt. km)
- Orai – Orai (UPPTCL) 400kV D/c (Quad) line (76 ckm)
  - ✓ *Issue – 400kV bays at Orai (UPPTCL) to be constructed by UPPTCL, on deposit work basis as per MoU signed on 06/06/2016. Work is yet to start.*
- LILO of one circuit of Satna-Gwalior 765 kV D/c line at Orai S/s (160 ckt. km)
- 2x1000MVA, 765/400 kV GIS substation at Orai S/s
- LILO of Agra-Meerut 765 kV S/c line at Aligarh S/s (35 ckt. km.)
- 765 kV switching station at Aligarh (GIS)
- LILO of Kanpur – Jhatikra 765 kV S/c at Aligarh S/s (35 ckt. km)

ii. Vindhyanchal–Varanasi 765 kV D/C (TBCB) – 450 ckm, 2019-20: to be implemented through TBCB

- This work is important for relieving congestion in the WR-NR corridor and eastern region of UP; hence, early completion is requested.

With the commissioning of above corridors, it is envisaged that total inter-regional capacity shall be enhanced to about 20,000 MW.

Intra-state transmission system

UPPTCL has planned substantial strengthening of the intra-state transmission network. While network augmentation under the ongoing projects is at various stages of implementation, the State has also prepared the 13th Five-Year Plan (FYP) covering FY17 to FY22. The following tables show the summary of: (i) year-wise planned addition of transformation capacities at different voltage levels; and (ii) year-wise additions in transmission lines at different voltages until FY19.

Table 15: Existing transformation capacity and additions planned till FY19 (MVA)

Voltage level	Aggregate capacity in FY17	FY18		FY19		Capacity in FY19 in % of capacity in FY17
		Additional	Cumulative	Additional	Cumulative	
765/ 400 kV	*9000*	4000	13000	3000	16000	178%
400/ 220 kV	*16585*	3000	19585	5000	24585	148%
220/ 132 kV	*29750*	4020	33770	5370	39140	132%
132/33 kV	*37221*	3848	41069	4294	45363	122%

Table 16: Existing transmission line capacity and additions planned till FY19 (ckt km)

Voltage level	Aggregate capacity in FY17	FY18		FY19		Capacity in FY19 in % of capacity in FY17
		Additional	Cumulative	Additional	Cumulative	
765 kV	*1508.56*	1005	2513.56	100	2613.56	173%
400 kV	*6192.98*	1460	7652.98	1100	8752.98	141%
220 kV	*10281.56*	980	11261.56	960	12221.56	119%
132 kV	*18129.66*	1500	19629.66	1500	21129.66	116%

The projects are at different stages of completion. Considering accelerated rural electrifications and load growth, the State will ensure efficient project management to complete the projects on priority basis, including the projects which were delayed in the past.

Peak demand in FY19

As per the CEA, the actual met peak demand in FY16 was 14,503 MW and in FY17, 15,501 MW as against peak demand of 16,988 MW in FY16 and 17,183 MW in FY17. Further, the estimated peak demand is expected to rise to 18,918 MW due to the massive programme of electrification of unconnected households and implementation of 24x7 Power for All project on top of normal load growth.

Table 17: Peak demand and planned transformation capacity

Particulars	FY2016-17			FY2018-19		
	Transformation capacity: MVA			Transformation capacity: MVA		
	POWERGRID	UPPTCL	Total	POWERGRID	UPPTCL	Total
765/400 kV	24,000	9,000	33,000	30,500	16,000	46,500
400/220kV	9,615	16,585	26,200	10,430	24,585	35,015
220/132 kV	300	29,750	30,050	500	39,140	39,640
132/33kV	0	37,221	37,221	0	45,363	45,363

Analysis of transmission system adequacy based on the above system parameters:

i. Keeping in view that demand is met entirely at 33 kV and below, barring a few very large industrial consumers supplied at 132 kV and above, it is apparent that aggregate capacity available at 33 kV should be commensurate with full demand of the State. Assuming an optimistic power factor of 0.9 and overall diversity factor of 1.4, the average loading of 132/33kV transformers under peak-demand condition works out to 64.78%. Applying a lower diversity factor of 1.2 at 132 kV, average loading of 220/132 kV transformers works out to 68.78% under peak-demand conditions. These

figures are based on the implicit assumption that all power sources (both intra-state and inter-state generators) are coupled to the network at 220 kV and above.

ii. Following the same logic and assumptions, the average loading of 132/33 kV transformers in FY19 at peak demand of 18,918 MW would be 64.87%, while that of 220/132 kV transformers will be equal to 63.63% during similar period. However, the system has been planned with a view to relieve uncomfortable sectoral overloading of transformers and concurrently address contingency issues to provide reliable power.

iii. Substantial capacity and line addition would enable the intra-state transmission system in the State to adequately cater to the expected demand in FY19.

Way forward

i. A regular review shall be undertaken, so that there is no mismatch between capacity addition at higher and at lower voltage levels. However, currently, the capacity addition planned at various voltage levels are commensurate with the requirements of power evacuation and transmission.

ii. A major augmentation of the transmission system has been planned under the 13th Plan to cater to enhanced future load requirements. However, considering the compressed time schedule of rural electrification, adequacy of the transmission network needs be checked through load flow studies by UPPTCL, which should be verified by the CEA within a total timeframe of three months.

UPPTCL shall provide network data and studies to CEA for U.P. State related to FY18 and FY19. CEA shall incorporate overall data from other states of region and carry out studies of northern region. CEA and UPPTCL will jointly conclude findings and gaps in network sufficiency, if any, for 24x7 supply.

Funding of capital expenditure

The funding of the new schemes has been proposed through internal investments and loans from financial institutions, such as REC, PFC and the World Bank.

The 13th Plan prepared by the State for power evacuation from new power plants, development and strengthening of transmission network until FY22 is estimated to cost around Rs 20,000 crore of investment, of which Rs 2,100 crore has been identified to be funded by the World Bank.

The following funding requirement is envisaged in FY18 and FY19:

Table 18: Expected funding requirement to strengthen intra-state transmission system (Rs crore)

Particulars	FY18	FY19	Total
Total investment			
New substation	2945	2830	5775
New lines	3668	3200	6868
S/S augmentation	700	900	1600
Total	**7313**	**6930**	**14243**
Funding			
Share of PPP	1200	194	1394
Share of UPPTCL	6113	6736	12849
Funding to be arranged by UPPTCL			
Funding from PFC, REC, World Bank	4369	4807	9176
Required budgetary support	1744	1929	3673

Action points for State Government

Congestion of substations/ lines

CHALLENGE: Currently, there is low/minimal congestion on the transmission network, i.e., on the substations and transmission lines. However, as peak demand increases, the congestion level on the transmission infrastructure is expected to rise.

ACTION PLAN*:* While the transmission utility, UPPTCL, is developing new transmission infrastructure as well as augmenting the old, it is critical at this stage to carry out a *detailed load flow study* at different voltage levels. Under this study, UPPTCL needs to monitor the loading of lines and substations periodically to ascertain actual growth in loading of the load centres along with changes in consumer mix.

This will help identify the capacity addition required to cater to growth in demand over the coming years, and hence will enable timely planning as well as proper investments. It will also enable UPPTCL to consider and plan for timely augmentation of lines, which are anticipated to be overloaded in future with high-capacity conductors.

Integration of clean energy

CHALLENGE: With a strong focus on renewable energy, power procurement through clean energy sources will be higher in the future, and an integrated view is required for grid management and stability.

ACTION PLAN: Keeping in mind the high quantum of renewable energy to be added in the coming years, the State needs to conduct a ***clean energy grid integration study*** for the stability of the grid as well as for requirement of ancillary power plants.

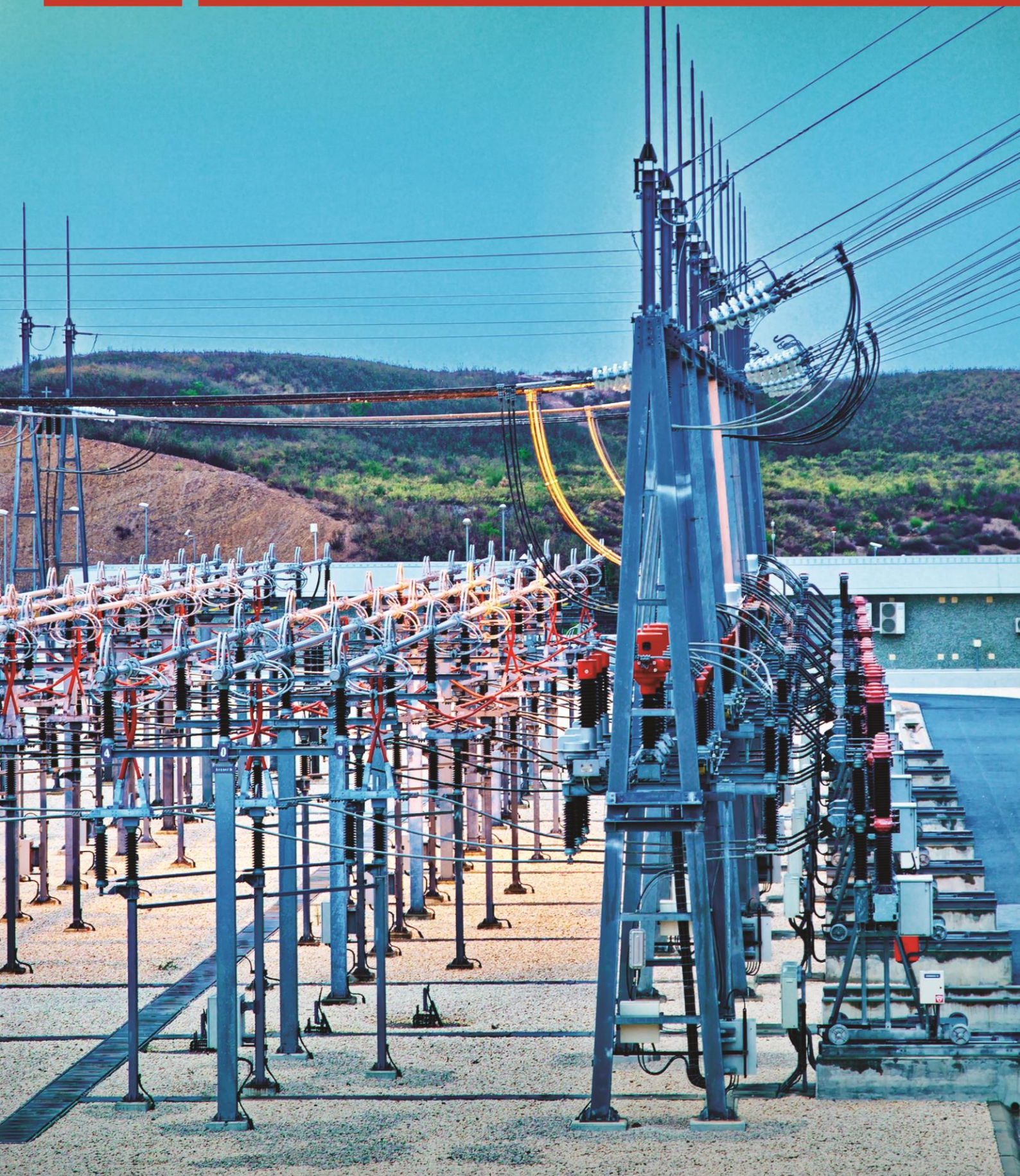
Further, the State will carry out the following:

- The state will implement all the existing and planned projects on time to ensure availability of transmission system for 24x7 power supply.
- UPPTCL will monitor the loading of lines and substations on a periodic basis to ascertain actual growth in loading of the load centres along with changes in the consumer mix.
- UPPTCL will consider and plan for timely augmentation of lines, which are anticipated to be overloaded in the future with high-capacity conductors. This work of re-conductoring shall be taken up on a sectoral-priority basis.
- One set Emergency Restoration System (ERS) is expected in April 2017, and the second set in June 2017.
- Based on requirement, the State will look for options for the construction of new lines through tariff-based competitive bidding (TBCB) and invite more private participation.
- Considering the compressed time schedule of rural electrification, adequacy of the transmission network needs be checked through load flow studies by UPPTCL, and verified by CEA within of three months.

Rollout plan

Sl. No.	Category	Base year scenario (FY17)	Rollout Ppan		Total	Total expected capacity FY19
			FY18	FY19		
A	**Transmission lines (CKM):**					
1	765 kV	1,509	1,005	100	1,105	2,614
2	400 kV	6,193	1,460	1,100	2,560	8,753
3	220 kV	10,282	1,500	1,500	3,000	13,282
4	132 kV	18,130	980	960	1,940	20,070
	Total transmission lines	**36,114**	**4,945**	**3,660**	**8,605**	**44,719**
B	**Transformation capacity (MVA):**					
1	765/ 400 kV	9,000	4,000	3,000	7,000	16,000
2	400/ 220 kV	16,585	3,000	5,000	8,000	24,585
3	220/ 132 kV	29,750	4,020	5,370	9,390	39,140
4	132/33 kV	37,221	3,848	4,294	8,142	45,363
	Total transformation capacity	**92,556**	**14,868**	**17,664**	**32,532**	**1,25,088**

7 Distribution plan



Connecting the unconnected households

As detailed in Chapter 3, there are around 1.12 crore un-electrified rural households in the State. Out of these un-electrified households, around 0.50 crore rural households are targeted to be electrified under the ongoing State and Central schemes. Further, the State will validate the balance 0.62 crore un-electrified households by undertaking a survey and formulate DPRs for electrification of the final verified un-electrified households by July 2017. The required financial tie-ups, if any, shall be completed before September 2017, so as to complete electrification of these remaining households by 2019.

Further, around 0.15 crore un-electrified households also exist in urban areas. State also envisages to target the electrification of these remaining 0.15 crore urban households by 2019 after undertaking appropriate augmentation/ extension of the existing network of urban areas. As these consumers are not covered under any existing scheme, the State needs to formulate a scheme to connect all urban un-electrified consumers within the target date.

Existing distribution system

A snapshot of the existing distribution system of the utilities serving in Uttar Pradesh is given below:

Table 19: Existing distribution system (March 2017)

Particulars	MVVNL	DVVNL	PuVVNL	PVVNL	KeSCO	NPCL
33 KV cubstation (MVA)	9211	8591	9410	15427	1360	678
33 KV line length (CKT KM)	13530	16057	16415	11381	599	217
11 KV line (CKT KM)	121430	112008	158980	87027	1105	2186
LT line (CKT KM)	393015	528900	399500	241381	1985	2850
Capacity of 11/0.4 KV distribution T/F (MVA)	9360	10351	13434	13628	1352	588
No of 11/0.4 KV distribution T/F	212141	304996	352537	238222	4754	6040

Schemes under implementation

Metering plan

Different Discoms are at different levels of metering and the State Government is planning to complete the metering of all un-metered registered consumers in a time-bound manner. The metering plans of Discoms are as follows:

Table 20: Metering plan for Discoms (in lakh)

Discom	FY18	FY19
MVVNL	6.7	4.5
DVVNL	3.7	7.0
PVVNL	10.2	8.0
PuVVNL	16.9	11.3
KESCO	0.0	0.0
NPCL	0.0	0.0

In addition to the above, the State also has a challenging task to formalise and meter around 84 lakh electricity consumers and around 126 lakh meters (112 lakh – rural and 15 lakh- urban) would also be required for new connections envisaged to achieve 100% electrification within the next two years. To achieve this the State shall develop a comprehensive metering policy and formalisation and metering plan on priority basis.

Integrated Power Development Scheme (IPDS)

The new IPDS proposal aims to cover 637 towns including towns covered under R-APDRP. The distribution utilities of the State have proposed works amounting to Rs 4,889.37 crore, to be undertaken under the new IPDS scheme, which is summarised in Table 21.

For implementation of these works, 60% of project cost is available as grant from GoI under IPDS and the State has to arrange the balance amount - 30 % as loan and 10% as equity. On meeting certain conditions laid down in IPDS such as timely completion, AT&C loss reduction, etc. the grant component may go up to 75% of project cost.

Under the Integrated Power Development Scheme (IPDS), GoUP has submitted proposals for works in urban areas such as: i) Strengthening of sub-transmission and distribution networks, and ii) Metering of DT / feeders / consumer.

