Confederation of Indian Industry

Contents

The leap towards sustainable power in eastern India

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Foreword

Power is among the key infrastructure that contributes towards the development of any nation. Policymakers in India have been trying to introduce new methods on organisational and financial reforms, on operational and information technologies, as well as on corporate governance aspects, to enable the utilities to become viable, efficient and responsive to customer demands.

Since the liberalisation of the Indian economy in the 1990s, the electricity sector in India has witnessed significant growth. Installed electricity generation capacity in India has reached 250 GW, with a contribution of 69% from thermal followed by 29% from hydro and renewable energy sources and 2% from nuclear. In transmission, the country has adopted extra high voltage and high voltage DC (HVDC) technologies to meet requirements. Presently, the transmission capacity in India is more than 2,90,000 circuit kilometers comprising 500kV HVDC, 756kV, 400kV and 220kV. Power distribution utilities are improving their efficiencies by reducing losses, through significant investment in capital works and O&M activities, information technology (IT) enabled process improvements and improving customer service orientation. With investments in distribution infrastructure, rural electrification has crossed over 95%[1].

Eastern India is keeping pace with the development in the sector and has taken several initiatives which contribute towards its growth. Odisha is the first state in India which introduced and implemented power sector reforms. Bihar has taken key initiatives to operate the public private partnership model in power distribution. West Bengal demonstrates a flawless public governing system in all three aspects viz generation, transmission and distribution. Chhattisgarh is leading power generation by enabling effective utilisation of its natural resources. Jharkhand is mineral rich and has the tremendous potential for power generation through various sources.

However, in recent times, the Indian electricity sector has been witnessing a number of challenges– generating stations either running dry due to poor monsoon or facing shutdown due to non-availability of fuel; transmission networks falling prey to either natural calamities or adverse grid disturbances due to defaults by the utilities, thereby causing extensive electricity outages and unhappy consumers who sometimes resort to violent means of protest, against rising prices and lengthy power-cuts in non-priority areas. The pressure on conventional sources of electricity generation as well as their environmental and socio-economic implications, have compelled policymakers, thought leaders, investors, utilities as well as consumers to look for the expansion of sustainable non-conventional energy sources.

The viability and sustainability of the Indian electricity sector are dependent on the success of the electricity distribution business, whether these are owned by the government or private sector. A number of experiments have been done with the electricity distribution sector in India, across all states, with initiatives from the central as well as state governments, regulators, multi-lateral agencies, utilities and investors. However, the Indian electricity sector is saddled with approximately 1.5 lakh crore INR of debt.

While there is no dearth of ideas for actions necessary to revive the electricity sector in India, there is a need of commitment by the governments, regulators, the utilities and consumer groups, to convert these ideas into actionable items and implement them.

Initiatives such as smart grid, IT enablement and process automation, energy efficiency, demand side management, public private partnership, high voltage transmission system, renewable energy generation, systems operations , power trading, shall play significant roles in facilitating the development of sustainable power in coming years.

In this context, Confederation of Indian Industry (CII) along with PricewaterhouseCoopers Private Limited (PwC) as a knowledge partner, is bringing together policymakers, thought leaders, investors, utilities, regulators, funding agencies to discuss and present options for the Indian electricity sector to establish clean, reliable and affordable modes of electricity sourcing and supply, and set forth directions to follow, for stakeholders of the Indian power sector.

1. CEA-Monthly All India Installed Generation Capacity Report

Introduction

The Indian economy has been following a growth curve for the past two decades with the GDP clocking well during the period. Considering the positive change in policy matters, the country's growth is expected to follow an upward trend. Growth in the economy has given rise to demands for growth in infrastructure, electricity being the most prominent. The demand for electricity in India has grown at an average rate of 5.5% in the last five years. India's total generation capacity in June 2014 stood at almost 250 GW[2], accounting for 4.5% of global capacity[3]. With multiple policy initiatives to accelerate addition of generation capacities and renovation and modernisation projects of existing generation units, the demand-supply gap has come down to over 4%. The average per capita electricity consumption in India stands at 917 kWh as compared to the global worldwide per capita consumption of more than 3000 kWh[4].

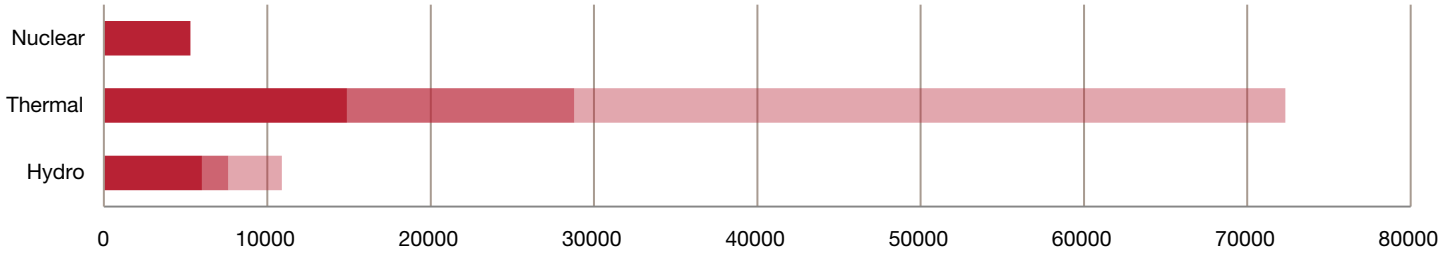
The 11th Plan (2007-12) called for the capacity addition of 62,374 MW of power from various sources and it achieved 54,964 MW in total. The private sector on the other hand achieved over 110% while the central and state sector underachieved the target. The 12th Plan (2012-17) target is more ambitious, calling for the addition of over 88,537 MW of generation capacity to meet the energy deficit and boost economic growth[5].

In the 13th Plan (2017–2022) about 93 GW of capacity addition is planned to meet consumer demand[6].

In order to reduce high aggregate technical and commercial losses and to improve the electrification levels of villages and households, the total fund requirement for sub-transmission and distribution system development for urban and rural areas, during the 12th Plan period is estimated to be more than 3,000,000 million INR. Amidst all this, the question that policymakers and thought leaders in India are trying to answer is whether there are alternate ways to achieve the 'power for all' target.

The answer lies in exploring options in transforming the distribution and transmission sector, focussing on clean, affordable and reliable energy generation and implementing demand side management (DSM) and energy efficiency (EE) initiatives, which will not only resolve the power deficit scenario, but also contribute to reducing the carbon footprint of the nation and thereby, help develop a more sustainable world.