Table 21: Work proposed under IPDS scheme

Item	Unit	Total for state	
		quantity	cost (Rs cr)
33/11 kV SS : New	Nos.	240	498.18
33/11 kV SS : Additional transformer	Nos.	87	81.08
33/11 kV SS : Transformer capacity enhancement	Nos.	172	180.05
Renovation and modernisation of 33/11 kV S/S	Nos.	466	88.66
New 33 kV new feeders / Bifurcation of feeders	Km	2295	283.13
33 kV feeder reconductoring / augmentation	Km	431	96.51
33 kV line bay extension of EHV station	Nos.	344	78.94
11 kV line: New feeder / feeder bifurcation	Km	4004	547.10
11 kV line: Augmentation / reconductoring	Km	806	103.46
Aerial bunched cables	Km	7171	614.69
Underground cables	Km	469	337.84
11 kV line bay extension	Km	0	0.00
Installation of distribution transformer	Nos.	6336	549.17
Capacity enhancement of LT sub-station	Nos.	2648	246.55
LT line: New feeder / feeder bifurcation	Km	3249	320.44
LT line: Augmentation / Reconductoring	Km	568	192.71
Capacitor bank	Nos.	429	154.55
High-voltage distribution system (HVDS)	Nos.	0	0.00
Metering	Nos.	344252	115.02
Provisioning of solar panels	Lot	527	9.31
Ring main unit (RMU), sectionaliser, auto reclosures, fault passage indicators (FPI) etc.	Lot	1362	163.32
Others	LS	2649	228.65
Grand Total			**4889.37**

Projects with estimated capital expenditure totaling Rs 4,721 crore (including PMA cost) for 82 circles have been sanctioned for Uttar Pradesh by GoI. An amount of Rs 680.78 crore has already been released to utilities. Work has been awarded partially in 81 circles out of 82 for an amount of Rs 4,034.84 crore. Discom-wise status of IPDS (as on March 20, 2017) is summarised in the following table:

Table 22: Discom-wise details regarding the project expenditure and sanctioned cost for non-SCADA towns under RAPDRP scheme (Rs crore)

Utility	No of circles/ zones	No of towns	Approved cost	Amount disbursed
MVVNL	12	181	724	81.90
DVVNL	17	176	768	113.07
PVVNL	21	137	1486	243.54
PuVVNL	16	142	1280	187.21
KESCO	1	1	463	55.06
Total	**67**	**637**	**4721**	**680.78**

The following table shows the financial status of R-APDRP (subsumed in IPDS) as on March 20, 2017:

Table 23: Financial status of R-APDRP (subsumed in IPDS)

Project	Towns (Nos)	Approved cost	Amount disb
Part-A IT	168	775	475
Part-A SCADA	12	281	80
Part-B	167	6915	1037
Total		**7971**	**1592**

Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY)

Under the DDUGJY launched by GOI on 3rd December, 2014, GoUP has submitted proposals for works in rural areas covering: a) Separation of agriculture and non-agriculture feeders facilitating different hours of supply to agricultural & non-agriculture consumers, b) Strengthening and augmentation of sub-transmission & distribution infrastructure in rural areas, including metering of distribution transformers /feeders/consumers, and c) Rural electrification for achieving the targets laid down under RGGVY for 12th and 13th Plans by carrying forward the approved outlay for RGGVY to DDUGJY.

In all, 150 projects are covered under X, XI and XII plan of RGGVY scheme (X Plan – 64, XI Plan – 22, and XI Plan – 64). The scope and achievement in respect of these 150 projects is as below:

Table 24: Scope and achievement for projects covered under X, XI and XII plan of DDUGJY scheme (as on 28/02/2017)

Particulars	Scope	Achievement
Electrification of villages (nos.)	29288	29251 (99.8%)
Intensive electrification of villages (nos.)	90811	41988 (46%)
BPL households connections (nos. in lakh)	52.80	20.78 (39.3%)
Financial (Rs crore)	15398	9007 (58%)

The State had proposed works amounting to Rs 18,774 crore to be undertaken under the new scheme (DDUGJY). Projects amounting to Rs 6,946.40 crore (including PMA cost) for the State have been sanctioned by GoI, this is summarised in table below:

Table 25: Works sanctioned under DDUGJY scheme (Rs crore)

Discom	No of districts	Electrification of UE villages	Feeder separation	Connecting/ unconnected Hhs	Metering	System strengthening	Sansad Adarsh Gram Yojna	PMA	Grand total
DVVNL	21	0.00	966.60	397.02	59.69	522.83	23.92	9.84	1979.90
PVVNL	14	2.70	1218.92	198.20	59.67	652.74	17.08	10.75	2160.06
MVVNL	19	6.78	427.90	287.74	59.75	442.25	6.82	6.15	1237.39
PuVVNL	21	0.00	644.27	260.19	114.94	529.94	11.93	7.78	1569.05
Total	**75**	**9.48**	**3257.69**	**1143.15**	**294.05**	**2147.76**	**59.75**	**34.52**	**6946.40**

For implementation of these works, 60% of project cost is available as grant from GoI under DDUGJY and the State has to arrange the balance amount- 30% as loan and 10% as equity.

On meeting certain conditions laid down in DDUGJY, such as timely completion of schemes and AT&C loss reduction, the grant component may go up to 75% of project cost.

Apart from the centrally promoted schemes, the State has also taken certain initiatives to improve the electrification status in the State.

Feeder separation: Out of 75 districts of the State, proposal of feeder separation for 73 districts for Rs 7,084.49 crore was submitted for sanction, under DDUGJY. The sanction granted in 28 districts for complete works and 11 districts for partial works for an amount of Rs 3,257.69 crore.

Vidyut Chori Roko Abhiyan

The State has also launched an aggressive initiative to reduce theft / unauthorised use of electricity through Vidyut Chori Roko Abhiyan "VICRA" in which utilities are taking measures like new connection drives, reduction of AT&C losses and formalisation of existing connections. Activities also include load enhancement, correct metering of consumers and disconnection on pending dues and its realisation.

The State would follow zero tolerance towards corruption and eliminate power theft through strict monitoring. There will be a State-wide campaign against power theft along with a drive to sensitise all stakeholders. This will result in reducing electricity bills of consumers.

As a part of GoI's initiative under IPDS, Government of UP has implemented the "1912" - the Electricity Call Centre number for addressing power supply-related complaints on a proactive basis and provide effective, assured and timely services to customers across all its Discoms.

Adequacy of distribution system

The State has submitted a perspective distribution plan to CEA envisaging substantial distribution capacity addition in the next few years.

This would include augmentation of the existing network as well as expansion and setting up of last-mile lines to the un-electrified areas. Summary of infrastructure addition planned in the State is shown in the table below:

Table 26: Summary of infrastructure addition

Particulars	FY17	FY19
33 KV substation (MVA)	44677	52403
33 KV line length (CKT KM)	58199	67695
11 KV line (CKT KM)	482736	532341
LT line (CKT KM)	1567631	1644733
Capacity of 11/0.4 KV distribution T/F (MVA)	48713	55701
No. of 11/0.4 KV distribution T/F	1118690	1251595

Presently, the distribution transformation capacity at 33 kV level is about 44,677 MVA, over and above which the Discoms are planning to add about 7,726 MVA, resulting in cumulative total capacity of 52,403 MVA by the end of FY19.

At the DT level, huge capacity addition is planned which is expected to reach 55,701 MVA by end of FY19.

With extensive electrification, number of electrified households is going to be more than doubled. However, as agriculture, commercial, and industrial consumption are expected to increase at normal growth, the expected infrastructure capacity addition would be adequate to meet the expected demand on overall basis. Loading of distribution lines and transformers should be monitored and timely action taken to plan and avoid overloading for ensuring reliable 24x7 supply.

The strengthening of the network will also improve the LT to HT ratio and will result in improvement in reliability, quality of supply improvement including improved voltage regulations.

AT&C losses

Under UDAY, the State, Discoms and GoI have signed a tripartite agreement, by which the State has agreed to reduce AT&C losses to 19.36% by end of FY19 and to 14.86% by end of FY20.

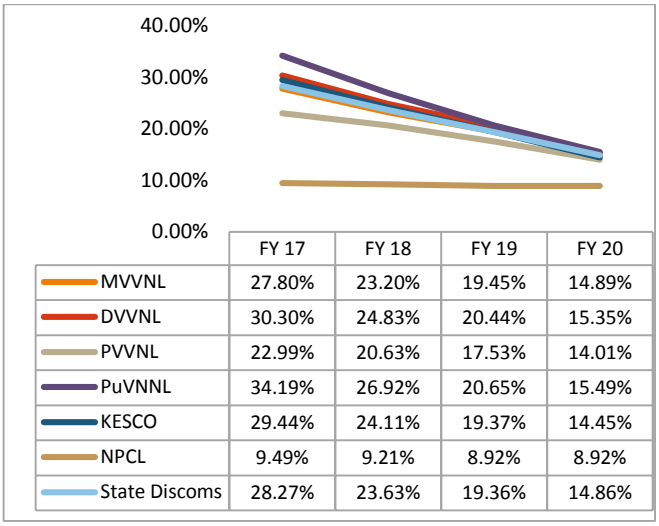
Loss trajectory as agreed under UDAY has been taken into account for preparing this road map document.

For NPCL, the projected AT&C losses and distribution loss target for FY19 have been considered as 8.92% and 8.00% respectively.

To achieve the targets, the State shall pursue implementation of ongoing schemes, i.e., IPDS, RAPDRP, DDUGJY, and Vidyut Chori Roko Abhiyan "VICRA" and will also take additional steps including installation of pre-paid meter, defective meter replacement, raids for checking thefts, replacement of mechanical meters, metering of unmetered connections, etc.

The projected AT&C loss trajectory for each distribution utility is given below:

Figure 7: AT&C loss trajectory for each distribution utility



	FY 17	FY 18	FY 19	FY 20
MVVNL	27.80%	23.20%	19.45%	14.89%
DVVNL	30.30%	24.83%	20.44%	15.35%
PVVNL	22.99%	20.63%	17.53%	14.01%
PuVNNL	34.19%	26.92%	20.65%	15.49%
KESCO	29.44%	24.11%	19.37%	14.45%
NPCL	9.49%	9.21%	8.92%	8.92%
State Discoms	28.27%	23.63%	19.36%	14.86%

Fund requirement

XI Plan (Phase-II): 22 projects with total cost of Rs 4,342 crore are under implementation and an amount of Rs 2,428 crore has been released so far. Electrification works in all 522 un-electrified villages and intensive electrification in 14,319 villages (74%, out of 19,271) has been completed; free electricity connections to 560,234 BPL households (65%, out of 857,317) have been released up to Feb, 2017. 39 villages are found to be uninhabited, remaining villages are being electrified by UPNEDA.

XII Plan: 64 projects with total cost of Rs 7,282.8 crore are under implementation and an amount of Rs 2,943 crore has been released so far. Electrification works in all 862 un-electrified villages and intensive electrification in 24,678 villages (36% out of 68,549) has been completed and free electricity connections to 560,234 BPL households (17%, out of 32,64,185) have been released.

DDG: 25 projects with total project cost of Rs 37.72 crore have been sanctioned in XI Plan. 17 projects have been commissioned and amount of Rs 12.62 crore has been released.

Thus, rural electrification projects with total cost of Rs 11,625 (XI & XII) crore are under implementation and an amount of Rs 5,371 crore has been released against these projects. Intensive electrification in 87,829 villages and free electricity connections to 41,21,502 BPL households are sanctioned under these schemes.

Thus, funds of around Rs 14,000 crore are available for rural electrification works, of which more than 10,000 crore have been allocated towards electrification of households.

Under DDUGJY, the State has also estimated a total cost of Rs 18,774 crore to achieve 100% electrification against which REC has sanctioned Rs 6,946 crore.

In order to ensure that target of 100% electrification is achieved by FY19, the State shall also undertake a survey, prepare DPR of verified un-electrified households and work out additional fund requirement, if any.

The total estimated fund requirement (subject to verification through survey and preparation of DPR) is summarised below:

Table 27: Fund requirement for distribution projects (in Rs crore)

Particulars	FY18	FY19	Total
IPDS	3,232.18	808.04	4,040.22#
DDUGJY	5,542.13	1,385.53	6,927.66#
R-APDRP	3,189.75	3,189.75	6,379.49
Other schemes	2,178.01	2,241.00	4,419.01
Additional fund requirement subject to verification through survey and DPR	2,365.54	9,462.18	11,827.72
Total distribution	**16,507.60**	**17,086.50**	**33,594.10**

 # Excluding the amount already disbursed in FY17

Mitigation of issue of reliability and low voltage

Distribution companies with the existing network are unable to deliver reliable and quality power supply due to old, aged and inadequate systems. Consumers are facing low-voltage problems due to longer LT lines, high LT: HT ratio of lines, over-loading DTs and non-availability capacitor banks at power substations and also at consumers' premises. As per Discoms, about 1.4 lakhs DTs in various areas are over-loaded; this is also affecting the reliability of power supply to the consumers.

Discoms /GoUP are considering following measures and options:

- Installation of new DTs in load centres, extension of HT lines and installation of HVDS will improve LT:HT ratio.
- Improvement in LT to HT ratio will help in increasing the reliability of the system, improve quality of supply as well as reduce the technical losses.
- The status of the LT to HT ratio of line length in FY17 and in FY19 is as per table below:

	LT/HT ratio	
	2017	2019
State	**3.25**	**3.09**
MVVNL	3.24	3.27
DVVNL	4.72	4.71
PVVNL	2.77	2.45
PuVVNL	2.51	2.33
KESCO	1.80	1.81
NPCL	1.30	1.39

- It may be noted that there is an improvement in LT/HT ratio; however, considering the good industry practice, the ratio needs to improve further to 1:1 in the long term for a more reliable system.
- Expediting the ongoing works of installation of new DTs and augmentation of existing DTs under IPDS, DDUGJY and State plans.Installation of automatic capacitor banks at identified power substations to improve voltage regulation and also enforce installation of capacitor banks in eligible consumer categories

Discom	Transformer	Capacitor bank	
		Nos	MVAr
MVVNL	5 MVA	594	1.98
	10 MVA	158	3.96
DVVNL	5 MVA	777	1.98
	10 MVA	316	3.96
PVVNL	5 MVA	226	1.98
	10 MVA	79	3.96
PuVVNL	5 MVA	786	1.98
	10 MVA	291	3.96
KESCO	5 MVA	25	1.98
	10 MVA	50	3.96

- Consider implementation of system automation and improve reliability with the introduction of system components, such as ring main units, sectionalised appropriately

Measures for improving consumer convenience

UPERC REGULATIONS

UPERC has issued Regulations "Standard of Performance (SOP) 2005." It covers the norms related to performance of Discoms for providing services to consumers. The SOP 2005 is under revision by UPERC. Many consumer-friendly measures are likely to come up, as the effort of UP Government in revised SOP such as consumer own choice meters, enforcement activities, and reliable power supply (24X7).

Initiatives taken by GoUP

Settlement scheme

In order to resolve long-pending consumer grievances and disputes, Government asked the Discoms to launch a settlement scheme in public interest. The

opportunity was given to all consumers to come to the mainstream by settling their cases.

Time of the day metering: Efforts are being made in consultation with UPERC to implement time of the day metering for all consumers, to contain consumption during peak hours, in order to flatten the load curve of Discoms.

Measures taken by Discoms

Minimised load-shedding:

This year, Discoms were able to contain load-shedding to only fraction of the total consumption, to the relief of the people of UP.

Suggested measures to facilitate household electrification

Following are the suggested measures to facilitate release of connections to rural households:

- States / Discoms should create awareness amongst public at large of uses of electricity, cost of accessing, cost of using electricity vis-à-vis cost being incurred on energy from alternative sources, including both direct & indirect costs, billing process, bill payments, immediate benefits of use, both tangible and intangible (quality of life, health, education, security, etc.), future prospects in income generation, employment, etc. This may be done by reaching out to them door-to-door with correct information and motivating them to obtain electricity connections.
- States / DISCOMs should take up extensive drive to curb the anti-social activity of theft of electricity and formalise connections where infrastructure is created, to bring them on ledgers of Discoms. Stern action against the culprits, including the Discom staff, if found colluding, is imperative.
- States / Discoms to focus on quality, reliability, and timings of power supply in rural areas. This is essential to create willingness amongst prospective consumers to obtain electricity connection.
- Rationalising cost of connection, particularly for households and allowing payment in installments
- Rationalising the tariff design to be in line with Tariff Policy 2016
- 100% metering at all levels (consumers/DTs/ feeders) to facilitate energy audit and extensive use of technology to improve efficiency and facilitate near real-time monitoring and interventions, to reduce AT&C losses.

Action points for State Government

Unelectrified consumers

CHALLENGE: Uttar Pradesh has a large number of un-electrified households. Last-mile connectivity is difficult due to the households being far-flung.

ACTION PLAN: A key step towards achieving complete electrification in the State would require a baseline database of the exact number and location of un-electrified households. A *survey* would be required to establish this database. Additionally, the survey will also help in establishing the number of unmetered/illegal connections.

Unmetered consumption of electricity

CHALLENGE: There is a large proportion of electrified domestic registered consumers who haven't installed meters. As per FY17 data, unmetered domestic consumers account for ~40% (68 lakh) of total domestic registered consumers. In addition to the above, State also has a challenging task to formalise and meter around 84 lakh electricity connections where infrastructure is created. Around 126 lakh meters (112 lakh – Rural and 15 lakh- Urban) would also be required for new connections envisaged, to achieve 100% electrification within next two years.

ACTION PLAN: Unmetered consumption is one of the reasons behind high loss levels in the State and hence it is of utmost importance that the State takes urgent action. Some of the key steps which need to be taken are:

1. ***Policy for metering****:* The survey as mentioned above will establish the baseline data. The next step is to roll out a metering policy/ guidelines to convert the unmetered consumers to metered ones. The policy may include a mechanism to incentivise the unmetered consumers going for meter installation within a well-defined timeline and penalty the unmetered consumers. Opportunity should be given to those with illegal connections to convert them to legal connections through an amnesty scheme/ waiver of interest dues and option of paying the principal by reasonable EMIs.
2. ***Metering the unmetered consumers****:* The final step is the implementation phase wherein meters shall be installed in a time-bound phased manner for all the households.

High loss levels

CHALLENGE: There are high AT&C losses due to poor repair & maintenance of equipment, theft, pilferage and meter tampering. etc.

ACTION PLAN: The following key steps may be adopted to reduce the high loss levels –

1. *Energy audit:* Extensive energy audit by an external agency be undertaken at each district level
2. *Feeder Separation:* Feeder segregation work may be carried out aggressively.
3. *Metering the unmetered consumers:* Unmetered/illegal connections need to be metered to reduce the loss levels as discussed above.
4. *Feeder managers* - Further the losses can be contained by appointing feeder managers, thereby making employees accountable for losses and failure of network.

Peak management

CHALLENGE: In Uttar Pradesh, there is considerable variation in off-peak and peak demand which needs to be addressed.

ACTION PLAN: Considering the variations in peak demand within the day as well as across the year, CEA will assist the State in formulating a strategy for flattening the load curve within next three months.

Quality of supply

CHALLENGE: Considering that UP is one of the biggest states in India in terms of area as well as population, providing quality supply is a key issue.

As more households get electrified it would become difficult to manage the supply as well as the associated consumer data.

ACTION PLAN: Various initiatives such as URJA MITRA will enable quality supply to the consumers.

While these measures will improve the quality of data, a detailed study on the feasibility of these measures should be conducted before implementing them.

Delay in implementation

CHALLENGE: There are delays in implementation of electrification works and other related utility projects.

ACTION PLAN: Some key steps to be undertaken for faster implementation of projects on the ground level are -

1. ***Project management unit****:* A project management unit may be created which will control various aspects of project execution and ensure timely and quality delivery of the projects.
2. ***New contractors****:* The state may look at hiring new contractors and conducting workshops to enable them to implement projects in a faster and transparent manner.

Additionally, the following actions points may be carried out-

- Free electricity connection will be given to urban and rural BPL households and APL households will be given 100% financing options at reasonable EMIs to avail of new connections.

- The State shall take all possible measures to help the distribution utilities achieve the targets and trajectories specified in UDAY.
- State envisages providing electricity to consumers with consumption up to 100 units per month at Rs 3.00 per unit.
- Based on a detailed study, the State will prepare a detailed plan to electrify households which are not covered under any of the ongoing State and Central schemes. The State will complete the said study within three months and would submit the supplementary DPRs for additional funding to achieve 100% electrification of households.
- The State may revisit the overall plan for augmentation of distribution network keeping in view increased load projections and would take necessary steps to meet the performance standards specified by UPERC.
- For effective implementation of projects and efficient operations, REC has planned to appoint Grameen Vidyut Abhiyanta and Urban Vidyut Abhiyanta.
- Feeder managers shall be placed at each feeder.
- The State will assist the distribution utilities in making use of technological developments including automation of substations, providing adequate communication infrastructure, GIS, Reliability, centralised network analysis and planning tools, SAP-driven ERP systems, OMS (Outage Management System), and distribution management systems.
- Weekly ground-level review of progress of projects under implementation will be conducted by the officials of Power Ministry of UP.

Rollout plan

Sl. No.	Category	Base year scenario (FY17)	Rollout plan		Total	Total expected capacity FY19
			FY18	FY19		
DISTRIBUTION						
A	**Connecting the unconnected**					
1	Target household electrification – Urban[1]	0	297209	1188838	1486047	1486047
2	Target household electrification – Rural – sanctioned	0	3998157	999539	4997696	4997696
3	Target household electrification – Rural - unsanctioned[2]	0	1242598	4970394	6212992	6212992
4	Formalisation of connections where infrastructure is created		6770156	1692539	8462695	8462695
5	Target village electrification	0	9	0	9	
B	**Consumer metering**					
	MVVNL	0	673246	448831	1122077	
	DVVNL	0	365419	700000	1065419	
	PVVNL	0	1015000	800000	1815000	
	PuVVNL	0	1692027	1128018	2820045	
	KESCO	0	0	0	0	
	NPCL	0	1564	1042	2606	
C	**Efficiency improvement**					
1	**AT&C losses**					
	MVVNL	27.80%	23.20%	19.45%		19.45%
	DVVNL	30.30%	24.83%	20.44%		20.44%
	PVVNL	22.99%	20.63%	17.53%		17.53%
	PuVVNL	34.19%	26.92%	20.65%		20.65%
	KESCO	29.44%	24.11%	19.37%		19.37%
	NPCL	9.49%	9.21%	8.92%		8.92%
	Total*	**28.27%**	**23.63%**	**19.36%**		**19.36%**
D	**Capacity addition/augmentation**					
	MVVNL					
	Urban					
1	33 KV substation (MVA)	5078	238	239	477	5555
2	33 KV line length (CKT KM)	5224	160	112	272	5496
3	11 KV line (CKT KM)	27880	550	1144	1694	29574
4	LT line (CKT KM)	157206	2200	7610	9810	167016

[1] It is assumed that remaining urban households will be electrified post 18 months of financial planning and tie up by Sept 2017

[2] It is assumed that these rural households will be electrified post 18 months of survey, financial planning & tie up by Sept 2017

Sl. No.	Category	Base year scenario (FY17)	Rollout plan		Total	Total expected capacity FY19
			FY18	FY19		
5	Capacity of 11/0.4 KV distribution T/F (MVA)	5911	61	293	354	6264
6	No. of 11/0.4 KV distribution T/F	36483	1400	1764	3164	39647
	Rural					
1	33 KV substation (MVA)	4133	335	189	524	4657
2	33 KV line length (CKT KM)	8306	800	160	960	9266
3	11 KV line (CKT KM)	93550	1950	4578	6528	100078
4	LT line (CKT KM)	235809	9500	11290	20790	256599
5	Capacity of 11/0.4 KV distribution T/F (MVA)	3450	125	166	291	3741
6	No. of 11/0.4 KV Distribution T/F	175658	5000	8533	13533	189191
	DVVNL					
	Urban					
1	33 KV substation (MVA)	2358	304	319	623	2981
2	33 KV line length (CKT KM)	4257	124	124	248	4505
3	11 KV line (CKT KM)	30326	495	545	1040	31366
4	LT line (CKT KM)	143734	2686	2686	5372	149106
5	Capacity of 11/0.4 KV distribution T/F (MVA)	2842	335	435	770	3612
6	No. of 11/0.4 KV distribution T/F	82437	4280	4250	8530	90967
	Rural					
1	33 KV substation (MVA)	6233	646	666	1312	7545
2	33 KV line length (CKT KM)	11800	625	625	1250	13050
3	11 KV line (CKT KM)	81682	1005	1040	2045	83727
4	LT line (CKT KM)	385166	3814	3814	7628	392794
5	Capacity of 11/0.4 KV distribution T/F (MVA)	7509	595	715	1310	8819
6	No. of 11/0.4 KV Distribution T/F (Nos.)	222559	11220	11180	22400	244959
	PVVNL					
	Urban					
1	33 KV substation (MVA)*	6476	1142	0	1142	7618
2	33 KV Line Length (CKT KM)	3032	500	306	806	3838
3	11 KV Line (CKT KM)	31289	850	814	1664	32953
4	LT Line (CKT KM)	101386	1600	1622	3222	104608
5	Capacity of 11/0.4 KV Distribution T/F (MVA)	5104	618	328	946	6050
6	No. of 11/0.4 KV Distribution T/F	58781	2978	1080	4058	62839
	Rural					
1	33 KV substation (MVA)	8951	1073	0	1073	10024
2	33 KV line length (CKT KM)	8349	1000	1182	2182	10531

Sl. No.	Category	Base year scenario (FY17)	Rollout plan		Total	Total expected capacity FY19
			FY18	FY19		
3	11 KV line (CKT KM)	55738	6840	4841	11681	67419
4	LT line (CKT KM)	139995	720	736	1456	141451
5	Capacity of 11/0.4 KV distribution T/F (MVA)	8524	400	610	1010	9534
6	No. of 11/0.4 KV distribution T/F	179441	7200	11299	18499	197940
	PuVVNL*					
	Urban					
1	33 KV substation (MVA)	3160	365	430	795	3955
2	33 KV line length (CKT KM)	3520	600	210	810	4330
3	11 KV kine (CKT KM)	39745	4200	4410	8610	48355
4	LT line (CKT KM)	105000	4500	2400	6900	111900
5	Capacity of 11/0.4 KV distribution T/F (MVA)	3500	347	315	662	4162
6	No. of 11/0.4 KV distribution T/F	19573	12200	4300	16500	36073
	Rural					
1	33 KV substation (MVA)	6250	690	785	1475	7725
2	33 KV line length (CKT KM)	12895	1400	490	1890	14785
3	11 KV line (CKT KM)	119235	8300	7590	15890	135125
4	LT line (CKT KM)	294500	13400	7600	21000	315500
5	Capacity of 11/0.4 KV distribution T/F (MVA)	9934	725	535	1260	11194
6	No. of 11/0.4 KV distribution T/F	332964	30692	13700	44392	377356
	KESCO					
1	33 KV substation (MVA)	1360	105	125	230	1590
2	33 KV line length (CKT KM)	599	554	500	1054	1653
3	11 KV line (CKT KM)	1105	124	103	227	1332
4	LT line (CKT KM)	1985	224	205	429	2414
5	Capacity of 11/0.4 KV Distribution T/F (MVA)	1352	145	160	305	1657
6	No. of 11/0.4 KV Ddstribution T/F	4754	475	525	1000	5754
	NPCL					
1	33 KV substation (MVA)	678	38	38	75	753
2	33 KV line length (CKT KM)	217	18	6	24	241
3	11 KV line (CKT KM)	2186	117	110	227	2413
4	LT line (CKT KM)	2850	245	250	495	3345
5	Capacity of 11/0.4 KV distribution T/F (MVA)	588	40	39	80	668
6	No. of 11/0.4 KV distribution T/F	6040	409	420	829	6869

8 Clean energy initiative

Achievement in renewable energy

An aggregate 2,244 MW capacity of renewable energy systems / plants has been installed in the state of Uttar Pradesh. Technology-wise details of renewable energy projects are given below:

Renewable energy projects (Total – 2,244 MW):

- Solar photovoltaic – 222 MW
- Wind – 0 MW
- Biomass power – 2,022 MW

Existing and proposed electrification through off-grid projects

Presently, the State is implementing following schemes to add off-grid capacity:

1. DDG scheme is being implemented in 25 villages / habitats in various districts and will cover 3,765 households with total installed capacity of 0.577 MW.
2. Installation of 138,805 **solar power packs** with total capacity of 16.6 MW has been completed till FY17.

The proposed electrification through off-grid projects is detailed below:

1. Under the DDG scheme, 498 villages / habitations shall be covered during the next 2 years to add total capacity of 12 MW and will cover around 35,000 households.
2. About 3.2 MW of solar-based mini grids have been installed, covering about 5,000 households. In addition, the State has planned to add around 10 MW of solar-based mini grid projects which will cover around 15,000 households.
3. Summarising the above, the State has planned to electrify around 50,000 households through upcoming off-grid projects.

Status of renewable energy policies in the State

GoUP has issued Uttar Pradesh Solar Power Policy, 2013, with targeted capacity addition of 500 MW through solar power plants by FY17. The solar power projects to be set up under this policy were categorised as follows:-

1. The first type is reserved for selling to UPPCL for meeting its Renewable Purchase Obligation for which the projects are selected through tariff based competitive bidding process.
2. The second type is for the projects set up for third-party sale.
3. And the third type is for the projects set up for captive usage.

Directions or the guiding policies are in place for capacity addition through small hydro power, grid connected solar rooftop power plants, DDG projects, bioenergy projects and solar off-grid projects. However, guiding policies for capacity addition through bioenergy power is under consideration for announcement.

SECI has been approached by the State to tie up around 2,000 MW capacity under State-specific VGF Schemes expected by FY19.

RPO status in Uttar Pradesh

Renewable purchase obligation– current status

The Hon'ble UP Electricity Regulatory Commission has issued UPERC (Promotion of Green Energy through Renewable Purchase Obligation) Regulations, 2010, which specifies that during each financial year, every obligated entity shall purchase a minimum percentage of its total consumption of electricity (in kWh) from renewable energy (RE) sources under RPO. The following table shows the status of RPO compliance in the State.

Table 28: Status of RPO compliance in the State

Year	FY16
Total power purchase at UPPCL Level (MU)	85597.03
Power purchased from renewable sources	32117.03
RPO compliance %	3.76%
RPO target %	6.00%
- RPO compliance (Non Solar) %	*5.00%*
- RPO compliance (Solar) %	*1.00%*

Plan for renewable energy addition up to FY19

Proposed addition in renewable energy

The proposed addition in grid connected renewable energy is shown below:

Table 29: Proposed addition in grid connected renewable energy (MW)

Particulars	FY18	FY19	Total
Solar power ground mounted	300	300	600
Grid connected solar rooftop	5	5	10
Wind	0	0	0
Biomass	50	100	150
SHP	1.5	6	7.5
SECI	0	2000	2000
Total	**356.5**	**2411**	**2767.5**

The proposed year-wise addition in off-grid renewable energy is shown below:

Table 30: Proposed addition in off-grid connected renewable energy (MW)

Particulars	FY18	FY19	Total
Solar (mini grid) & under DDG scheme	11	11	22
Solar other	8.0	8.0	16.0
Biogas	0.3	0.3	0.6
Wind	0	0	0
Small hydro	0	0	0
Biomass	10	10	20
Total	**29.3**	**29.3**	**58.6**

Proposed investment in renewable energy

UPERC may specify the RPO trajectory in line with RPO trajectory notified by Ministry of Power as under:

Year	Solar	Non-solar	Total
2016-17	2.75%	8.75%	11.50%
2017-18	4.75%	9.50%	14.25%
2018-19	6.75%	10.25%	17.00%

According to the above RPO trajectory, it is estimated that for fulfillment of RPO level of 17% in 2018-19, the requirement of solar power will be 3,960 MW and Non-solar power will be 4,570 MW.

The present solar power capacity available in the State as on 31.3.2017 is 222 MW and non-solar power capacity is 2022 MW only. Grid connected capacity addition of 2767.5 MW (including 2000 MW of SECI) of solar and 157.5 MW of non-solar proposed.

It is to be mentioned that all the renewable clean energy targets are dependent on UPPCL agreeing to buy power at discovered price as per RPO trajectory mentioned in the new tariff policy.

It is suggested that the State should plan for RE capacity addition as per RPO requirement of RPO trajectory issued by MoP.

UP has option to purchase solar and wind power from other states through ISTS to fulfil its RPO compliance.

Proposed investments:

a) A 440 MW solar park has been allotted to Uttar Pradesh, for which MNRE would provide CFA of Rs. 88 crore (i.e. Rs. 20 Lakhs/MW).

b) Expected investment in bioenergy is around Rs. 1,125 crore.