Capacity addition target for 12th Plan (MW)



	Hydro	Thermal	Nuclear
Central	6004	14878	5300
State	1608	13922	0
Private	3285	43540	0

Source: CEA

2. CEA's Monthly All India Installed Generation Capacity Report
3. International Energy Agency's World energy statistical report
4. UN data-data.un.org
5. CEA's Power Sector at Glance Nov'12
6. Indian Electrical Equipment Industry Mission Plan 2012-2022, Ministry of Heavy Industries & Public Enterprises

Energy efficiency improvement

It has been constant effort from the government at the central as well as state levels to promote energy efficiency initiatives. The Energy Conservation Act, 2001 was also passed with the objective of empowering governments to facilitate and enforce the efficient use of energy and its conservation. As per the provision of chapter II of the Act, the government of India has constituted the Bureau of Energy Efficiency (BEE) with an objective to reduce energy intensity of India by developing policies with a focus on self-regulation and market principles.

To generate awareness on energy efficiency and conservation, the Ministry of Power (MoP) has instituted a programme which provides incentives by granting National Energy Conservation Awards. It also includes media communication for creating general awareness and promoting awareness among schoolchildren by arranging competitions like essay, debate and painting.

The National Mission for Enhanced Energy Efficiency (NMEEE) is one of the eight missions launched by the government of India in 2008 as a part of National Action Plan on Climate Change. The mission has the objective of promoting policy and regulatory matters, mechanism to finance the initiatives and implementation of sustainable business model to achieved deliverables in a timebound manner. It also has inbuilt provisions for monitoring and evaluation so as to ensure transparency, accountability, and responsiveness. The MoP and the BEE were tasked to prepare the implementation plan for the NMEEE. The NMEEE has brought following four initiatives to enhance energy efficiency[7]:

- Perform, Achieve and Trade (PAT): A market based mechanism to improve energy efficiency in energy-intensive large industries and facilities, through tradable certification of energy savings
- Market Transformation for Energy Efficiency (MTEE): Accelerating energy-efficient appliances in designated sectors
- Energy Efficiency Financing Platform (EEFP): A mechanism to finance DSM programmes in all sectors.

Initiative	Components
Bachat Lamp Yojana	Provides high-quality compact fluorescent lamps to consumers at rate comparable to that of incandescent bulbs, it targets the reduction of 4000 MW of electricity demand as well as reducing 24 million tonnes of CO2 emissions every year.
Standards and Labelling Scheme	This lays down minimum energy performance standards for high energy equipment and appliances.
Energy Conservation, Building Code (ECBC)	ECBC sets performance standards for new commercial buildings with a connected load of more than 100 KW or 120 kVA of electricity consumption, energy conservation measures in existing buildings proposed through energy service companies (ESCOs) under performance contracting.
Demand side management	In agriculture and municipalities
Strengthening state designated agencies (SDAs)	Financial assistance to SDAs to enhance institutional capabilities
National Energy Conservation Awards	For specified sectors, large, medium and small industries, SDAs and municipalities
Energy efficiency in enterprises	For energy efficiency measures in small and medium enterprises
Certification and Accreditation	Audits by accredited energy auditors and designate energy managers
Education Programme	Energy efficiency education for schoolchildren
State Energy Conservation Fund	The central government is to contribute to the State Conservation Fund once it is set up by the respective states for energy conservation on activities.

Source: MoP

- Framework for Energy Efficient Economic Development (FEEED): Developing fiscal instruments to promote energy efficiency

Several measures have been taken by the MoP and the BEE to promote energy conservation and its efficient use targeting reduction in demand.

Demand side management (DSM)

DSM is the mechanism through which various initiatives are undertaken that aim to utilise electricity resourcefully, and modify its usage to manage demand. It can cause significant reduction in energy requirement without reducing energy services. The Integrated Energy Policy Report prepared by the Planning Commission has identified DSM as an important option for energy planning. However, to date, little experience exists in India regarding the development, implementation and monitoring of DSM programmes.

The DSM models being implemented in India envisage reducing peak demand without further addition to the generation capacity, which will have consequent impact of less burdening on the transmission and sub-transmission capacity expansion. One unit of energy saved translates into three units of generation capacity. Hence, DSM is being actively propagated and greater importance is being attached to energy-saving measures. Successful implementation of DSM in various state utilities have reinforced faith in DSM initiatives and are gradually gaining momentum with further support from private players. The BEE is expected to set up a DSM cell and build the capacity in five utilities. Initiatives in agriculture and municipal operations have been identified for DSM. Urban local bodies have been mandated for developing suitable strategies and implementing energy-efficient initiatives.

7. *PAT Booklet July 2012*

An unprecedented 829 nominations were received for the National Energy Conservation Awards in 2013 as compared to 123 in 1999. The collective investment by participants was more than 4500 crore INR, which targets to save 4354 MU[8]. It is beyond doubt that successful DSM implementation will facilitate reduction in power deficit and ensure effective utilisation of scarce resources.

National Awards on Energy Conservation '13	
From 1999 to 2013	22,816 participants
Investment	30679 crore INR
Saving in energy	26487 MU

Towards sustainable development

Sustainable development in India has caught the attention of the central and state governments, and encompasses a variety of development schemes in clean energy, water and sustainable agriculture. India is expected to begin the greening of its national income accounting, making depletion in natural resources wealth a key component in its measurement of GDP.

During the 11th Plan period, the country has witnessed accelerated policy change in increasing the influence of solar in power generation. The Jawaharlal Nehru National Solar Mission was launched by the central government in 2010 aiming to install 20,000 MW of grid connected solar power by 2022. In Phase I of the mission, 1047 MW of solar power was inducted in 2012. Chandigarh, Gandhinagar, Nagpur and Mysore will be developed as model solar cities along with 42 others. In this plan period, total renewable energy generation has reached 24,915 MW with 10,260 MW grid connected wind, 1491 MW of small hydro and 2041 MW of bio mass. With the introduction of the mechanism for renewable energy certificates, the market for renewable energy has emerged along with the mandate of renewable purchase obligations (RPO). The government's focus in renewable energy has continued in the 12th Plan.

Access to electricity for the rural population remains a key challenge and implementation of renewable energy in the off-grid and distributed generation mode has evolved as a solution to provide a clean source of energy. Similarly, for remote areas such as Leh and Kargil, a dedicated renewable energy initiative has been inducted.[9]

India has an installed capacity of more than 31,500 MW of grid connected renewable energy generation at present, and almost 1000 MW of off-grid capacity[10]. In the 12th Plan, the contribution of renewable is expected to reach 55,000 MW with a target of 21,000 MW from wind, small hydro and solar power and 1900 MW from biomass and bagasse co-generation. With the focus of policymakers and implementing agencies, the portfolio of renewable energy in India is expected to grow in the next two decades.