The proposed investment in additional renewable energy projects is shown below:

Table 31: Proposed investment in renewable energy sources (Rs crore)

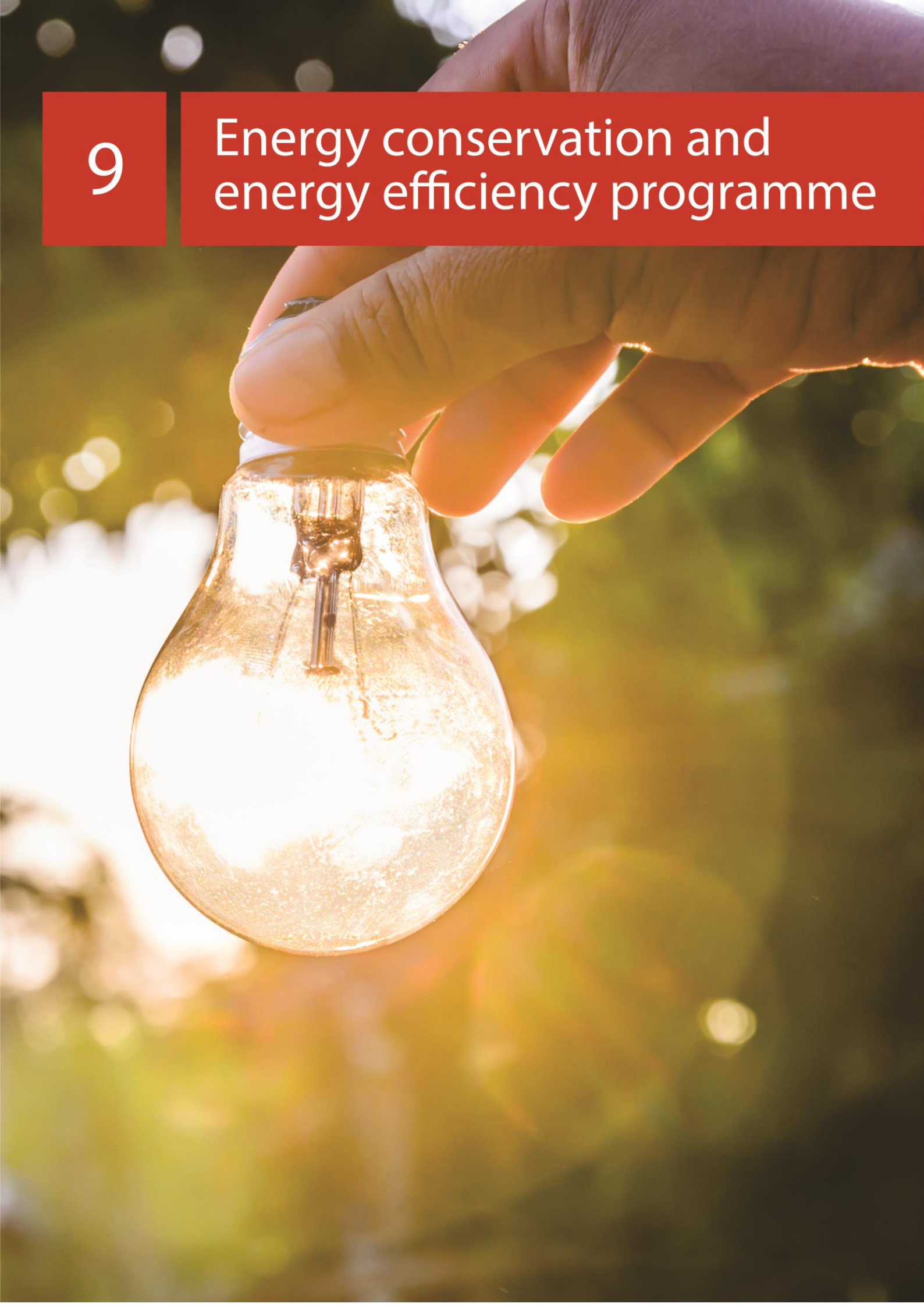
Particulars	FY18	FY19	Total
Solar	2285	2285	4570
Wind	0	0	0
SHP	10	48	58
Bioenergy	375	750	1125
Total	**2670**	**3083**	**5753**

Funding of proposed investment

The total proposed investment of Rs 5,753 crore for deployment of additional 2,826.1 MW (including 2,000 MW tie-up from SECI) capacity of renewable energy projects will be met from:

1. Central Financial Assistance provided from Ministry of New and Renewable Energy, under various schemes of GoI
2. Central financial assistance provided from Ministry of Power, GoI under DDG schemes
3. Grant provided from State Government
4. Investment by private developers
5. Funds / Technical Assistance mobilised through multilateral and bilateral organisations

9 Energy conservation and energy efficiency programme



Scope of demand-side measures

With implementation of various Demand Side Management (DSM) and Energy Efficiency measures in various sectors such as agriculture, municipalities, buildings, domestic, industries a considerable quantum of electricity can be saved. DSM has been traditionally seen as a means of reducing peak electricity demand. In fact, by reducing the overall load on an electricity network, DSM has various beneficial effects, including mitigating electrical system emergencies, reducing the number of blackouts and increasing system reliability.

Benefits also include reducing dependency on expensive imports of fuel, energy cost, and harmful emissions to the environment. Finally, DSM has a major role to play in deferring high investments in generation, transmission and distribution networks. Thus, DSM applied to electricity systems provides significant economic reliability and environmental benefits. Opportunities for reducing energy demand are numerous in all sectors and many are low-cost, or even no-cost items that most enterprises or individuals could adopt in the short term.

As per the report of National Productivity Council there is a scope of 13% to 15% reduction in electricity usage through demand side measures, which translates into 15,000 MU of annual energy savings which, in turn, results in reduction of around 1,500 MW of avoidable capacity in Uttar Pradesh.

In the area of NPCL, the potential for energy conservation is around 1 MU by lighting load reduction of 800 kW in peak hours.

Scope of various activities under different sectors to take DSM measures are summarised as follows:

Table 32: Scope of DSM measures in different sectors

Area	Activities
Municipal sector	(i) Lighting (ii) Pumping (iii) PF correction
Agricultural sector	(i) Lighting (ii) Pumping
Government buildings	(i) Air Conditioning (ii) Lighting (iii) PF correction
Multistory complexes	(i) Energy efficient building construction
Commercial buildings	(i) Lighting (ii) PF correction
Industries	(i) Energy efficient appliances (ii) PF correction
Promotion of solar power	(i) For all sectors
Reduction of T&D losses	(i) On substations (ii) Distribution network
Efficiency improvements in thermal power stations	(i) All state generating units

Demand side management measures:

The State has ordered various measures on energy efficiency, such measures include the following:

a. Demo projects under MuDSM programme of BEE for LED street lights shall be undertaken for Ghaziabad Development Authority with the help of EESL.

b. Façade lighting for Manmahal at Manmandir Ghat and Tulsi Ghat has been installed in Varanasi. EESL is also working on development of façade lighting for about 10 more heritage buildings at the Ganges Ghats of Varanasi.

c. Replacement of conventional lights with energy-efficient LED lights at all the 84 ghats of Varanasi has been successfully completed & about 1,200 LED lights have been installed at all the ghats and approach roads under Varanasi Ghat Flood Lighting Project in FY17. The expected energy saving per year is about 1.83 MU.

d. EESL has completed installation of more than 29,000 LED street lights in the city area of Varanasi under SLNP in FY17. Varanasi Nagar Nigam is expected to save over Rs 10 crore per annum and reduction in peak load from 5.4 MW to 3.0 MW. Additionally, LED heritage lighting installation is

under progress and 800 LED heritage lights have been installed in Kashi.

e. The works under the Energy Conservation Building Code shall be aggressively undertaken.

f. The Uttar Pradesh secretariat shall be developed as energy conservation model.

g. 30,000 kVAR capacity automatic power factor correctors (APFC) have been installed so far in 89 government buildings. Other government buildings will be covered gradually.

UP Electricity Regulatory Commission (UPERC) has passed an Order to implement DELP (DSM based Efficient Lighting Programme) through Energy Efficiency Services Limited (EESL) in 41 districts of the State. In the first phase, EESL has implemented the scheme in 41 districts of Purvanchal Vidyut Vitran Nigam Limited, Madhyanchal Vidyut Vitran Nigam Limited and KESCO. PVVNL & DVVNL Discoms are distributing LED lights in the districts they service. Total 1.5 crore (approx) LED lights (7 W/9W) have been distributed in the State since its launch on 8th June, 2015, at Varanasi. It has resulted in estimated energy saving of 1,948 MU. EESL's service model enables domestic households to procure LED lights at an affordable price of Rs. 10/- each and the balance on easy instalment from their electricity bill.

Uttar Pradesh Rajya Krishi Utpadan Mandi Parishad has replaced its present lighting system with energy-efficient LED lights. Total annual electricity saving is 0.350 MU.

The vision is to distribute 10 crore LED bulbs in Uttar Pradesh. EESL will supply LED bulbs through its distribution partners. EESL's regional officers will ensure frequent and high number of distribution kiosks at all places in U.P. The distribution of LED bulbs has to be complimented by a "massive awareness campaign" to educate consumers about the UJALA scheme. LED Bulb distribution will start simultaneously in all 22 Mandal Headquarters after 14th April, 2017, along with rollout of awareness campaigns across the State.

EESL will start distribution with target of at least 1.5 crore bulbs in FY17-18 and at least 2.0 crore bulbs in FY18-19. The plan for the distribution of the balance along with the time frame will be fixed based on the experience in the above phase. Further, under the agreement signed between EESL and Aligarh Municipal Corporation, LED street lighting implementation work in Aligarh is completed, where more than 14,000 LED street lights have been installed in FY17 resulting in estimated energy saving of about 9.0 MU with centralised control monitoring system (CCMS).

The energy audit of 20 State Government buildings has been done and annual energy saving potential has been estimated to be Rs. 5.27 crore with required investment of Rs. 9.61 crore.

By partial implementation of recommendations of energy audit reports in nine buildings, only around 0.22 MU per month is being saved with monthly cost savings of around Rs. 12.77 lakh.

Regular awareness programmes are being conducted in the State for 'energy efficiency'

A website http://upsavesenergy.com/Index.aspx has been started to create awareness amongst schools & students.

All State Government power houses and some heavy industries in the State have been identified as "Designated Consumers" and these are brought under the ambit of the "Perform, Achieve and Trade" (PAT) scheme of BEE to promote energy efficiency. Twenty-five DCs were covered in PAT Cycle-I and they have been issued total 4,06,551 positive ESCerts. These ESCerts are equivalent to 4,06,551 Toe.

In PAT Cycle-II, 46 DCs have been identified, including five Discoms.

The draft Energy Conservation Building Code" has been sent to the PWD department for notification. Along with it, capacity building for Energy Conservation Building Code (ECBC) is also being undertaken. As a pilot project, an ECBC compliant, UPERC building is being constructed.

The Government of Uttar Pradesh has established UPNEDA (Uttar Pradesh New and Renewable Energy Development Agency) as the **"State Designated Agency" (SDA)** working to promote energy efficiency under consultation with the Bureau of Energy Efficiency, MOP, GoI.

A government notification dated 27th October, 2016, has been issued to administer the State Energy Conservation Fund.

Implementation of "5 Star Rated Energy Efficient Fan": EESL has signed an MoU with MVVNL, PuVVNL & KESCO for distribution of energy-efficient fans. The implementation programme was launched on 9th April, 2016, from Varanasi and Kanpur, followed by Mirzapur, Gorakhpur, Chandauli, Sonbhadra, Azamgarh, Mau, Jaunpur and Allahabad, where more than 16,000 energy efficient fans have been distributed as on 22nd March, 2017, resulting in saving of approximately 6,300 units/ day.

Energy Efficient Pumps: In the State of Uttar Pradesh, approximately 10 lakh electrical pumps are used for agriculture. Under **"National Energy Efficient Agriculture Pumps Programme",** by replacing existing inefficient pumps with BEE 5-star rated energy efficient pumps, approximately 3.5 billion units of energy will be saved every year.

In addition, EESL would develop a programme to provide a reliable source of supply to agricultural pump sets, which are currently being operated through grid supply by way of solar mini grids. By developing such renewable energy-based grids, where the solar PV panel of around 2-3 times of existing pump-sets shall be put in the field of the farmer. The beneficiary will be able to receive considerable revenue on monthly basis by selling the excess power to the grid and based on his earmarked quantity for a period of 25 years. The benefits of the programme to the farmers includes social emancipation as well as contribution to the society by means of water conservation.

To start the above mentioned programme, EESL will submit the DPR of 10,000 gird connected pumps in April 2017 and PPA model document to UPPCL.

Before taking up the replacement of 10 lakh conventional pumps with energy efficient pumps, a pilot project for 10,000 pumps will be undertaken by EESL.

The phases for replacing 10 lakh conventional pumps shall be 10% in the first year, 15% in the second year, 35% in the third year, 20% in the fourth year, and 20% in the fifth year.

Table 33: Details on energy efficient pumps

Particulars	Unit	Approx value
Total pump sets*	Nos	10 lakh
Agricultural **consumption** - 18% of total consumption in state*	MU	11.755
Agricultural connected load*	kW	6,164,842
Average pump set capacity*	kW	6.20
Average consumption per pump set per year*	kWh	11,819
Approx cost of BEE Star rated pump set with smart panel & 5 years free repair (5, 7.5, 10 HP)	Rs	45,000
Project cost for 10,00,000 nos. of pump sets	Rs crore	3,500
Energy saving potential per year @ 30% for 1000,000 nos. of pump sets	MU	3,550
Monetary benefits @ Rs. 3.80 per kWh	Rs	1,350 crore
Implementation period for 10,00,000 nos. of pump sets	Years	5

** As per CEA General Review 2015*

MUNICIPAL ENERGY EFFICIENCY PROGRAMME (MEEP): Energy audit and optimising energy consumption are mandatory reforms under Atal Mission for Rejuvenation and Urban Transformation (AMRUT), a Mission driven by the Ministry of Urban Development, Government of India (Mound).

In this regard, EESL, a JV of PSUs under the Ministry of Power has signed an MoU with the MoUD, GoI to provide an overarching framework to facilitate

engagement between state governments and municipal bodies in the area of energy efficiency projects in Indian cities. By using the mandate and core competency of this public sector enterprise of the Ministry of Power, GoI, namely EESL, efforts in this area regarding preparation and implementation of projects in energy efficiency are fast tracked.

There are a total of 61 nos. of cities (as per Table 25) in the State of Uttar Pradesh identified under AMRUT which also includes cities identified under the Smart Cities Mission.

Subsequently, the Government of Uttar Pradesh (through the AMRUT Mission Directorate) and EESL entered into an agreement for preparation of investment grade energy audit (IGEA) report for determining potential of implementation of Municipal Energy Efficiency Programme (MEEP) in the public water works and sewerage systems. After preparation of the IGEA reports, replacement of the inefficient pump sets in the 61 cities shall be taken up on ESCO mode, wherein all the investment shall be done by EESL and the repayment shall be made by the State Government / Municipality through the energy savings achieved.

As per CEA's General Review 2013-14, electrical energy sale in the public water works and sewage system in the State of Uttar Pradesh was 1602.71 MU. At an approximate energy saving potential of 20% to 50%, it is estimated that by replacement of old inefficient pump sets in these public water works and sewage systems, approximately 400 MU may be saved each year which will result in monetary savings of approximately Rs. 260 crore per annum. This shall further help avoid need of generation by about 277 MW and reduce carbon emissions to the tune of 3,28,556 tonnes per annum.

IGEA reports for all 61 cities shall be prepared and submitted in a phased manner and shall be completed by June 2017. It is envisaged that replacement in all the 61 cities shall be completed by the end of August, 2018. The detailed list of 61 cities is shown in the table below:

Table 34: List of Cities in Uttar Pradesh

1	Agra	32	Jhansi
2	Akbarpur	33	Kanpur
3	Aligarh	34	Kasganj
4	Allahabad	35	Khurja
5	Amroha	36	Lakhimpur
6	Ayodhya*	37	Lalitpur
7	Azamgarh	38	Loni
8	Bahraich	39	Lucknow
9	Ballia	40	Mainpuri
10	Banda	41	Mathura
11	Baraut	42	Maunath Bhanjan
12	Bareilly	43	Meerut
13	Basti	44	Mirzapur-cum-Vindhyachal
14	Budaun	45	Modinagar
15	Bulandshahar	46	Moradabad
16	Chandausi	47	Mughalsarai
17	Deoria	48	Muzaffarnagar
18	Etah	49	Orai
19	Etawah	50	Pilibhit
20	Faizabad	51	Rae Bareli
21	Farrukhabad-cum-Fatehgarh	52	Rampur
22	Fatehpur	53	Saharanpur
23	Firozabad	54	Sambhal
24	Ghaziabad	55	Shahjahanpur
25	Ghazipur	56	Shamli
26	Gonda	57	Shikohabad
27	Gorakhpur	58	Sitapur
28	Hapur	59	Sultanpur
29	Hardoi	60	Unnao
30	Hathras	61	Varanasi
31	Jaunpur		

Proposed investment and funding

Year-wise action plan on energy conservation is being prepared by the State. Requirement of funds may be estimated only after preparation of such action plan. The distribution utilities have been asked to prepare annual action plans for Demand Side Management. Three distribution utilities have prepared DSM plan with the support of UPNEDA (UPSDA). UPERC has constituted a DSM Consultation Committee (DSM-CC) under the chairmanship of UPERC's chairman.

Funding for implementation of this action plan shall be sought from the following:

a. Central Financial Assistance provided by Bureau of Energy Efficiency (BEE), Ministry of Power, GoI

b. Uttar Pradesh State Energy Conservation Fund

c. Various beneficiaries/users

d. Central Financial Assistance provided from Ministry of New and Renewable Energy, GoI, under its various schemes.

Government of India intervention

Under the guidance of the Bureau of Energy Efficiency, Ministry of Power, the State Designated Agency has so far used the following methods to encourage energy efficiency,

a. Publicity/awareness

b. Workshops / training programmes for capacity building of stakeholders

c. Demonstration projects to showcase potential of new energy efficient technology

For achievement of desired targets, following actions are proposed to be undertaken at the level of the Central Government.

a. Ask the State Government to set targets of DSM and energy efficiency in specific measurable units (Megawatts and million units)

b. Monitor the implementation of year-wise action plans of energy efficiency in the State on a regular basis.

c. Ask the State Government to convert the distribution network of electricity into profit centres under such an arrangement.

d. Facilitate the State Government in notifying the Energy Conservation Building code to suit its local climatic condition and implement it through integration of the same in municipal bye-laws.

e. Facilitate the State Government in establishment of "Standalone" State Designated Agency for focused and effective implementation of energy efficiency in the State.

   i. The individual distribution sub-division of a distribution utility shall be an independent profit centre with an independent balance sheet.

   ii. The profit centre should be allowed to retain a certain percentage of revenue earned by the individual sub-division and should be allowed to spend it on reducing the T&D losses of the distribution network under its control.

   iii. The individual profit centres should be asked to act on an action plan to retrofit their sub-stations with energy-efficient technologies.

   iv. Huge commercial construction is likely to occur in many major cities in the State and having mandatory energy efficiency requirements will drastically reduce the demand-side energy used for commercial buildings.

Energy efficiency in the State can be implemented more effectively and coordinated smoothly in the presence of a "Standalone" State Designated Agency.

Action points for the State Government

a. State Power department to take steps to replace pump sets that are more than 10 years old across the State with energy-efficient pumps with smart control panel.

b. Efforts will be made to replace street lights in all municipalities with LED fittings and provide affordable energy-efficient fans and tubelights to people across the State.

c. EESL will arrange for 10 crore LED bulbs in the next two years to be made available to the people under the UJALA scheme. These LEDs are planned to be provided with the new release of connection also under electrification programme.

d. Discoms will conduct awareness programmes among common people for success of the scheme.

e. The State Government may sign agreement with EESL for replacement of the entire state's conventional street lights with LED street lights, which will help reduce peak load in the evening.

10 Financial viability of distribution companies

Financial Position of Distribution Utilities

The accumulated loss for the state distribution utilities based on their provisional accounts and NPCL as per its audited accounts is around Rs. 72,770 crore.

In contrast to its historical accumulated losses, in FY16, the utilities has booked a net loss of Rs 6,320 crore on standalone basis.

Although as per Tariff Regulations, the distribution licensees are entitled to claim 16% of return on equity, except NPCL, none of the utilities are claiming the same.

A detailed scenario analysis has been done to measure the financial performance in coming years.

This analysis provided hereafter decipher the condition of utilities with improvement in performance by end of FY19.

The existing Profit and Loss statement for each of the distribution utilities is given below:

Table 35: Profit and loss statement of the distribution licensees for FY16 (Rs crore)

Particulars	MVVNL	DVVNL	PVVNL	PuVVNL	KESCO	NPCL	Total
Income							
Sales turnover	5945	6502	11781	5909	2102	1001	33241
Net sales	*5945*	*6502*	*11781*	*5909*	*2102*	*1001*	*33241*
Other income	512	298	123	124	30	16	1103
Stock adjustments							
Subsidy	1593	2884	1241	3001	6	0	8724
Total income	**8051**	**9685**	**13145**	**9034**	**2138**	**1017**	**43069**
Expenditure							
Transmission charges	291	357	479	366	62	56	1611
Power and fuel cost	6800	8567	11298	8659	1504	609	37437
Employee cost	408	136	192	330	104	20	1191
R&M cost	447	416	559	425	81	56	1983
Total expenses	**7946**	**9476**	**12528**	**9781**	**1751**	**742**	**42222**
Operating profit	*105*	*208*	*617*	*-747*	*387*	*276*	*847*
PBDIT	105	208	617	-747	387	276	847
Interest	1006	2034	1104	1348	341	70	5903
PBDT	*-901*	*-1826*	*-487*	*-2095*	*46*	*206*	*-5057*
Depreciation	118	156	163	235	10	49	732
Exceptional items (prior period)	-11	8	3	1	1		2
Profit before tax	*-1008*	*-1990*	*-654*	*-2331*	*35*	*157*	*-5791*
Provision (Doubtful debt)	93	94	222	47	36		493
PBT (Post Extra-ord items)	*-1101*	*-2084*	*-875*	*-2378*	*-1*	*157*	*-6283*
Tax						36	36
Reported net profit	**-1101**	**-2084**	**-875**	**-2378**	**-1**	**120**	**-6320**
Accumulated losses	**-14829**	**-22307**	**-13223**	**-19489**	**-3525**	**602**	**-72770**

Status of UDAY

The Government of India, the State of Uttar Pradesh and the Discoms of Uttar Pradesh (Dakshinanchal Vidyut Vitran Nigam Limited, Kanpur Electric Supply Company Limited, Madhyanchal Vidyut Vitran Nigam Limited, Paschimanchal Vidyut Vitran Nigam Limited and Purvanchal Vidyut Vitran Nigam Limited) have signed a Memorandum of Understanding (MOU) under the Scheme UDAY – "Ujwal Discom Assurance Yojana" on 30th January, 2016, for operational and financial turnaround of the Discoms. UDAY is aimed at ensuring a permanent solution to the debt-ridden distribution utilities to achieve financial stability and to improve their operational efficiencies for sustained growth.

The Government of Uttar Pradesh would take over 75% of the total Discom debt outstanding as on 30th September, 2015, as envisaged in the scheme. The scheme also provides for the balance debt to be re-priced or issued as state-guaranteed Discom bonds, at coupon rates around 3% less than the average existing interest rate. The annual saving in the interest cost to the Discoms would be around Rs.1600 crore on account of the State's takeover of debt and reduction in interest rates on the balance debt.

Besides helping the Discoms to bring about financial turnaround, UDAY lays stress on improving operational efficiencies of the DISCOMs. During the period of turnaround, the State of Uttar Pradesh and the Discoms will bring about operational efficiency through compulsory feeder and distribution transformer metering, consumer indexing and GIS mapping of losses, upgrade/change transformers, meters etc, smart metering of high-end consumers, thereby bringing about reduction in transmission losses and AT&C losses, besides eliminating the gap between cost of supply of power and realisation. The reduction in AT&C losses and transmission losses to 15% and 3.95%, respectively, is likely to bring additional revenue of around Rs.17,700 crore during the period of turnaround, besides various other measures that shall benefit the State through other initiatives under the scheme.

Projected Benefits: Uttar Pradesh would derive an overall net benefit of approximately Rs.33,000 crore through UDAY, by way of savings in interest cost, reduction in AT&C and transmission losses, interventions in energy efficiency, coal reforms, etc. during the period of turnaround.

Bonds taken over: During FY16 and FY17, State Bonds of Rs. 39,133 crore and Discom Bonds of Rs. 10,376 crore have been issued.

The following table shows the estimated financial position of the State's distribution companies till end of FY19:

Table 36: Profit and loss statement of state Discoms as per UDAY (Rs crore)

Particulars	FY17	FY18	FY19
Income			
Sales turnover	52175	61529	73889
Net sales	*52175*	*61529*	*73889*
Other income	132	141	151
Subsidy	5500	5910	6002
Total income	57807	67580	80042
Expenditure			
Transmission charges	2239	2678	3241
Power and fuel cost	52174	57314	65021
Employee cost	2375	2565	2771
R&M cost	1806	1951	2107
Selling and admin expenses	926	1000	1080

Particulars	FY17	FY18	FY19
Miscellaneous expenses			
Pre-operative exp capitalised	-984	-1063	-1148
Total expenses	58536	64445	73072
Operating profit	*-729*	*3135*	*6970*
PBDIT	-729	3135	6970
Interest	3107	4363	4763
PBDT	*-3836*	*-1228*	*2207*
Depreciation	1176	1393	1639
Profit Before Tax	***-5012***	***-2621***	***568***

As per the provisional data for FY16 available, there is annual loss of Rs. 6,320 crore after considering subsidy of Rs. 8,724 crore.

Financial analysis as per 24x7 Power for All

Based on the roadmap discussed in the previous chapters, financial analysis has been done for Discoms. However, the impact analysis on financial position has been restricted up to FY19 as there are no projections of key drivers of capex and revenue items beyond FY19.

Common assumptions

- Any change in the power purchase cost will be taken care by the fuel and power purchase cost adjustment mechanism.
- Power purchase from short-term sources considered at the average rate of Rs. 3.50 per unit.
- Escalation towards employee expense has been considered at 6% except in FY18 where 17% escalation has been considered to capture the impact of 7th Pay Commission.
- Phasing of capital expenditure in IPDS and DDUGJY schemes has been considered as envisaged by distribution companies.
- Asset additions have been considered as 50% in same year of capital expenditure. Interest is calculated on assets capitalised only and no IDC has been considered.
- Interest computations have been done as per the existing loan profile of Discoms and addition of new loans at the prevailing market rates.
- The average cost of supply has been computed after deducting non-tariff income from the expenses.
- Interest due to delay in realisation of amount pertaining to FPPCA has been considered additionally at rate equivalent to delayed payment surcharge for period of around 9 months.
- Category-wise average billing rate for computation of revenue for FY17 has been taken as per the Tariff Order for FY17 with proportionate impact from expected date of revision in tariff.
- Transmission charges have been escalated in proportion to the increase in power purchase quantum and allocation and escalation of 5%.
- For new assets, depreciation has been calculated @ 7.50% and for the existing assets, depreciation has been calculated at the actual average depreciation rate of FY16.
- Other income has been considered at FY16 level.
- Debt: Equity ratio is 70:30 wherever applicable for internal schemes.
- Rate for selling surplus power has been considered as Rs. 3.50/kWh.
- For IPDS and DDUGJY, ratio of Grant: Loan: Equity is 60:30:10 is as per the provisions of the respective schemes.

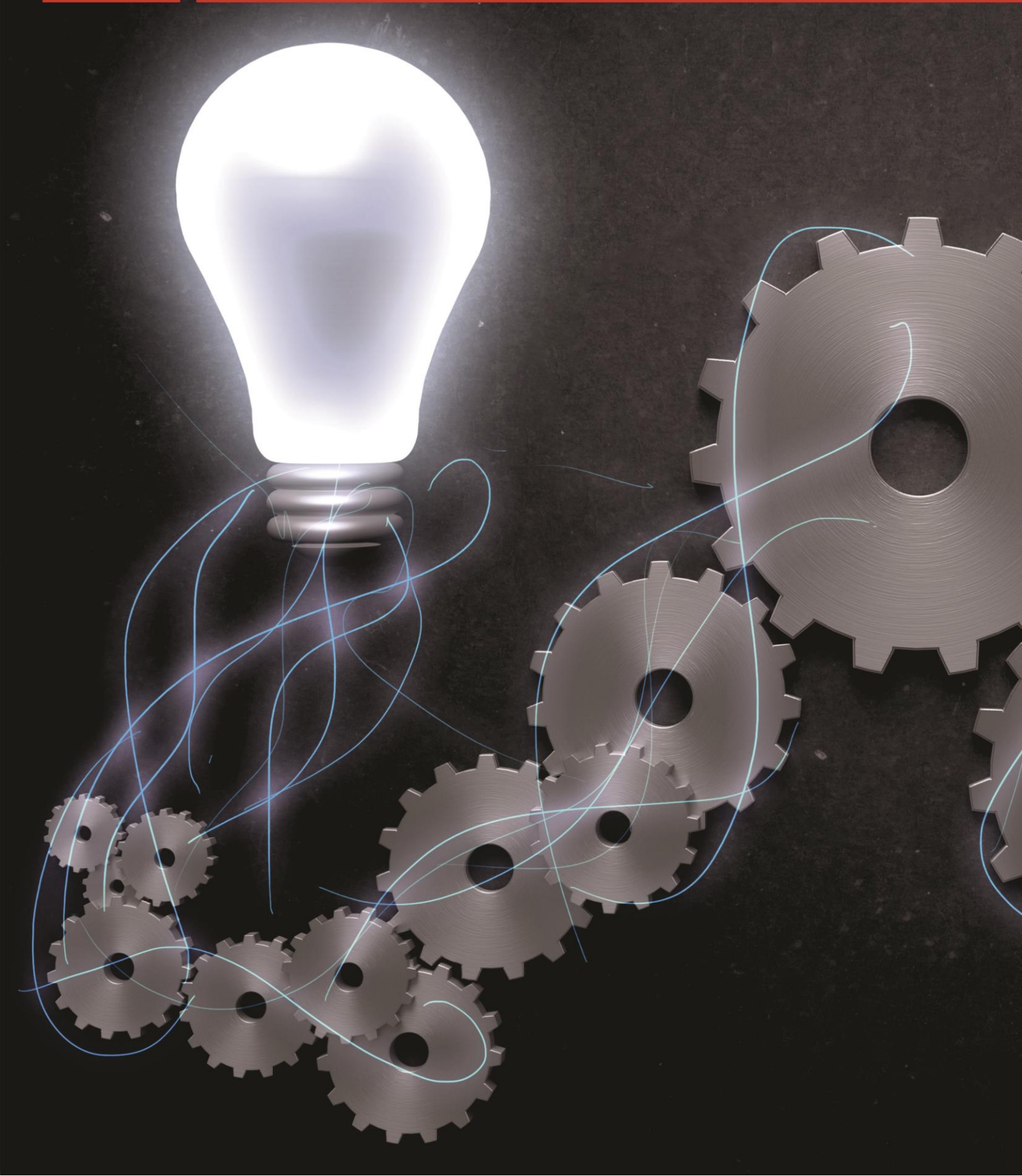
- Revenue subsidy has been considered as projected in UDAY.
- Capital expenditure pertaining to energy efficiency measures has not been considered as either these schemes are primarily funded through grants or have short payback period, thus having negligible impact on the financials of the distribution company.

Considering the above assumptions on achievement of 100% electrification and 24 hours supply in the State, the Discoms may become profitable from FY19 onwards if they reduce the AT&C losses and commensurate tariff revision projected in UDAY. The projected financial position of the Distribution companies in the State till end of FY19 is shown in Annexure 3 of this report.

Challenges: Although operational funding requirement has been assessed and factored in the projections, there may be time lag in arranging funds or unavailability of such funds given the condition of meeting this requirement only through issue of bonds. This time lag in arranging funds may have an impact on financing cost.

Further, due to the shortage of manpower, a number of persons are employed on contract/*samvida* basis. In view of the Hon'ble Supreme court's orders to pay the equivalent wages of regular workforce, the utility may have to pay them the wages at par with regular staff, which will have an impact on overall O&M cost.

11 Other initiatives



Communication

Successful implementation of 24x7 Power Supply Scheme requires clear communication among all the stakeholders across the value chain, including the consumers. In order to avoid potential roadblocks in implementation due to poor communication and flow of information, the following table lists the primary responsibility of each stakeholder and the corresponding method in which it will be carried out.

A centralised corporate communications team may be formed at the headquarters of UPPCL for overseeing implementation of the overall communications strategy.

The financial situation of the State makes it imperative to revise tariffs as per the UDAY MOU, while other initiatives including 24x7 supply are implemented. To address revision in tariff, the utilities should clearly communicate their plans on implementing the reliable 24x7 power supply scheme along with the other reliability and efficiency improvement measures that they are implementing. A high level of involvement of the GoUP will also be required:

Table 37: Proposed communication responsibilities

Key areas	Responsibility	Frequency
"Power for All" - Rollout plan	Secretary, Energy	Quarterly
Status update on deliverables	Secretary, Energy	Quarterly
Power procurement planning, IT and corporate planning, review and monitoring of state discoms	Chairman & MD UPPCL	Quarterly
Generation projects (thermal) *physical progress, achievements and other action areas*	Managing Director, UPRVUNL	Quarterly
Generation projects (hydro) *physical progress, achievements and other related issues*	Managing Director, UPJVNL	Quarterly
Inter-state transmission projects *Physical progress, achievements and other related issues*	Director (Projects), PGCIL	Monthly
Intra-state transmission projects *Physical progress, achievements and other related issues*	Managing Director, UPPTCL	Monthly
Distribution *progress, achievements, losses, consumer initiatives etc.*	Managing Director, (Each Distribution Company)	Monthly
Renewable power	Chairman, UPNEDA	Quarterly

Information technology

The need to adopt IT in every sphere of utility operation is self-evident. Power is a complex product that must be consumed on a real time basis. The overall value involved in the process is very high. Even more importantly it touches all citizens. Yet, the information systems that drive the operations of the sector are generally very basic and information transparency and consistency is poor.

While significant efforts have been made in the past to improve this, further enhancement and upgradation of existing IT systems are required in all spheres of the power sector.

- Power procurement planning and optimisation tools will be implemented to reduce power procurement costs and improve supply reliability. This will be achieved through the institution of technically robust forecasting, scheduling and dispatch (Unit Commitment) and settlement tools. The tools shall be used to ensure that the control room operators have the ability to take real-time decisions to achieve cost reduction.
- Requirement of Regional Distribution Control Centres (RDCC) within the State will be identified in view of upcoming projected load. These will initially cater to the principal load centres, but would thereafter be expanded to all load centres of

the State. This will be a key initiative, not only for effectively managing 24x7 power supply, but also thereafter for other functions like load forecasting.