Technology enablement for sustainability and energy efficiency

The traditional power system, where power is generated at one location, transmitted far to the demand centre and distributed in a region, is facing tremendous challenges. At the same time, consumption pattern and consumer demand is radically changing. With the implementation of efficient technologies, demand is reducing and with the improved access to rural and below-poverty-line consumers, electricity consumption is also increasing. Grid-connected non-conventional energy sources like solar, wind are nature dependable and impact the integrated operation of power system. Assimilating the system with the change scenario, demands for automated operations based on flexible protocols. The concept of smart grid has evolved to the meet consumer needs, bring about seamless integration of clean energy sources, provide flexible operation, optimise resources and reduce manual interventions, with the use of cutting edge technological solution.

A smart grid system provides a two-way communication between the utility and consumer. Consumers have the flexibility to alter their electricity consumption pattern by understanding the offered rates, and the utility can control the demand of the consumer, for cost effective and safe system operation by abiding the regulatory norms. Necessary infrastructure like smart metres, communication system, consumer data management system, and power system information system, etc are needed to support the process. The system also provides the smooth interface to the renewable sources of power generation, which are intermittent in nature. This includes power sources like wind, biomass, hydro and solar.

8. National Awards on Energy Conservation 2013
9. MNRE Annual Report 2013
10. CEA-Monthly All India Installed Generation Capacity Report

In the Indian context, the advent of smart grid is still sometime into the future, considering the maturity of the Indian electricity transmission and distribution utilities on information technology deployment. Further, the smart grid implementation has to be supplemented with concomitant regulatory and policy support that provides a roadmap to the manner in which smart grid initiatives are rolled out. Also, initiatives for increasing consumer awareness to apprise on the benefits to the individual and the society from a smart grid deployment will support the development. As has already been witnessed in the western and European countries, smart grid initiatives are cost-intensive and therefore, an upfront business case and cost-benefit analysis needs to be done to establish benefit targets.

In India, several initiatives have begun in this direction, both by the government as well as private sector utilities, through planning for and deployment of smart metres, automated metering infrastructure (AMI), etc. The Restructured APDRP or R-APDRP, sponsored by the government of India, which provides direction towards a smart grid environment in the future, has been adopted by several government-owned electricity distribution utilities.

In 2013, the Smart Grid Vision and Roadmap for India was framed to leverage the infrastructure built by schemes such as R-APDRP and RGGVY and upgrade it to the next level of smart grid to supply electricity. The scheme envisioned upto the 14th Plan and states, "Transform the Indian power sector into a secure, adaptive, sustainable and digitally enabled ecosystem that provides reliable and quality energy for all with active participation of stakeholders".

Currently, initiatives in advance metering infrastructure, outage management system, power quality management, demand response, renewable energy integration, energy storage, electrical vehicle, cyber security and the communication system are being explored in the country.

Smart Grid pilot projects are in initial stages, where utilities have come up with tenders for the selection of implementation partners. The projects will take a further 18 to 24 months to complete. Recently the new formed government has announced to set-up 100 smart cities in the country.

Necessary policy and regulatory provisions are required to promote and implement smart technologies. There has been discussion in regulatory forums for the formulation of regulations on smart grid on aspects such as technology selection, investment approval, tariff implications, incentive mechanism, consumer privacy and cyber security.

Many electricity distribution utilities and private sector utilities such as Tata Power Delhi Distribution Limited, BSES Rajdhani and Yamuna, Ahmedabad Electricity Company and Surat Electricity Company have already deployed smart metres. POWERGIRD is the pioneer in the implementation of smart grid in the transmission segment and has installed Phasor Measurement Units and Wide Area Monitoring Systems in the central transmission network. The Central Power Research Institute shall develop a smart grid test bed for the certification, testing and training, under the grant provided by the US Trade and Development Agency.

Policymakers and regulators are increasingly concerned about the proliferation of renewable energy technologies and their adoption by the utilities. A smart grid will be an inevitable requirement to manage large numbers of on-grid and off-grid RE generators and distributed direct generation (DDG) sources.

State	Utility	Implementation details	Status
Haryana	UHBVN	Advanced metering infrastructure (AMI), outage management system (OMS) for revised 11,000 (from 31,914) consumers at Panipat City Sub-Division	Feasibility study completed
Himachal Pradesh	HPSEB	AMI, PLM, OMS, power quality management (PQM) for 650 consumers at KalaAmb	Tendering stage
Punjab	PSPCL	OMS for 9,818 consumers at the Industrial Division of City Circle Amritsar	Tendering stage
Rajasthan	JVVNL	AMI, PLM for 34,752 consumers at VKIA Jaipur	RFP yet to be released
Chhattisgarh	CSPDCL	AMI, PLM for 1,900 consumers at Siltara–Urla area	Tendering stage
West Bengal	WBSEDCL	AMI, PLM for 4,404 consumers at Siliguri town	Regulatory approval obtained
Tripura	TSECL	AMI, PLM for 46,071 consumers at Electrical Division No 1 of Agartala town	Tendering stage
Assam	APDCL	AMI, PLM, OMS, PQM, distributed generation (DG) for 15,000 consumers at Guwahati Distribution Region	Tendering stage
Gujarat	UGVCL	AMI, OMS for 39,422 consumers at Naroda of Sabarmati and Deesa of Palanpur circles	Tendering stage
Maharashtra	MSEDCL	AMI, OMS for 25,629 consumers at Baramati town	Tendering stage
Karnataka	CESCL	AMI, PLM, OMS, PQM, DG/ Microgrid for 21,824 consumers at Additional City Area Division, Mysore	Implementing agency selected
Kerala	KSEB	AMI for 25,078 consumers across state	Tendering stage
Puducherry	Electricity Department	AMI for 87,031 consumers at Division 1 of Puducherry	RFP yet to be released
Andhra Pradesh	TSPDCL (previous APCPDCL)	AMI, PLM, OMS, PQM for 11,904 consumers at Jeedimetla Industrial Area	Tendering stage

Source: ISGF Smart Grid Bulletin

Electricity sector in eastern India

Regional energy statistics (2013-14)		
Energy (MU)	Requirement (MU)	126,722
	Availability (MU)	125,170
	Surplus (+)/deficit (-) (MU)	-1,552
	Surplus (+)/deficit (-)	-1.2%
Demand (MW)	Requirement (MW)	20,738
	Availability (MW)	20,462
	Surplus (+)/deficit (-) (MW)	-276
	Surplus (+)/deficit (-) (%)	-1.3%

Source: CEA: Executive Summary Power Sector April '14

The eastern Indian states of Bihar, Chhattisgarh, Jharkhand, Odisha and West Bengal are abundantly blessed with rich mineral resources, including coal which is foreseen as the fuel that will dominate the Indian electricity generation sector for a long time to come. Further, in comparison to the other regions of the country, the eastern region is relatively better off in terms of the demand-supply gap, a peak deficit of 1.3% compared to the all-India deficit of 4.5% and an energy deficit of 1.2% compared to the all-India deficit of 4.2% in FY14[11]. In the 12th Plan period, the region is expected to induct more than 25,600 MW of generation capacity which is 29% of the total capacity allocated in the plan.