- Project monitoring tools shall be incorporated in the PMU to ensure that progress on investments in the State are monitored rigorously and bottlenecks identified.
- Establishment of IT enabled Online Energy Metering, Billing & Collection System in state Discoms. Establishment of meter data acquisition system (MDAS), which will be integrated with all feeders and select consumers' meters. Integration of MDAS with Online Billing System will facilitate computation of feeder-wise AT&C losses. MDAS will also provide frequency and duration of power interruption and improve customer care centre services.
- The above online services may also be implemented in rural areas of the State using cloud computing based web enabled IT system, which will provide metering billing and collection (MBC) and other consumer centric services on internet. This system will facilitate arrangement of mobile camps for consumer billing and collection services at 40,000 consumer service centres available throughout the State.
- Implementation of various mobile applications for ease of business operation to provide the consumers on-the-go services and monitoring of KPIs of commercial activities. Mobile applications for the consumer (Consumer App), management (Management App) and field activities (Field App) shall be developed on priority with a monitoring dashboard.
- Centralised Information & Monitoring System for operational, enforcement & litigation, vigilance activities and analysis needs to be operationalised.
- In order to curb the malpractices at the level of meter reading, human intervention shall be gradually reduced by adopting appropriate metering and communication technology with IT tools.
- Standards of service specified under Section 57 of the Electricity Act 2003 will be monitored. Suitable IT tools may also be used by the utilities to gather the information required to redress consumers' grievances, effective tracking and escalation. The utilities shall use IT based customer care centres to improve service standards with minimal manual intervention and increase consumer awareness about the consumer centric services through various electronic modes.
- The above measures need to be implemented on priority basis by distribution companies in a unified and integrated manner and further to ensure that the systems are operational on uniform and common standards. For this, the UPPCL and Discoms will evolve a comprehensive IT plan to implement the above measures in a well-coordinated manner.
- A number of mobile applications to enhance ease of use, accountability and transparency in measuring and monitoring of various schemes and project status have been developed. Application and key features are as listed below :
- **Vidyut PRAVAH:** This app provides highlights of power availability, demand and market price in the exchange on real time basis.
- **Tarang:** Monitors progress of intra and inter-state transmission projects status on pan-India basis to ensure timely corrective actions.
- **DEEP:** This app supports in short- and medium-term power procurement in a uniform and transparent manner by utilities.
- **GARV – II:** App provides village-wise and habitation-wise base line data of household electrification of all states.
- **URJA:** App provides outage information, addressing complaints, power reliability of urban IT enabled towns.
- **National UJALA Dashboard-** App provides effective monitoring of distribution of LED to state utilities.

- **UDAY Monitoring Portal-** App provides effective monitoring of various parameters and reform measures signed under UDAY scheme.
- **URJA Mitra-** App provides effective monitoring of power outage and information dispensation to consumers.

Institutional arrangement

A strong monitoring framework is essential to ensure the success of the "Power for All" scheme. The following structure is being proposed to undertake regular monitoring of the progress of all initiatives being undertaken in this scheme.

- **Government of India (GOI) Level Committee:** It is proposed that this committee will review the overall progress of the scheme on a quarterly basis and provide necessary support to ensure a coordinated response from the Central Government - where necessary. The committee may be constituted with the following members – PFC, REC, CEA, SECI, EESL, BEE, Ministry of Power, MoEF, and MNRE.
- **State Government Level Committee:** It is proposed that a State level committee headed by the Secretary (Power) will be formed to review the progress of the scheme on a quarterly basis. This committee will monitor the progress of the works undertaken as part of the scheme and issue directions to enable faster execution.
- **Department Level Committee:** It is proposed that a Department level committee at UPPCL headed by the Chairman will be formed. This committee will undertake progress reviews on a monthly basis. A Discom-level DLC headed by MD which shall undertake steps required to ensure that the projects are progressing as per the action plan.
- **Project Monitoring Unit (PMU)** – A project monitoring unit shall be set up for monitoring the progress of the works being undertaken under this scheme. The PMU will operate under the Secretary, (Energy) and shall be operated by an external independent agency.

The PMU would be responsible for undertaking coordination, preparing action plans and monitoring progress of all works under the "Power for all" scheme. The PMU will facilitate tracking action taken/ to be taken and providing feedback to the various committees that are proposed to be set up under the scheme. The Government of India would supplement the efforts of the Government of Uttar Pradesh in establishing the Project Monitoring Unit (PMU).

The committees that are being proposed above are required to be set up at the earliest to kickstart the whole scheme. It is important that the committees keep meeting on a regular basis as per the frequency/ timelines mentioned above – to ensure that the objectives set out under the "Power for all" scheme are achieved.

Capacity building

With the increase of IT applications in the Transmission & Distribution system and to meet the expectations of 24x7 power supply for the consumers in the State, it is important to focus on capacity building of the employees for enhancement of technical know-how and keeping abreast with latest technological developments. Capacity building may also include consumer grievance redressal system, awareness regarding importance of working with safety, outage management system, demand side management, etc. It is also imperative that for transforming a distribution utility into a customer-friendly one, change of mind-set of employees would be required. It is critical that change management initiatives are rolled out and institutionalised for achieving better results.

In view of the importance of training on new technologies, there is a requirement for development and implementation of a well-structured Human Resource Training Programme to help realise the dream of 24x7 power supply system in the State in its true sense.

There is already a provision for Demand Side Management (DSM) training under various programmes of the Bureau of Energy Efficiency (BEE)

and the same should be implemented to achieve the goal of 24 x 7 power. Training for the class C & D employees is also being provided under the RAPDRP Part C scheme.

The already established state level training institute (ETI), may be strengthened and upgraded to update the latest technological and managerial skills for the employees of UP power utilities in sync with best practices across other power utilities. Following training programmes are proposed to be implemented for the utility:

- Two weeks' training for technical staff including officers and engineers once in every two years.
- One week's training for non-technical officers every two years.
- One week's training for subordinate technical staff at each district headquarters every year.

The institute will also facilitate following specific training to make every level of officers and staff competent for upcoming challenges:-

- Customer relationship management
- Organisational leadership building programme
- Data analytics
- Change management

Identification and following app of KPI and dovetailing of suitable MIS covering various schemes at different levels and thereby culminating into a dynamic, but integrated, financial impact on holistic level.

12 Year-wise rollout plan

SWOT analysis

In the above sections, we have discussed in detail the existing status and future needs. We have also provided some actionable targets which will help Uttar Pradesh achieve the set goal. Before structuring the above targets, a Strength, Weakness, Opportunities and Threats (SWOT) analysis of the existing power sector in Uttar Pradesh has been discussed. The exercise has been done to draw out some of the key risk indicators which affect the overall market in Uttar Pradesh and reveal advantages present.

Strengths

- Multiple licensees lead to better accountability
- Central procurement provides economies of scale
- Considerable quantum of power supply through central allocation

Weaknesses

- Large state – difficulty in last mile connectivity
- Most populous state – high proportion of low paying consumers
- Low collection efficiency
- High T&D and AT&C losses
- High manpower requirement
- Around 40% of unmetered domestic connections. High level of households to be formalised and metered.

Opportunities

- Improvement in efficiency of billing system
- Efficiency of revenue collection system
- Renewable energy potential
- Huge scope in DSM measures
- Modernisation of utilities and infrastructure

Threats

- Higher cost of new infrastructure
- Adequate fund availability
- Lower tariff hikes
- Cases under litigation
- Environmental issues

From the above analysis, it is quite evident that most of the threats are external factors which would need continuous efforts from Uttar Pradesh to mitigate them as soon as possible. Further, from the weaknesses, it is seen that with some strong and bold measures, Uttar Pradesh will be able to attain the target.

Based on the above observations, a roadmap for Uttar Pradesh has been developed to mitigate the above weaknesses and threats.

Rollout plan for 24 x 7 Power for All

Year-wise rollout plan for the State is summarised in the following table:

Table 38: Year-wise rollout plan

Sl. No.	Category	Base year scenario (FY17)	Rollout plan		Total	Total expected capacity FY19
			FY18	FY19		
GENERATION						
A	**Contracted capacity (MW):**					
	State sector					
1	Hydro	455	2	0	2	457
2	Thermal	5679	0	0	0	5679
3	Renewable – UPNEDA + private	2244	396	2452	2849	5093
	Grid	2244	355	2411	2766	5010
	Off grid	0	41	41	83	83
	Central sector					
4	Thermal (gas + coal)	4839	0	622	622	5461
5	Hydro + free power share	867	0	155	155	1022
6	Nuclear	361	0	0	0	361
	Private, JV& Others					
7	Private, JV & others (including competitive bid projects)	8157	2221	458	2679	10836
	Total (MW)	**22602**	**2619**	**3688**	**6307**	**28909**
B	**Peak demand (MW):**					
1	Peak demand (MW)	**17355**	**17934**	**18918**	**18918**	**18918**
TRANSMISSION						
C	**Transmission lines (CKM):**					
1	765 kV	1509	1005	100	1105	2614
2	400 kV	6193	1460	1100	2560	8753
3	220 kV	10282	1500	1500	3000	13282
4	132 kV	18130	980	960	1940	20070
	Total transmission line	**36113**	**4945**	**3660**	**8605**	**44718**
D	**Transformation capacity (MVA):**					
1	765/ 400 kV	9000	4000	3000	7000	16000
2	400/ 220 kV	16585	3000	5000	8000	24585
3	220/ 132 kV	29750	4020	5370	9390	39140
4	132/33 kV	37221	3848	4294	8142	45363
	Total transformation capacity	**92556**	**14868**	**17664**	**32532**	**125088**

Sl. No.	Category	Base year scenario (FY17)	Rollout plan		Total	Total expected capacity FY19
			FY18	FY19		
DISTRIBUTION						
E	**Connecting the unconnected**					
1	Target household electrification – Urban[3]	0	297209	1188838	1486047	1486047
2	Target Household Electrification – Rural - Sanctioned	0	3998157	999539	4997696	4997696
3	Target household electrification – Rural - unsanctioned[4]	0	1242598	4970394	6212992	6212992
4	Formalisation of connections where infrastructure is created		6770156	1692539	8462695	8462695
5	Target village electrification	0	9	0	9	
F	**Consumer metering**					
	MVVNL	0	673246	448831	1122077	
	DVVNL	0	365419	700000	1065419	
	PVVNL	0	1015000	800000	1815000	
	PuVVNL	0	1692027	1128018	2820045	
	KESCO	0	0	0	0	
	NPCL	0	1564	1042	2606	
G	**Efficiency improvement**					
1	**AT&C losses**					
	MVVNL	27.80%	23.20%	19.45%		19.45%
	DVVNL	30.30%	24.83%	20.44%		20.44%
	PVVNL	22.99%	20.63%	17.53%		17.53%
	PuVVNL	34.19%	26.92%	20.65%		20.65%
	KESCO	29.44%	24.11%	19.37%		19.37%
	NPCL	9.49%	9.21%	8.92%		8.92%
	Total	**28.27%**	**23.63%**	**19.36%**		**19.36%**
H	**Capacity addition/augmentation**					
	MVVNL					
	Urban					
1	33 KV substation (MVA)	5078	238	239	477	5555
2	33 KV line length (CKT KM)	5224	160	112	272	5496
3	11 KV line (CKT KM)	27880	550	1144	1694	29574
4	LT line (CKT KM)	157206	2200	7610	9810	167016
5	Capacity of 11/0.4 KV distribution T/F (MVA)	5911	61	293	354	6264
6	No of 11/0.4 KV distribution T/F	36483	1400	1764	3164	39647
	Rural					

[3] It is assumed that remaining urban households will be electrified post 18 months of financial planning and tie up by September 2017.

[4] It is assumed that these rural households will be electrified post 18 months of survey, financial planning and tie up by September 2017.

Sl. No.	Category	Base year scenario (FY17)	Rollout plan		Total	Total expected capacity FY19
			FY18	FY19		
1	33 KV substation (MVA)	4133	335	189	524	4657
2	33 KV line length (CKT KM)	8306	800	160	960	9266
3	11 KV line (CKT KM)	93550	1950	4578	6528	100078
4	LT line (CKT KM)	235809	9500	11290	20790	256599
5	Capacity of 11/0.4 KV distribution T/F (MVA)	3450	125	166	291	3741
6	No of 11/0.4 KV distribution T/F	175658	5000	8533	13533	189191
	DVVNL					
	Urban					
1	33 KV substation (MVA)	2358	304	319	623	2981
2	33 KV line length (CKT KM)	4257	124	124	248	4505
3	11 KV line (CKT KM)	30326	495	545	1040	31366
4	LT line (CKT KM)	143734	2686	2686	5372	149106
5	Capacity of 11/0.4 KV distribution T/F (MVA)	2842	335	435	770	3612
6	No of 11/0.4 KV distribution T/F	82437	4280	4250	8530	90967
	Rural					
1	33 KV substation (MVA)	6233	646	666	1312	7545
2	33 KV line length (CKT KM)	11800	625	625	1250	13050
3	11 KV line (CKT KM)	81682	1005	1040	2045	83727
4	LT line (CKT KM)	385166	3814	3814	7628	392794
5	Capacity of 11/0.4 KV distribution T/F (MVA)	7509	595	715	1310	8819
6	No of 11/0.4 KV distribution T/F	222559	11220	11180	22400	244959
	PVVNL					
	Urban					
1	33 KV substation (MVA)	6476	1142	0	1142	7618
2	33 KV line length (CKT KM)	3032	500	306	806	3838
3	11 KV line (CKT KM)	31289	850	814	1664	32953
4	LT line (CKT KM)	101386	1600	1622	3222	104608
5	Capacity of 11/0.4 KV distribution T/F (MVA)	5104	618	328	946	6050
6	No of 11/0.4 KV distribution T/F	58781	2978	1080	4058	62839
	Rural					
1	33 KV substation (MVA)	8951	1073	0	1073	10024
2	33 KV line length (CKT KM)	8349	1000	1182	2182	10531
3	11 KV line (CKT KM)	55738	6840	4841	11681	67419
4	LT line (CKT KM)	139995	720	736	1456	141451
5	Capacity of 11/0.4 KV distribution T/F (MVA)	8524	400	610	1010	9534
6	No of 11/0.4 KV distribution T/F	179441	7200	11299	18499	197940

Sl. No.	Category	Base year scenario (FY17)	Rollout plan		Total	Total expected capacity FY19
			FY18	FY19		
	PuVVNL					
	Urban					
1	33 KV substation (MVA)	3160	365	430	795	3955
2	33 KV line length (CKT KM)	3520	600	210	810	4330
3	11 KV line (CKT KM)	39745	4200	4410	8610	48355
4	LT line (CKT KM)	105000	4500	2400	6900	111900
5	Capacity of 11/0.4 KV distribution T/F (MVA)	3500	347	315	662	4162
6	No of 11/0.4 KV distribution T/F	19573	12200	4300	16500	36073
	Rural					
1	33 KV substation (MVA)	6250	690	785	1475	7725
2	33 KV line length (CKT KM)	12895	1400	490	1890	14785
3	11 KV line (CKT KM)	119235	8300	7590	15890	135125
4	LT line (CKT KM)	294500	13400	7600	21000	315500
5	Capacity of 11/0.4 KV distribution T/F (MVA)	9934	725	535	1260	11194
6	No of 11/0.4 KV distribution T/F	332964	30692	13700	44392	377356
	KESCO					
1	33 KV substation (MVA)	1360	105	125	230	1590
2	33 KV line length (CKT KM)	599	554	500	1054	1653
3	11 KV line (CKT KM)	1105	124	103	227	1332
4	LT line (CKT KM)	1985	224	205	429	2414
5	Capacity of 11/0.4 KV distribution T/F (MVA)	1352	145	160	305	1657
6	No of 11/0.4 KV distribution T/F	4754	475	525	1000	5754
	NPCL					
1	33 KV substation (MVA)	678	38	38	75	753
2	33 KV line length (CKT KM)	217	18	6	24	241
3	11 KV line (CKT KM)	2186	117	110	227	2413
4	LT line (CKT KM)	2850	245	250	495	3345
5	Capacity of 11/0.4 KV distribution T/F (MVA)	588	40	39	80	668
6	No of 11/0.4 KV distribution T/F	6040	409	420	829	6869

Discom-wise quarterly rollout plan is shown in Table 48 in Annexure-1.