According to the Load-Generation Balance Report published by the Central Electricity Authority, the anticipated energy and peaking shortage in the country will be 5.1% and 2% respectively in FY15. The peaking shortage will prevail in all the regions except the East, varying from 1.4% in the North to 22.2% in the South. The East is expected to be in a position of surplus in terms of peak. However, there will be an energy deficit of 3.4% in the East, while other regions such as the South and North-East will face a deficit of 12.7 and 17.4% respectively. Odisha and West Bengal will have less than 1% of energy deficit while Bihar and Jharkhand will face a deficit in double digits. Jharkhand and Odisha will have surplus of peak and Bihar will be the worst affected state with 25.9% peak deficit.

Despite having an advantage over other regions in terms of the availability of power, the East lags behind with respect to the electrification of villages and households as well as per capita consumption. Village electrification in the East is 92% as compared to the overall 95.7% of rural electrification in India and the 97% rural electrification of the rest of India. The rural electrification in Odisha is the lowest at 81.6% and highest in West Bengal at 99.99%.[12]

11. CEA: Executive Summary Power Sector April '14
12. CEA- Village Electrification Progress Report

West Bengal

Key indicators	
Requirement (MW)	7,325
Availability (MW)	7,294
Surplus(+)/deficit(-) (MW)	-31
Surplus (+)/deficit (-) (%)	-0.4
Population (in million)	91.35
Villages electrified (%)	99.9
Energy availability (MU)	42,762
Surplus (+)/deficit (-) (%)	-0.3
Per capita consumption (kWh)	468

Source: CEA, Census 2011 data

In 2012-13, West Bengal was the sixth largest economy in India[13]. It is the centre of the agricultural industry, and is endowed with huge reserves of minerals. The state currently has a lower average ownership of household goods and basic amenities such as electricity compared to the all-India average. West Bengal's power sector has a total installed generation capacity of 8507 MW[14], of which thermal and hydro constitute 5% and 13% respectively. The state has a strong pumped-storage-based hydel power capacity and potential. Village electrification level is 99%[15]. In the 12th Five Year Plan period, the state is expected to add 2,092 MW of generation capacity, by government as well as private investment.

Over the past few years, the state's power sector has evolved through administrative as well as managerial interventions, wherein the West Bengal State Electricity Board got unbundled into a separate generation, transmission and distribution companies, resulting in the formation of the West Bengal Power Development Company Limited (WBPDCL), West Bengal State Electricity Transmission (WBSETCL) and the West Bengal State Electricity Distribution Company Limited (WBSEDCL). Both the WBSETCL as well as WBSEDCL are among the top performing utilities in India.

WBSEDCL has been implementing the Smart Grid Pilot Project at an estimated cost of 8.05 crore INR in Siliguri. The project is expected to improve billing efficiency as well as customer satisfaction. It will also support areas such as peak load management, outage management, energy audit, load curtailment and reduce AT&C loss[16]. The US Trade and Development Agency (USTDA) provided 618,860 USD in grant funding to support a feasibility study for Calcutta Electric Supply Corporation (CESC), the Kolkata-area electric distribution company. The assistance will address a range of improvements as well as investments, including integration of smart metres and automated metre reading into CESC's distribution system. The grant for this initiative was signed during the US Commerce Secretary, John Bryson's infrastructure trade mission to India in March 2012.[17]

DSM and energy efficiency measures

The state government has been putting increased efforts on promoting energy efficiency within the state. The office of West Bengal Renewable Energy Development Agency (WBREDA) and the office-cum-laboratory for the West Bengal Pollution Control Board, both based out of Kolkata, are among the certified energy efficient buildings in India[18].

Some of the DSM initiatives are as follows:

- Tariff for LED street lighting is 50% of the normal street lighting tariff.
- Pilot LED-based street lighting is completed in 273 locations under KMC. LED street light projects in Darjeeling, Siliguri, Jalpaiguri, Coochbehar and Dinhata municipalities are being undertaken.
- LED village campaign rolled out at Dandirhat, Basirhat division is on the verge of completion.
- For improving energy efficiency within the state, capacitor bank across 79 sub-stations and 67,000 LT industrial consumer's premises has been installed.

13. Ministry of Statistics and Programme Implementation
14. Department of Power and Non-conventional Energy Sources, GoWB
15. CEA's Progress report of village electrification
16. FOR-26th meeting note
17. US-India Energy Dialogue- Joint Action Plan
18. TERI- List of energy efficient buildings in India

- Emphasis on DSM of system load through time-of-day metering HV consumer, LT industrial and irrigation consumers
- Investment grade energy audit has been completed for 16 government buildings in the state.
- Massive campaign undertaken for the replacement of incandescent lamps by CFL lamps in order to manage the demand.[19]
- Energy Efficiency Services Ltd has been entrusted with the preparation of a sector-specific annual energy savings plan which includes government as well as municipality sectors within the state, with connected load of more than 120 kVA[20].
- With the support of external agencies, the Waste Heat Recover Policy and DPR preparation for sectors such as cement, jute, rice, steel re-rolling, sponge iron, and tea has been undertaken. It shall be extended for small as well as and medium enterprises as well as large industries[21].
- Awareness campaign for energy conservation within the tea sector, implementation of the Perform Achieve and Trade (PAT) Programme and Energy Conservation Building Code by the WBREDA.

Renewable energy and sustainability

West Bengal has a renewable energy (RE) potential to the extent of 2206 MW. However, the total achievement till date is around 200 MW. The state has targeted a capacity of around 1000 MW by the end of the 12th Five year Plan, and has undertaken a number of initiatives towards achieving this goal.[22] The West Bengal Electricity Regulatory Commission (WBERC) has mandated 6% procurement from cogeneration and renewable energy sources as RPO by 2017-18. While wind, biomass and small hydro would be classified as limited renewable energy resources in the context of West Bengal, solar energy on the other hand can offer limitless opportunities. Land availability has proved to be the strongest deterrent to several project plans in the renewable source energy space.

The WBREDA, formed in 1993 has a mandate to promote RE technologies and create an environment conducive to their commercialisation through innovative projects. However, the role of the WBREDA was limited to demonstrate the renewable energy technologies. In order to promote the commercialisation of RE technologies successfully demonstrated by the WBREDA, the West Bengal Green Energy Development Corporation Limited (WBGEDCL) was created by the Department of Power and Government of West Bengal. The objective of the WBGEDCL is to promote private sector investment and involvement in developing grid connected renewable energy units.

Regulatory developments

Fixed RPO		
Year	Solar	Total
2014-15	0.15%	4.5%
2015-16	0.20%	5.0%
2016-17	0.25%	5.5%
2017-18	0.30%	6.0%

In order to encourage investments into the renewable energy sector within the state, the WBERC had passed a regulation for the cogeneration and generation of electricity from renewable sources of energy in 2006 which was subsequently amended. The regulation also fixed the cap price for each RE technology and also specified the period for which such prices will be valid. It prescribes connectivity guidelines for renewable energy installations.

- The cogeneration and renewable energy sources excepting roof-top solar PV and bio-gas sources shall be connected to the state grid at a voltage level of 132 kV to 6kV subject to technical suitability determined by the licensee.
- Roof-top solar PV sources shall be allowed connectivity at LV, MV, 6 kV or 11 kV of the distribution system of the licensee as considered technically and financially suitable by the licensee.
- Bio-gas plants, if connected to the distribution system, shall be connected at 415 V, three-phase or at 6 kV or 11 kV of the distribution system of the licensee, according to the technical suitability examined by the licensee.

The key achievements in the state with respect to renewable energy are as follows[23]:

- WBREDA has conceived a proposal to electrify five villages (Purba

19. Forum of regulators 26th meeting notes
20. WBSDA website
21. WBSDA website
22. Policy on co-generation and generation of electricity from renewable sources of energy, GoWB
23. Source: WBREDA & WBGEDCL website

Radhanagar, Kumirmari, Amalamethi, Muriganga and Gobindapur of Gosaba and Sagar Blocks) in the Sundarbans region with renewable energy systems with the support of the MNRE.

- The WBREDA formulated a project proposal for interim electrification of 18 remote census villages under the Remote Village Electrification (RVE) Programme of the MNRE. Under the Programme, all households, including community establishments within the proposed village shall be provided with solar photovoltaic home lighting systems and solar photovoltaic street lighting systems
- Currently, the WBREDA is running three biomass gasifier power plants at Gosaba, Chotto Mollakhali and Herembo with a capacity of 1400 kW to serve more than 1600 rural consumers.
- Within the state 163 rice-husk based gasifier systems have been commissioned to meet the captive demand of rice mills.
- Wind generators with a capacity of 8 X 250 kW have been installed at Freserganj by the WBREDA. There has been a proposal for the installation of an additional two projects at Ganga Sagar and Beguakhali in Sagar Island with a capacity of 1 X 250 kW, each under the South 24 Parganas District.
- The WBREDA conceived a project proposal for the installation of wind-solar hybrid projects for six different schools under the Sagar Block in the Sundarban region. The main objective of the project is to provide power for operating computers as well as laboratory equipments. Each hybrid system comprises 3 kW aero generators and 3 kW PV with battery storage system.
- Twenty-three small hydro plants (SHP) with a cumulative capacity of close to 100 MW have been installed within the state. Sixteen SHP with a cumulative capacity of 80 MW are currently in the process of installation.
- The country's first tidal power plant has been proposed to be set up in the Durgaduani creek of Sundarbans. The 3.6 MW project will cost 40 crore INR and is likely to be funded by the central and the state government. The detailed project report has been prepared.
- The WBREDA has introduced PV home lighting system as well as the solar PV street lighting system for 6161 members with the support of the MNRE.
- Almost 4946 tribal houses of the Binpur and Nayagram block of the West Midnapore district have been electrified through LED based solar lighting system.
- Sixteen solar PV power plants with a cumulative capacity of 1 MW have been installed in the Sunderbans by the WBREDA.
- Solar water heaters covering 5000 sq m have already been installed by the WBREDA with a total investment of around 18 lakh INR.
- Around 1000 solar cooking systems are being installed by the WBREDA.
- The WBGEDCL has identified land in Purulia for establishing a 100 MW solar park.
- Around 1,75,000 domestic biogas systems have been installed in the state. In FY 2009-10, almost 15,000 domestic biogas systems were installed with the subsidy received from the MNRE.
- A project for an eco-friendly housing complex at Kolkata with 25 solar homes has been undertaken by the WBREDA. The community centre of the housing complex shall be connected with the sewage system to operate a biogas plant.
- Suzlon Energy Ltd is planning to set up a large 50 MW wind-power project in the state with an initial planned investment of 250 crore INR.

Odisha

Key indicators	
Requirement (MW)	3727
Availability (MW)	3722
Surplus (+)/deficit (-) (MW)	-5
Surplus (+)/deficit (-) (%)	-0.1
Population (in million)	41.95
Villages electrified (%)	81.6
Energy availability (MU)	24546
Surplus (+)/deficit (-) (%)	-1.7
Per capita consumption (kWh)	585

Source: CEA, Census 2011 data

Odisha was the first state in the country to embark upon reforms in the power sector, resulting in separate utilities managing the generation, transmission and distribution functions. The objectives of the reforms were to increase efficiency, bring accountability, attract private sector investment, and establish an independent and transparent regulatory regime.

The state of Odisha is abundantly blessed with coal reserves, which has attracted both public and private sector to plan investments in setting up thermal power plants. The Odisha Power Transmission Corporation Limited (OPTCL) with the help of the government of Odisha has planned to invest over 12,000 crore INR in the 12th Plan. This planned spending will add almost 14,600 km of extra high tension lines and a transformation capacity of 22,000 MVA to the existing system[24]. The state government has signed MoUs with a number of independent power producers (IPPs) with a combined generation capacity of 37440 MW. In the 12th Plan period, the state is expected to add 3960 MW of generation capacity, through private investment. Ultra Mega Power Projects (UMPP) in Sundargarh, Bhadrak and Kalahandi are also planned in the state.

Eighty-three per cent of Odisha's total population lives in rural areas[25]. The state government has committed a capex of 3600 crore INR for the Odisha Distribution System Strengthening project to build distribution infrastructure in rural areas. Realising the importance of strengthening the transmission and distribution network especially in the state capital region, the state government has planned a capex outlay of 1500 crore INR in the State Capital Region Improvement of Power System project. The investment is aimed to meet the electricity need in the Comprehensive Development Plan for the Bhubaneswar and Cuttack Urban Complex area region upto year 2030.

Chhatrapur is set to become the first smart grid town in Odisha and the project will be implemented under the Asian Development Bank funded proposed Disaster Resilient Power Strengthening System. This scheme involves setting up gas insulated substation with the supervising control and data acquisition (SCADA) facility and also involves underground cabling, which will be first of its kind in the state.