Annexures

Annexure – 1

Table 39: District-wise households and electrification status as per Census, 2011 (%)

S No	District	Households		Electrification status - Rural		Electrification status - Urban	
		Rural	Urban	Electrified	Un-electrified	Electrified	Un-electrified
1	Saharanpur	68.70	31.30	58.83	41.17	90.29	9.71
2	Muzaffarnagar	70.60	29.40	42.87	57.13	80.82	19.18
3	Bijnor	75.84	24.16	32.65	67.35	74.14	25.86
4	Moradabad	66.37	33.63	14.34	85.66	78.46	21.54
5	Rampur	74.07	25.93	17.69	82.31	78.00	22.00
6	JyotibaPhule Nagar	74.94	25.06	12.81	87.19	75.64	24.36
7	Meerut	47.17	52.83	56.87	43.13	90.88	9.12
8	Baghpat	78.62	21.38	51.00	49.00	81.51	18.49
9	Ghaziabad	29.25	70.75	64.47	35.53	91.75	8.25
10	Gautam Buddha Nagar	34.52	65.48	57.06	42.94	94.30	5.70
11	Bulandshahr	75.30	24.70	25.79	74.21	76.97	23.03
12	Aligarh	67.22	32.78	26.56	73.44	80.83	19.17
13	Mahamaya Nagar	78.86	21.14	43.11	56.89	84.11	15.89
14	Mathura	70.83	29.17	58.55	41.45	92.54	7.46
15	Agra	54.58	45.42	67.88	32.12	94.01	5.99
16	Firozabad	65.86	34.14	29.27	70.73	82.88	17.12
17	Mainpuri	84.33	15.67	16.42	83.58	73.68	26.32
18	Budaun	82.04	17.96	9.15	90.85	58.62	41.38
19	Bareilly	63.73	36.27	14.40	85.60	75.50	24.50
20	Pilibhit	82.33	17.67	14.02	85.98	64.65	35.35
21	Shahjahanpur	80.82	19.18	11.66	88.34	66.70	33.30
22	Kheri	88.75	11.25	11.51	88.49	62.84	37.16
23	Sitapur	89.47	10.53	7.13	92.87	61.53	38.47
24	Hardoi	87.41	12.59	6.54	93.46	61.63	38.37
25	Unnao	83.76	16.24	8.43	91.57	64.45	35.55
26	Lucknow	33.34	66.66	30.20	69.80	91.17	8.83
27	Rae Bareli	91.46	8.54	37.07	62.93	75.46	24.54
28	Farrukhabad	77.68	22.32	15.71	84.29	73.42	26.58
29	Kannauj	83.42	16.58	14.17	85.83	61.73	38.27
30	Etawah	77.72	22.28	29.26	70.74	82.33	17.67
31	Auraiya	83.61	16.39	17.51	82.49	71.56	28.44
32	Kanpur Dehat	90.75	9.25	10.69	89.31	58.41	41.59
33	Kanpur Nagar	35.50	64.50	15.70	84.30	89.03	10.97
34	Jalaun	75.52	24.48	26.06	73.94	67.78	32.22
35	Jhansi	59.94	40.06	30.08	69.92	82.75	17.25
36	Lalitpur	85.60	14.40	27.83	72.17	80.27	19.73

S No	District	Households		Electrification status - Rural		Electrification status - Urban	
		Rural	Urban	Electrified	Un-electrified	Electrified	Un-electrified
37	Hamirpur	82.06	17.94	18.14	81.86	65.79	34.21
38	Mahoba	79.20	20.80	17.78	82.22	58.58	41.42
39	Banda	84.73	15.27	14.20	85.80	70.36	29.64
40	Chitrakoot	90.04	9.96	19.69	80.31	68.09	31.91
41	Fatehpur	88.08	11.92%	9.31	90.69	64.70	35.30
42	Pratapgarh	94.88	5.12	23.56	76.44	77.19	22.81
43	Kaushambi	92.23	7.77	12.54	87.46	54.86	45.14
44	Allahabad	77.48	22.52	30.45	69.55	88.74	11.26
45	Bara Banki	90.59	9.41	14.41	85.59	63.68	36.32
46	Faizabad	86.65	13.35	22.85	77.15	80.72	19.28
47	Ambedkar Nagar	88.31	11.69	22.70	77.30	62.29	37.71
48	Sultanpur	94.80	5.20	34.65	65.35	84.09	15.91
49	Bahraich	92.39	7.61	9.82	90.18	70.21	29.79
50	Shrawasti	96.80	3.20	9.49	90.51	55.38	44.62
51	Balrampur	92.27	7.73	13.16	86.84	74.18	25.82
52	Gonda	93.37	6.63	15.07	84.93	80.89	19.11
53	Siddharthnagar	93.67	6.33	22.20	77.80	62.12	37.88
54	Basti	94.41	5.59	25.36	74.64	80.81	19.19
55	SantKabir Nagar	92.86	7.14	27.96	72.04	67.95	32.05
56	Mahrajganj	94.93	5.07	19.38	80.62	66.66	33.34
57	Gorakhpur	80.40	19.60	31.80	68.20	87.17	12.83
58	Kushinagar	95.22	4.78	20.69	79.31	64.79	35.21
59	Deoria	90.29	9.71	27.79	72.21	68.51	31.49
60	Azamgarh	92.23	7.77	24.07	75.93	71.90	28.10
61	Mau	78.61	21.39	37.48	62.52	80.71	19.29
62	Ballia	90.64	9.36	20.92	79.08	63.09	36.91
63	Jaunpur	92.32	7.68	22.77	77.23	80.63	19.37
64	Ghazipur	92.57	7.43	15.99	84.01	71.87	28.13
65	Chandauli	87.05	12.95	27.72	72.28	74.64	25.36
66	Varanasi	55.65	44.35	39.66	60.34	90.12	9.88
67	SantRavidas Nagar (Bhadohi)	85.56	14.44	32.13	67.87	71.93	28.07
68	Mirzapur	85.84	14.16	30.71	69.29	77.64	22.36
69	Sonbhadra	81.77	18.23	17.18	82.82	83.31	16.69
70	Etah	84.57	15.43	14.01	85.99	78.50	21.50
71	Kanshiram Nagar	80.58	19.42	11.04	88.96	63.95	36.05
72	**Total**	**77.37**	**22.63**	**23.77**	**76.23**	**81.42**	**18.58**

Table 40: Projected category-wise sales (in MU) combined for six distribution utilities

Categories	Projections		
	FY17	FY18	FY19
Domestic	35427	46092	57423
Commercial	5762	6354	7010
Public lamps	937	1003	1076
Public & private institutions	1601	1699	1807
Small private **tubewell**	10199	10709	10849
Small industries	3244	3433	3636
Public water works	1900	2098	2324
State tubewells	3249	3411	3582
Temporary connections	261	316	384
Departmental employees	555	606	663
Non-industrial bulk load	2877	3236	3644
Large & heavy industries	12849	13698	14621
Railway traction	1051	1148	1265
Medium & large pumped canals	1021	1068	1117
Extra & bulk sales	2855	2858	2862
Energy efficiency	0	-2598	-9092
Total	**83789**	**95131**	**103173**

Table 41: Energy requirement (in MU) and peak demand (in MW) for MVVNL

Particulars	FY17	FY18	FY19	FY20	FY21	FY22
Total **sale** (MU)	14250	16270	17616	19859	21393	23072
Distribution loss	18.31%	14.71%	12.17%	11.99%	11.99%	11.99%
Energy input at distribution interface	17444	19076	20058	22566	24309	26217
Intra-state transmission losses	3.59%	3.59%	3.59%	3.59%	3.59%	3.59%
Total energy requirement at state boundary (MU)	**18093**	**19786**	**20805**	**23406**	**25214**	**27193**
Load factor	71.6%	74.9%	74.1%	74.1%	74.1%	74.1%
Maximum demand (MW)	**2885**	**3014**	**3204**	**3604**	**3883**	**4187**

Table 42: Energy requirement (in MU) and peak demand (in MW) for DVVNL

Particulars	FY17	FY18	FY19	FY20	FY21	FY22
Total sale (MU)	22307	25805	28261	32840	36291	40153
Distribution loss	21.49%	16.81%	13.47%	12.47%	12.47%	12.47%
Energy input at distribution interface	28411	31020	32661	37518	41462	45874
Intra-state transmission losses	3.59%	3.59%	3.59%	3.59%	3.59%	3.59%
Total energy requirement at state boundary (MU)	**29469**	**32175**	**33877**	**38915**	**43006**	**47582**
Load factor	71.6%	74.9%	74.1%	74.1%	74.1%	74.1%
Maximum demand (MW)	**4699**	**4902**	**5217**	**5992**	**6622**	**7327**

Table 43: Energy requirement (in MU) and peak demand (in MW) for PVVNL

Particulars	FY17	FY18	FY19	FY20	FY21	FY22
Total sale (MU)	24570	28281	31643	35702	38207	40917
Distribution loss	20.48%	18.02%	14.79%	11.08%	11.08%	11.08%
Energy input at distribution interface	30896	34496	37136	40152	42970	46018
Intra-state transmission losses	3.59%	3.59%	3.59%	3.59%	3.59%	3.59%
Total energy requirement at state boundary (MU)	**32046**	**35781**	**38519**	**41648**	**44570**	**47731**
Load factor	71.6%	74.9%	74.1%	74.1%	74.1%	74.1%
Maximum demand (MW)	**5109**	**5451**	**5931**	**6413**	**6863**	**7350**

Table 44: Energy requirement (in MU) and peak demand (in MW) for PuVVNL

Particulars	FY17	FY18	FY19	FY20	FY21	FY22
Total sale (MU)	17669	19367	20159	21959	23548	25275
Distribution loss	19.84%	14.04%	9.77%	12.62%	12.62%	12.62%
Energy input at distribution interface	22042	22531	22342	25129	26948	28923
Intra-state transmission losses	3.59%	3.59%	3.59%	3.59%	3.59%	3.59%
Total energy requirement at state boundary (MU)	**22863**	**23370**	**23174**	**26065**	**27951**	**30000**
Load factor	71.6%	74.9%	74.1%	74.1%	74.1%	74.1%
Maximum demand (MW)	**3645**	**3560**	**3568**	**4014**	**4304**	**4620**

Table 45: Energy requirement (in MU) and peak demand (in MW) for KeSCO

Particulars	FY17	FY18	FY19	FY20	FY21	FY22
Total sale (MU)	3225	3442	3392	3607	3837	4083
Distribution loss	23.76%	18.73%	14.42%	11.54%	11.54%	11.54%
Energy input at distribution interface	4230	4236	3964	4077	4337	4616
Intra state transmission losses	3.59%	3.59%	3.59%	3.59%	3.59%	3.59%
Total energy requirement at state boundary (MU)	**4388**	**4394**	**4112**	**4229**	**4499**	**4788**
Load factor	71.6%	74.9%	74.1%	74.1%	74.1%	74.1%
Maximum demand (MW)	**700**	**669**	**633**	**651**	**693**	**737**

Table 46: Energy requirement (in MU) and peak demand (in MW) for NPCL

Particulars	FY17	FY18	FY19	FY20	FY21	FY22
Total sale (MU)	1768	1966	2101	2418	2770	3200
Distribution loss	8.00%	8.00%	8.00%	8.00%	8.00%	8.00%
Energy input at distribution interface	1922	2137	2284	2628	3011	3479
Intra-state transmission losses	3.59%	3.59%	3.59%	3.59%	3.59%	3.59%
Total energy requirement at state boundary (MU)	**1994**	**2217**	**2369**	**2726**	**3123**	**3608**
Load factor	71.6%	74.9%	74.1%	74.1%	74.1%	74.1%
Maximum demand (MW)	**318**	**338**	**365**	**420**	**481**	**556**

Table 47: Source-wise existing contracted capacity (MW)

Sr. No.	Source	Capacity Available in MW
A	**Existing State sector thermal generating stations**	
1	*Anpara A*	630
2	*Anpara B*	1000
3	*Anpara D*	1000
4	*Harduagunj*	105
5	*Obra A*	94
6	*Obra B*	1000
7	*Panki*	210
8	*Parichha*	220
9	*Parichha Extn.*	420
10	*Parichha Extn. Stage II*	500
11	*Harduaganj Ext.*	500
	Existing state sector thermal generating stations	**5679**
B	**Existing state sector hydel generating stations**	
1	*Khara*	58
2	*Matatila*	20
3	*Obra (Hydel)*	99
4	*Rihand*	255
5	*UGC power stations*	14
6	*Belka & Babail*	6
7	*Sheetla*	4
	Existing state sector hydel generating stations	**455**
C	**Existing NHPC generating stations**	
1	Chamera	109
2	Chamera-II	86
3	Chamera-III	62
4	Dhauliganga	75
5	Salal I&II	48
6	Tanakpur	21
7	Uri	96
8	Dulhasti	111
9	Sewa-II	35
10	Uri-II	25
11	Parbati ST-III	104
	Existing NHPC generating stations	**773**
D	**Existing NTPC generating stations**	
1	*Anta*	119
2	*Auriya*	243
3	*Dadri Thermal*	84
4	*Dadri Gas*	271

Sr. No.	Source	Capacity Available in MW
5	*Dadri Extension*	148
6	*Rihand-I*	372
7	*Rihand-II*	346
8	*Singrauli*	846
9	*Tanda*	440
10	*Unchahar-I*	257
11	*Unchahar-II*	152
12	*Unchahar-III*	74
13	*Farakka*	33
14	*Kahalgaon St. I*	77
15	*Kahalgaon St.II Ph.I*	251
16	*Koldam (Hydro)*	95
17	*Rihand-III*	375
18	*Others (including unallocated)*	750
	Existing NTPC generating stations	**4933**
E	**Existing central sector atomic power stations**	
1	*NAPP*	166
2	*RAPP #3&4*	80
3	*RAPP#5&6*	115
	Existing central sector atomic power stations	**361**
F	**Existing stations (IPP / JV)**	
1	*Srinagar*	290
2	*Sasan*	465
3	*Karcham-Wangtoo*	200
4	*VISHNUPRAYAG*	352
5	*Rosa Power Project*	600
6	*Rosa Power Project*	600
7	*Anpara 'C'*	1100
8	*Lalitpur*	1980
9	*CASE-I*	932
10	*Bara*	1188
11	*Bajaj Hindusthan*	450
	Existing stations (IPP / JV)	**8157**
G	**Co-generation & other sources**	
1	*Captive and cogeneration & other renewable*	2022
2	*Solar energy from outside state*	222
	Co-generation & other sources	**2244**
	Total contracted capacity for state	**22602**

Table 48: Discom-wise quarterly rollout plan

SL	Category	Base year scenario (FY17)	FY18				FY19				Total	Total expected capacity FY19
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
DVVNL Urban												
1	33 KV substation (MVA)	2358	76	76	76	76	80	80	80	80	623	2981
2	33 KV line length (CKT KM)	4257	31	31	31	31	31	31	31	31	248	4505
3	11 KV line (CKT KM)	30326	124	124	124	124	136	136	136	136	1040	31366
4	LT Line (CKT KM)	143734	672	672	672	672	672	672	672	672	5372	149106
5	Capacity of 11/0.4 KV distribution T/F (MVA)	2842	84	84	84	84	109	109	109	109	770	3612
6	No of 11/0.4 KV distribution T/F	82437	1070	1070	1070	1070	1063	1063	1063	1063	8530	90967
DVVNL Rural												
1	33 KV substation (MVA)	6233	162	162	162	162	167	167	167	167	1312	7545
2	33 KV line length (CKT KM)	11800	156	156	156	156	156	156	156	156	1250	13050
3	11 KV line (CKT KM)	81682	251	251	251	251	260	260	260	260	2045	83727
4	LT line (CKT KM)	385166	954	954	954	954	954	954	954	954	7628	392794
5	Capacity of 11/0.4 KV distribution T/F (MVA)	7509	149	149	149	149	179	179	179	179	1310	8819
6	No of 11/0.4 KV distribution T/F	222559	2805	2805	2805	2805	2795	2795	2795	2795	22400	244959
1	Connecting the unconnected (Urban)[5]	0	15061	15061	15061	15061	60245	60245	60245	60245	301226	301226
2	Connecting the unconnected (Rural)[6]	0	248146	248146	248146	248146	301393	301393	301393	301393	2198154	2198154
3	Formalisation of connections where infrastructure is created	0	312108	312108	312108	312108	78027	78027	78027	78027	1560541	1560541
4	Metering the unmetered consumers	0	91355	91355	91355	91355	175000	175000	175000	175000	1065419	1065419

[5] It is assumed that remaining urban households will be electrified post 18 months of financial planning and tie up by September 2017

[6] It is assumed that these rural households will be electrified post 18 months of survey, financial planning and tie up by September 2017

SL	Category	Base year scenario (FY17)	FY18				FY19				Total	Total expected capacity FY19
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
PuVVNL Urban												
1	33 KV substation (MVA)	3160	91	91	91	91	108	108	108	108	795	3955
2	33 KV line length (CKT KM)	3520	150	150	150	150	53	53	53	53	810	4330
3	11 KV line (CKT KM)	39745	1050	1050	1050	1050	1103	1103	1103	1103	8610	48355
4	LT line (CKT KM)	105000	1125	1125	1125	1125	600	600	600	600	6900	111900
5	Capacity of 11/0.4 KV distribution T/F (MVA)	3500	87	87	87	87	79	79	79	79	662	4162
6	No of 11/0.4 KV distribution T/F	19573	3050	3050	3050	3050	1075	1075	1075	1075	16500	36073
PuVVNL Rural												
1	33 KV substation (MVA)	6250	173	173	173	173	196	196	196	196	1475	7725
2	33 KV line length (CKT KM)	12895	350	350	350	350	123	123	123	123	1890	14785
3	11 KV line (CKT KM)	119235	2075	2075	2075	2075	1898	1898	1898	1898	15890	135125
4	LT line (CKT KM)	294500	3350	3350	3350	3350	1900	1900	1900	1900	21000	315500
5	Capacity of 11/0.4 KV distribution T/F (MVA)	9934	181	181	181	181	134	134	134	134	1260	11194
6	No of 11/0.4 KV distribution T/F	332964	7673	7673	7673	7673	3425	3425	3425	3425	44392	377356
1	Connecting the unconnected (Urban) [7]	0	15061	15061	15061	15061	60245	60245	60245	60245	301226	301226
2	Connecting the unconnected (Rural) [8]	0	147816	147816	147816	147816	67504	67504	67504	67504	861282	861282
3	Formalisation of connections where infrastructure is created	0	236505	236505	236505	236505	59126	59126	59126	59126	1182525	1182525
4	Metering the unmetered consumers	0	423007	423007	423007	423007	282005	282005	282005	282005	2820045	2820045

[7] It is assumed that remaining urban households will be electrified post 18 months of financial planning and tie up by September 2017.