DSM and energy efficiency measures

The state government has realised the importance of energy conservation. Numerous initiatives have been taken towards the promotion of energy efficiency[26]:

- Odisha has been the first state to amend the Energy Conservation Building Code in discussion with the BEE to match the state's priority and the notified Odisha Energy Conservation Building Code.
- The state has notified Odisha State Energy Conservation Fund rules and the fund has been established for the effective implementation of the Energy Conservation Act in the state.

24. OPTCL's Shakti Samachar
25. Census 2011 Data
26. Census 2011 Data

- The scheme extending financial support to state public sector undertakings, cooperatives and autonomous institutions for the implementation of energy efficiency in buildings, industries, municipalities and agricultural pursuits has been approved and notified.
- The state action plan for climate change has been finalised with action templates for energy conservation and efficiency.
- The state has framed the Energy Conservation Policy for the implementation of energy efficiency.
- The Odisha State Designated Agency has conducted an Investment Grade Energy Audit of energy usage at government buildings, major drinking water pumping systems, dairy plants and has estimated energy savings by implementing energy efficiency initiatives[27].
- In order to develop model green buildings in the state, a proposal has been taken up at an estimated cost of 124 crore INR[28].
- Raghurajpur and Satyabhamapur in Odisha are part of the nationwide LED village campaign[29].
- Odisha is the third state in the country to make energy audits mandatory in industries across the state, which shall be recorded through the innovative E-FILE system[30].
- In order to curtail the peak demand in Odisha, power distribution utilities have tied up with Banyan Environmental Innovations Pvt Ltd to replace over 70 lakh incandescent lamps by compact fluorescent lamps (CFL) under Odisha Lighting Energy Efficiency Project[31].

27. State designated agency, Odisha: sdaodisha.org/web/ActivitiesOfSDA/IGEA/tabid/69/Default.aspx
28. Business Standard: www.business-standard.com/article/economy-policy/odisha-finalises-rs-124-crore-green-building-contract-114070700011_1.html
29. Outcome budget 2013: Department of Energy, government of Odisha
30. The Economic Times : economictimes.indiatimes.com/news/news-by-industry/energy/power/Odisha-to-make-energy-audit-mandatory/articleshow/4617968.cms
31. Banyan Environmental Innovations: ecarbon.co.in/lfg_orissa.html

- The Orissa Electricity Regulatory Commission (OERC) has framed the regulation of DSM:
  - It mandates the distribution utility to assess potential areas for DSM. The distribution utility shall constitute a DSM cell to carry out related activities. The licensee shall develop and submit the DSM plan to the commission. The licensee shall submit the DSM programme document to the regulator for approval. The utility may propose a methodology for the recovery of net incremental costs through tariff or any other mechanism. The utility shall monitor the DSM initiatives based on the guidance of the regulator.
  - It empowers the regulator to set DSM targets and issue guidelines on the DSM process. The commission shall approve the DSM plan developed by the utilities. The commission may undertake third-party evaluation measurement and verification of the DSM programme. The commission may provide incentives to distribution licensees for achieving or exceeding DSM objectives.

Renewable energy and sustainability

Renewable energy source	Gross potential (MW)	Feasible potential (MW)
Biodiesel	300	150
Solar PV & thermal	50000	10000
Wind	1700	910
Biomass	1700	750
Small hydro	120	120
Total	43802	11930

Source: OREDA Annual Action Plan 2012-13

Odisha by virtue of its geographical location has the feasible potential for the production of nearly 12000 MW of power from renewable sources. The government of Odisha has constituted the Odisha Renewable Energy Development Agency (OREDA) to promote renewable energy generation with the sources such as solar, wind, hydro, biomass, geothermal and tidal energy sources.

Regulatory developments

The OERC has published a regulation for the Renewable and Co-generation Energy Purchase Obligation and its compliance. The Regulation prescribes that every obligated entity shall purchase not less than 6% of its total annual consumption of energy from co-generation and renewable energy sources from 2013-14 onwards with 0.5 percentage points increase every year till 2015-16.

Year	Solar	Non-solar	Co-gen-eration	Total
2014-15	0.25%	1.80%	4.45%	6.5%
2015-16	0.30%	2.00%	4.70%	7.0%

In order to facilitate the supply of energy from the co-generation and renewable energy sources into the state grid, the Commission has facilitated the following action through various Orders:

- The co-generation and renewable energy sources excepting roof-top solar PV and bio-gas sources shall be connected to the state grid at a voltage level of 132 kV, 33 kV or 11 kV subject to technical suitability determined by the licensee.
- Roof-top solar PV sources shall be allowed connectivity at LV or MV or 11 kV of the distribution system of the licensee as considered technically and financially suitable by the licensee and the developer.
- Bio-gas plants, if connected to the distribution system, shall be connected at 415 V, 3-phase or at 11 kV of the distribution system of the licensee according to the technical suitability examined by the licensee.

Some of the significant developments in the area of renewable in Odisha are as follows:

- OREDA has undertaken schemes of remote village electrification, decentralised distributed generation, renewable energy power projects, off-grid solar power projects, national biogas and manure management programme, solar photovoltaic (PV) programme and energy plantation and bio-diesel production.
- Fifty-two megawatts generation in Damanjodi is proposed to be developed by Suzlon and a detailed project report (DPR) is to be examined by OREDA[32].
- The state has implemented 5 MW under the Jawaharlal Nehru National Solar Mission scheme.
- OREDA has identified 200 acres of land for setting up a 30- 50 MW wind energy plant in the Gopalpur region.
- A 50kWp rooftop solar PV power plant is proposed to be installed on the rooftop of the North Annex Building of the Odisha Secretariat.
- A 20-MW project by Shalivahana Green Energy in Nimidah village of Dhenkanal district is planned.
- Under the off-grid solar power projects, an initiative of the government of Odisha, 50 kW rooftop solar power plants for the Orissa Secretariat building have been sanctioned.
- The state government has identified 22 locations for setting up wind power projects[33].
- OREDA has taken several initiatives for the cultivation of biofuels Jatropha and Pomgambia in the state.
- The state government has decided to set up a new renewable energy park at Nawarangpur with an estimated investment of 1 crore INR covering a land bank of 2 to 3 acres.[34]
- OREDA has shortlisted about 100 solar projects in Odisha. The state government has cleared solar power projects with a total capacity of close to 350 MW in 12th Plan[35].
- The Science and Technology Department of the state has identified lands in Bolangir and Boudh to take up the solar power project by the National Thermal Power Corporation[36].

32. OREDA: Annual Action Plan 2012-13
33. AZoNetwork UK Ltd: http://www.azocleantech.com/news.aspx?newsID=12252
34. Business Standard: www.business-standard.com/india/news/second-renewable-energy-park-at-nawarangpur/395268/
35. Business Standard: www.business-standard.com/india/news/Odisha-approves-nine-more-solar-power-projects/394278/
36. Business Standard: www.business-standard.com/india/news/Odisha-identifies-land-for-ntpc-solar-projects/396048/

Chhattisgarh

Key indicators	
Requirement (MW)	3,365
Availability (MW)	3,320
Surplus(+)/deficit(-) (MW)	-45
Surplus (+)/deficit (-) (%)	-1.3
Population (in million)	25.54
Villages electrified (%)	97.40
Energy availability (MU)	18,800
Surplus (+)/deficit (-) (%)	-0.7
Per capita consumption (units)	736

Source: CEA, Census 2011 data

Chhattisgarh was formed in 2000 and is one of the fastest-growing states. The strategic location of the state in central-eastern India and bountiful natural resources led the state government to formulate the 'Power Hub' strategy. Power Finance Corporation estimated that the state has the potential of 61,000 MW of additional thermal power in terms of availability of coal for more than 100 years and more than 2500 MW of hydel capacity[37]. To tap this vast potential, substantial addition to the existing generation capacity is already under way. During the 12th Five Year Plan the state is expected to add 12840 MW of generation capacity, by the government and private investment. UMPP in Surguja are also in the planning stage.

However, in 2013-14 the state experienced a 132 MU (0.7%) energy shortage and a 45 MW (1.3%) peak demand deficit. The CEA has estimated that the state shall be surplus of energy and peak demand by 9,687 MU and 485 MW in FY 2015 with the commissioning of 500 MW unit from the Marwa Thermal Power Plant.

DSM and energy efficiency measures

The state government is attuned to the vast scope of energy conservation. Activities relating to energy conservation can help conserve huge amounts of energy. Potential for energy conservation is roughly estimated at 20 to 30% and hence mass energy conservation awareness and education drives were initiated[38]. The Chhattisgarh State Renewable Development Agency (CREDA) is responsible for initiating energy efficiency measures.

Some of the key initiatives in the area of energy efficiency include the following:

- In the government owned properties and housing boards, electric geysers are prohibited and solar water heating systems are mandatory
- For demonstrating the DSM project, sodium vapour lamps at the airport road are replaced with energy efficient lamps which aim to save 3.65 lakh units of electricity per year
- Nearly 1000 incandescent lamps and 50 street lights were replaced with LED luminaires in Dharseeva, Raipur through the LED village campaign
- Energy audit of 20 government buildings, nine water works, five industries and two rice mills were completed under the BEE schemes and state energy conservation fund
- Automatic power factor corrector panels were commissioned in the medical college hospital Raipur and the Chhattisgarh Institute of Medical Sciences, Bilaspur
- Announced energy efficiency in agricultural pumps with the approval of cabinet of ministers

37. CSERC article on power sector in Chhattisgarh
38. BEE report on CREDA

- CREDA is in the process of implementing an intensive programme for improving the power factor of government buildings
- State implemented energy conservation awareness and publicity campaign through various print, audio and video media.[39]

Renewable energy and sustainability

Chhattisgarh has 44% forest coverage, with varied kinds of flora and fauna[40]. Due to high availability of rich mineral resources, primarily coal, required for thermal generation plants as well as other fuel-intensive industries, the state is gradually being depleted of its green cover, thereby leading to environmental concerns. Korba, an industrial town in Chhattisgarh has been declared critically polluted by the Ministry of Environment. The ministry has banned setting up new factories till the Central Pollution Control Board and state boards will prepare a plan to improve the environment. This will create hurdles in establishing numerous thermal power plants and pose serious challenges to the nation's energy security. Therefore, the state government has to strike a right balance between growth and sustainability.

The CREDA was established to promote non-conventional and alternative energy sources in the state. It has been constituted under the Department of Energy, Chhattisgarh for implementing various schemes pertaining to renewable energy sources and energy conservation.

The state government has taken several measures to promote renewable energy. It has framed the Chhattisgarh Solar Energy Policy, 2012 to encourage solar power generation and add 500 to 1000 MW of solar projects by March 2017. The policy shall support grid-connected solar generation, solar parks and roof-top solar projects. As a part of the State Industrial Policy 2009-2014, benefits such as interest subsidy, fixed capital investment subsidy, exemption from electricity duty, etc are extended till 2017 for solar power generating plants.

39. Energy Manger Training: http://www.emt-india.net/eca2009/AwardBooklet2009/g-SDA's483-519.pdf
40. Forest department, government of Chhattisgarh

Also electricity duty on auxiliary and captive consumption shall be exempted. Also additional benefits such as VAT exemption on equipment, no cross-subsidy charges for third party sales within the state, fast-track grid connectivity technical feasibility T&D utility for evacuation of power, etc. Similarly, the government has framed small hydel projects policy 2012 to promote construction of hydel projects with capacity less than 25 MW. The policy offers benefits such as lower royalty, extension of benefits under the industrial policy, etc. The Power Generation from Wind Policy 2002 was framed to promote wind energy generation and private participation. The policy extends incentives under the industrial policy and government land shall be provided for 30 years or period of the project whichever is earlier etc.

Regulatory developments

The Chhattisgarh State Electricity Regulatory Commission (CSERC) has notified a regulation in 2013 for promoting renewable energy development for the period 2013-2016.

Fixed RPO				
Year	Solar	Biomass/ RE based co-generation	Others (hydel , wind)	Total
2014-15	0.75%	3.75%	2.25%	6.75%
2015-16	1.00%	3.75%	2.50%	7.25%

The key points of this regulation are mentioned below:

- Every distribution licensee, captive users and open access consumer has to meet the renewable purchase obligation as stated by the commission.
- The RPO can be met by purchase of renewable energy certificates from power exchange as mentioned in the Renewable Energy Certificate (for Renewable Energy Generation) Regulations, 2010
- The CREDA has been designated as the state agency for accreditation and recommending the renewable energy projects for registration and to undertake functions under these regulations.

- Any person generating electricity from renewable energy sources will have priority, irrespective of installed capacity and shall have open access to any licensee's transmission system or distribution system or grid or both.
- All renewable projects commissioned during the control period shall have an option of following either the tariff structure or other conditions as stipulated in the Chhattisgarh State Electricity Regulatory Commission (terms and conditions for determination of generation tariff and related matters for electricity generated by plants based renewable energy sources) Regulations, 2012 or adopt REC mechanism for pricing of the electricity generated from the project.