[8] It is assumed that these rural households will be electrified post 18 months of survey, financial planning and tie up by September 2017.

SL	Category	Base year scenario (FY17)	FY18				FY19				Total	Total expected capacity FY19
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
PVVNL Urban												
1	33 KV substation (MVA)	6476	286	286	286	286	0	0	0	0	1142	7618
2	33 KV line length (CKT KM)	3032	125	125	125	125	76	76	76	76	806	3838
3	11 KV line (CKT KM)	31289	213	213	213	213	203	203	203	203	1664	32953
4	LT lne (CKT KM)	101386	400	400	400	400	405	405	405	405	3222	104608
5	Capacity of 11/0.4 KV distribution T/F (MVA)	5104	155	155	155	155	82	82	82	82	946	6050
6	No of 11/0.4 KV distribution T/F	58781	745	745	745	745	270	270	270	270	4058	62839
PVVNL Rural												
1	33 KV substation (MVA)	8951	268	268	268	268	0	0	0	0	1073	10024
2	33 KV line length (CKT KM)	8349	250	250	250	250	296	296	296	296	2182	10531
3	11 KV line (CKT KM)	55738	1710	1710	1710	1710	1210	1210	1210	1210	11681	67419
4	LT line (CKT KM)	139995	180	180	180	180	184	184	184	184	1456	141451
5	Capacity of 11/0.4 KV distribution T/F (MVA)	8524	100	100	100	100	153	153	153	153	1010	9534
6	No of 11/0.4 KV distribution T/F	179441	1800	1800	1800	1800	2825	2825	2825	2825	18499	197940
1	Connecting the unconnected (Urban) [9]	0	25102	25102	25102	25102	100409	100409	100409	100409	502043	502043
2	Connecting the unconnected (Rural) [10]	0	459059	459059	459059	459059	571949	571949	571949	571949	4124033	4124033
3	Formalisation of connections where infrastructure is created	0	570891	570891	570891	570891	142723	142723	142723	142723	2854454	2854454
4	Metering the unmetered consumers	0	253750	253750	253750	253750	200000	200000	200000	200000	1815000	1815000

[9] It is assumed that remaining urban households will be electrified post 18 months of financial planning and tie up by September 2017.

[10] It is assumed that these rural households will be electrified post 18 months of survey, financial planning and tie up by September 2017.

SL	Category	Base year scenario (FY17)	FY18				FY19				Total	Total expected capacity FY19
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
MVVNL Urban												
1	33 KV substation (MVA)	5078	60	60	60	60	60	60	60	60	477	5555
2	33 KV line length (CKT KM)	5224	40	40	40	40	28	28	28	28	272	5496
3	11 KV line (CKT KM)	27880	138	138	138	138	286	286	286	286	1694	29574
4	LT line (CKT KM)	157206	550	550	550	550	1903	1903	1903	1903	9810	167016
5	Capacity of 11/0.4 KV distribution T/F (MVA)	5911	15	15	15	15	73	73	73	73	354	6264
6	No of 11/0.4 KV distribution T/F	36483	350	350	350	350	441	441	441	441	3164	39647
MVVNL Rural												
1	33 KV substation (MVA)	4133	84	84	84	84	47	47	47	47	524	4657
2	33 KV line length (CKT KM)	8306	200	200	200	200	40	40	40	40	960	9266
3	11 KV line (CKT KM)	93550	488	488	488	488	1144	1144	1144	1144	6528	100078
4	LT line (CKT KM)	235809	2375	2375	2375	2375	2823	2823	2823	2823	20790	256599
5	Capacity of 11/0.4 KV distribution T/F (MVA)	3450	31	31	31	31	42	42	42	42	291	3741
6	No of 11/0.4 KV distribution T/F	175658	1250	1250	1250	1250	2133	2133	2133	2133	13533	189191
1	Connecting the unconnected (Urban) [11]	0	19078	19078	19078	19078	76311	76311	76311	76311	381553	381553
2	Connecting the unconnected (Rural) [12]	0	455168	455168	455168	455168	551637	551637	551637	551637	4027219	4027219
3	Formalisation of connections where infrastructure is created	0	573035	573035	573035	573035	143259	143259	143259	143259	2865175	2865175
4	Metering the unmetered consumers	0	168312	168312	168312	168312	112208	112208	112208	112208	1122077	1122077

[11] It is assumed that remaining urban households will be electrified post 18 months of financial planning and tie up by September 2017.

[12] It is assumed that these rural households will be electrified post 18 months of survey, financial planning and tie up by September 2017.

SL	Category	Base year scenario (FY17)	FY18				FY19				Total	Total expected capacity FY19
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
KESCO Urban												
1	33 KV substation (MVA)	1360	26	26	26	26	31	31	31	31	230	1590
2	33 KV line length (CKT KM)	599	139	139	139	139	125	125	125	125	1054	1653
3	11 KV line (CKT KM)	1105	31	31	31	31	26	26	26	26	227	1332
4	LT Line (CKT KM)	1985	56	56	56	56	51	51	51	51	429	2414
5	Capacity of 11/0.4 KV distribution T/F (MVA)	1352	36	36	36	36	40	40	40	40	305	1657
6	No of 11/0.4 KV distribution T/F	4754	119	119	119	119	131	131	131	131	1000	5754
NPCL												
1	33 KV substation (MVA)	678	9	9	9	9	9	9	9	9	75	753
2	33 KV line length (CKT KM)	217	5	5	5	5	2	2	2	2	24	241
3	11 KV line (CKT KM)	2186	29	29	29	29	28	28	28	28	227	2413
4	LT line (CKT KM)	2850	61	61	61	61	63	63	63	63	495	3345
5	Capacity of 11/0.4 KV distribution T/F (MVA)	588	10	10	10	10	10	10	10	10	80	668
6	No of 11/0.4 KV distribution T/F	6040	102	102	102	102	105	105	105	105	829	6869
1	Metering the unmetered consumers	0	391	391	391	391	261	261	261	261	2606	2606

Annexure - 2

MNRE schemes/options for electrification of remote households

OPTION I:

- System proposed:
  - ✓ *100 Wp solar system will be provided to each household*
  - ✓ *This system would include:*
    - 5 Nos. of DC-operated LED lights (two luminaires of 5 watts each and three luminaires of 8 watts each) for 4 hours of operation each day.
    - One DC fan of 12 watts for 10 hours of operation each day.
    - One DC B&W TV 12 watts for 4 hours of operation each day can be attached or any other appliance can be powered.
    - One mobile charger

Load estimation:

S No	Load description	Nos	Unit load (W)[DC]	Total load (W)	Hours of use per day	Energy consumption (Wh)/day
1	DC-operated LED lights	5	8WX3 5WX2	34	4 hours	136
2	DC fan	1	12Wx1	12	10 hours	120
3.	DC B&W TV	1	12	12	4 hours	48
4.	Mobile charger	1	5	5	3 hours	15
Total						*319*
Say						*0.3units/day*

System requirement to meet consumer demand for above consumption profiles i.e. 0.3 units per day is estimated with autonomy for two (2) non-sunshine days as under:

S. No.	System	Consumption profile (with two-day autonomy)
1	Solar PV module	100 Wp
2	Battery storage (Tubular type)	12V, 75 AH

Estimated project cost: Broad estimated cost of system for typical household is**: Rs 25,000.**

OPTION II:

System proposed:

a. 200 Wp solar system will be provided to each household

b. This system would include:

- ✓ *5 Nos. of DC-operated LED lights (two luminaires of 5 watts each and three luminaires of 8 watts each) for 6 hours of operation each day.*
- ✓ *One DC fan of 24watts (or two fans of 12 watts each) for 12 hours of operation each day.*

- ✓ *One DC colour TV 30 watts for 4 hours of operation each day can be attached or any other appliance can be powered.*
- ✓ *One mobile charger*

Load estimation:

S No	Load description	Nos	Unit load (W)[DC]	Total load (W)	Hours of use per day	Energy consumption (Wh)/day
1	DC-operated LED lights	5	8WX3 5WX2	34	6 hours	204
2	DC fan*	1	24W X1 or 12Wx2	24	12 hours	288
3.	DC colour TV	1	30	30	4 hours	120
4.	Mobile charger	1	5	5	3 hours	15
Total						*627*
Say						*0.6 units/day*

System requirement to meet consumer demand for above consumption profiles i.e. 0.6 units per day is estimated with autonomy for two (2) non-sunshine days as under:

S. No.	System	Consumption profile (with two-day autonomy)
1	Solar PV module	200 Wp
2	Battery storage (tubular type)	12V, 75 AH

Estimated project cost: Broad estimated cost of system for typical household is: **Rs 50,000.**

OPTION III

- ➢ Target group : Village with a cluster of 15 "households", which cannot be connected to the grid
- ➢ Proposed solution : Through solar PV mini grid and central control room

Load estimation:

S No	Load description	Nos	Unit load (W)[DC]	Total load (W)	Hours of use per day	Energy consumption (Wh)/day
1	Power for AC LED Lights	5	8WX3 5WX2	34	6 hours	204
2	Power for AC, fan and or power for AC. Loads like colour TV, set-top/ PC and mobile charger etc.	1	50W	50	6 hours	300
Total						*504*
Say						*0.5 units/day*

i. Proposed load for each household: each household = 500 Whrs.

ii. Total load for 15 households = 7500 Whrs.

iii. Solar system specs. for the above Load:

iv. Solar PV panel = 2.5 KWp

v. Battery = 48V, 600AH

vi. Off grid PCU (inverter and charge controller) = 48 V , 2.5 KW

vii. A central control room for batteries and PCU

viii. Other balance of system components

ix. **Budgeted cost of the system is Rs. 7.5 lakh**

OPTION IV:

- Target group: Villages with 50 households which cannot be connected to the grid
- Proposed solution: Through solar PV mini grid and central control room

Load estimation:

S No	Load description	Nos	Unit load (W)[DC]	Total load (W)	Hours of use per day	Energy consumption (Wh)/day
1	Power for AC LED lights	5	8WX3 5WX2	34	6 hours	204
2	Power for AC fan and or power for AC loads like colour TV, set top/ PC and mobile charger etc.	1	50W	50	10 hours	500
Total						*704*
say						*0.7 unit/day*

i. Proposed load for each household: each household =700 Whrs.

ii. Total load for 50 households = 35,000 Whrs.

iii. Solar system specs for the above load:

iv. Solar PV panel =12.5 KWp

v. Battery = 240V, 600AH

vi. Off grid PCU (inverter and charge controller) =240 V , 12.5 KW

vii. A central control room for batteries and PCU

viii. Other balance of system components

ix. Budgeted cost of the system is Rs 30 lakh

PROPOSED SCHEME:

- MNRE may provide subsidy at the rate of 40% through NCEF
- A network of local technicians will have to be created for service and repairs.
- Some local agencies / NGOs will have to be involved to ensure upkeep and proper use through awareness and training of users.

The beneficiary may be asked to keep some fixed amount as “reserves” like for battery replacement in future.

Annexure - 3

Financial projections for the Discoms with 24x7 Power for All and benefits of UDAY

Assumptions

- Tariff hike as proposed under UDAY
- AT&C losses as per agreed trajectory in UDAY

Table 49: Broad assumptions

Year	Units	FY17	FY18	FY19
Energy-related assumptions				
Energy requirement	MU	1,08,853	1,17,722	1,22,856
Sales	MU	83,789	95,131	1,03,173
AT&C losses	%	28.27%	23.63%	19.36%
Distribution losses	%	20.16%	16.18%	12.89%
Transmission losses	%	3.59%	3.59%	3.59%
Power purchase	MU	1,08,853	1,28,257	1,40,709
Sale of surplus power	MU	-	10,535	17,854
Power purchase cost	Rs /kWh	4.21	4.27	4.27
Revenue parameters				
Tariff Increase	%	3.18%	6.95%	6.80%
Average billing rate	Rs /kWh	5.54	5.72	6.20
Expense				
Employee cost escalation	**%**	6%	17%	6%
Repair & maintenance escalation	**%**	8%	12%	12%

Table 50: Financial estimation under 24x7 Power for All (Rs. crore)

Particulars	FY17	FY18	FY19
Income			
Sales turnover	46416	54452	63948
Net sales	46416	54452	63948
Other income	1103	1103	1103
Sale of surplus power	0	3687	6249
Subsidy	5500	5500	5500
Total income	**53019**	**64742**	**76800**
Expenditure			
Transmission charges	1810	2055	2252
Power & fuel cost	45855	54770	60151
Employee cost	1263	1475	1564

Particulars	FY17	FY18	FY19
R&M cost	2142	2396	2681
Total expenses	**51070**	**60697**	**66647**
Operating profit	*1950*	*4046*	*10153*
PBDIT	873	4366	9275
Interest	4885	6452	8313
PBDT	*-2936*	*-2406*	*1839*
Depreciation	857	1204	1930
Exceptional items	0	0	0
Profit before tax	-3793	-3610	-91
Provision/Support on reimbursement of losses	0	-217	-447
PBT (Post-extraordinary Items)	-3793	-3393	357
Tax	72	95	138
Net profit	**-3865**	**-3488**	**219**

Abbreviations

ABR	Average billing rate
AT&C	Aggregate technical & commercial
BEE	Bureau of Energy Efficiency
BHEL	Bharat Heavy Electrical Limited
BTG	Boiler turbine generator
CAGR	Compounded annual growth rate
CEA	Central Electricity Authority
COD	Commercial operation date
CPI	Consumer Price Index
CTU	Central transmission utility
DDUGJY	Deendayal Upadhyaya Gram Jyoti Yojna
DMS	Distribution management systems
DSM	Demand side measure
DVVNL	Dakshinanchal Vidyut Vitran Nigam Limited
EESL	Energy Efficiency Services Limited
EHT	Extra high tension
EPC	Engineering, procurement, construction
EPJL	Essar Power (Jharkhand) Limited
ERP	Enterprise resource planning
FPI	Fault passage indicators
FRP	Financial restructuring plan
FY	Financial year
GoI	Government of India
GoUP	Government of Uttar Pradesh
HEP	Hydro electric plant
HT	High tension
IDC	Interest during construction
IPDS	Integrated Power Development Scheme
IPP / JV	Independent power producers / joint venture
IT	Information technology
KESCO	Kanpur Electricity Supply Company
LED	Light emitting diode
LT	Low tension
LTPPA	Long term PPA
MNRE	Ministry of New and Renewable Energy
MOEF	Ministry of Environment & Forests
MoP	Ministry of Power
MoU	Memorandum of Understanding

MU	Million unit
MVVNL	Madhyanchal Vidyut Vitran Nigam Limited
MW	Mega Watt
NAD	Need assessment document
NHPC	National Hydroelectric Power Corporation
NPCL	Noida Power Corporation Limited
NTPC	National Thermal Power Corporation
PBT	Profit before tax
PFA	Power for All
PFC	Power Finance Corporation
PGCIL	Power Grid Corporation Limited
PIS	Personnel information system
PLF	Plant load factor
PMU	Project monitoring unit
PPA	Power purchase agreement
PuVVNL	Purvanchal Vidyut Vitran Nigam Limited
PVVNL	Paschimanchal Vidyut Vitran Nigam Limited
RAPDRP	Restructured Accelerated Power Development & Reform Programme
RBI	Reserve Bank of India
RDCC	Regional Distribution Control Centres
REC	Rural Electrification Corporation
RGGVY	Rajiv Gandhi Grameen Vidyutikaran Yojana
RM&U	Renovation, modernisation & upgradation
RMU	Ring main unit
SECI	Solar Energy Corporation of India
SERC	State Electricity Regulatory Commission
SOP	Standard of performance
SWOT	Strength, weakness, opportunities and threats
T&D	Transmission and distribution
TOD	Time of day
TPP	Thermal power plant
UPERC	Uttar Pradesh Electricity Regulatory Commission
UPJVNL	UP Jal Vidyut Nigam Limited
UPNEDA	Uttar Pradesh New and Renewable Energy Development Authority
UPPCL	Uttar Pradesh Power Corporation Limited
UPPTCL	UP Power Transmission Corporation Limited
UPRVUNL	Uttar Pradesh Rajya Vidyut Utpadan Nigam Limited
WPI	Wholesale Price Index

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