Some of the key developments in the area of renewable energy are mentioned below:

- The government has signed a MoU with Welspun Renewables Energy Ltd for installation of 100 MW solar power project with an investment of 1,000 crore INR.[41]
- Off-grid programmes by CREDA include solar photovoltic, bio-gas manure, bio-mass, solar thermal schemes. Grid connected programmes includes power plants of solar photovoltic, bio-mass, and small hydro. The grid connected programmes have a total capacity of 277.4 MW out of which biomass alone contributes to 261 MW and the remaining comes from SPV and small hydro plants (SHP) plants. Around 26079 kW of grid power has been installed through various SPVs in health centres, ashrams, SPV drinking water pumps and through rural village electrification initiatives.
- The CREDA has developed an Energy Education Park in Raipur to create awareness on renewable energy sources[42].
- Nearly 50 remote villages in Barnawapara Wildlife Sanctuary are covered under the remote village electrification programme.
- Installation of solar street lights and solar water heating systems is mandated by the Department of Town and Country Planning for new colonies.
- For village electrification, the CREDA initiated implementation of micro-grids for big concentrated villages and solar home lighting systems for village with scattered hamlets.[43]
- Shri Bajrang power, Ispat Power, Chind Iron and Steel Industries and Jindal Electricity Generation to set upto 8MW, 20 MW, 8 MW and 8 MW respectively in the districts of Raipur, Durg and Mahasamund districts.[44]
- Hindustan Petroleum Corporation Limited has signed a MoU with the government and CREDA for the formation of joint venture company to undertake *Jatropha* plantation on 15,000 hectares of land in the state.[45]
- Indian Oil Corporation Limited and CREDA have established a joint venture company, Indian Oil – CREDA Bio-fuels Ltd to produce 30,000 MT of biodiesel per annum from energy crop plantation on 30,000 hectare of revenue wasteland.[46]

41. Business Standard: www.business-standard.com/article/companies/welspun-energy-to-set-up-solar-power-proj-in-chhattisgarh-112110400059_1.html

42. EAI: www.eai.in/club/users/krupali/blogs/428
43. Infochange: infochangeindia.org/environment/news/chhattisgarhs-solar-electrification-success-story.html
44. IBIS: biomass-power.industry-focus.net/chhattisgarh-biomass-projects.html
45. Hindustan Petroleum Corporation Limited: www.hindustanpetroleum.com/En/UI/PressnMedia.aspx?Id=27
46. Indian Oil:www.iocl.com/AboutUs/GroupCompanies%28CREDA%29.aspx

Jharkhand

Key indicators	
Requirement (MW)	1,111
Availability (MW)	1,069
Surplus(+)/deficit(-) (MW)	-42
Surplus (+)/deficit (-) (%)	-3.8
Population (in million)	32.97
Villages electrified (%)	92
Energy availability (MU)	7,007
Surplus (+)/deficit (-) (%)	-1.9
Per capita consumption (kWh)	213

Source: CEA, Census 2011 data

With the reorganisation of Bihar into two states, Jharkhand was endowed with mineral and industry rich belts along with the major share of installed power capacity. Since then, the state government has decided to take quantum jumps in generating capacity addition and at present the state has a total installed capacity of 3049 MW and the works on the construction of 3960 MW. In the 12th Five Year Plan, the state is expected to add 2080 MW of generation capacity, by the government and private investment. UMPP in Tilaiya and Deoghar are also a part of the planning process. Although the state has performed well with respect to capacity addition, some of the problems it has inherited from the parent state such as high aggregate technical and commercial losses, low plant load factor and poor network condition is proving to be deterrent for sector development.

The availability of coal in abundance makes Jharkhand an ideal state for establishing thermal power plants. With the abolition of freight-equalisation, there exists a tremendous cost advantage in setting up pit-head thermal power plants. A large number of new steel plants are coming up in the region with their own captive generation facility. There is also immense potential for setting up hydel, geo-thermal, atomic and methane and gas based power plants in the state.

Recently with the implementation of Jharkhand State Electricity reform Transfer Scheme 2013, the erstwhile Jharkhand State Electricity Board has been unbundled into four entities Jharkhand Bijli Vitran Nigam Limited, Jharkhand Urja Utpadan Nigam Limited, Jharkhand Urja Sancharan Nigam Limited, and Jharkhand Urja Vikas Nigam Limited. Unbundling of the utilities is a positive step toward the power sector reform.

DSM and energy efficiency measures

The state government has placed increased focus on promotion of energy efficiency. Some of the DSM initiatives are as follows:

- LED street lighting project at a few places in Ranchi
- In order to promote DSM and improve energy efficiency in the industrial, commercial and agricultural segment, the state has formulated a Jharkhand Energy Policy 2012.[47] Under this, priority shall be given to industries perusing certifications from ISO, BEE or LEED Certification along with governmental financial assistance
- Assessment of financial and technical viability to improve efficiency of power plants (switching towards super critical boilers) and designing fiscal incentives to promote energy efficiency are some of the measures taken by the state government along with BEE
- Initiatives such as the installation of CFL and LED lamps in the government building by replacing the general lighting service and incandescent lamps.[48]
- BEE star labelled energy efficient products are proposed to be installed in the government buildings

47. Government of Jharkhand: archive. jharkhand.gov.in/DEPTDOCUPLOAD/uploads/84/D201384002.pdf
48. Jharkand State annual plan-2010-11

- JSERC has notified regulation of the DSM in 2010, salient features of the regulation include the following:
  - It mandates the distribution utility to assess potential areas of the DSM. Distribution utilities shall constitute DSM cell to carry-out related activities. The licensee shall develop and submit the DSM plan to commission. The licensee shall submit the programme document to the regulator for approval. The utility may propose the methodology for recovery of net incremental costs through tariff or any other mechanism. The utility shall monitor the initiatives based on the guidance provided by the regulator.
  - It empowers the regulator to set DSM targets and issue guidelines on the DSM process. The commission shall approve the DSM plan developed by utilities. The commission may undertake third party evaluation measurement and verification of the DSM programme. The commission may provide incentives to distribution licensees for achieving or exceeding the set objectives.

Renewable energy and sustainability

The Jharkhand Renewable Energy Development Agency (JREDA) was established to promote the use of renewable energy sources. Being a nodal agency, JREDA is working for implementation of fiscal and financial incentives made available by the Ministry of New and Renewable Energy Sources and Indian Renewable Energy Development Agency.

Regulatory developments

In July 2010, JSERC introduced a regulation for promoting renewable energy development which was amended in 2012.

Fixed RPO			
Year	Solar	Non-Solar	Total
2014-15	1.00%	3.00%	4.00%
2015-16	1.00%	3.00%	4.00%

- Every distribution licensee, captive users and open access consumer has to meet the renewable purchase obligation as mentioned by the commission.
- The RPO can be met by the purchase of renewable energy certificates from the power exchange as mentioned in the Renewable Energy Certificate for Renewable Energy Generation) Regulations, 2010
- The Commission shall designate an agency as the state agency for accreditation and recommending the renewable energy projects for registration and undertake functions under these regulations.

Some of the key developments made in the area of renewable energy are mentioned below:

- The government recently signed a MoU worth 2200 crore INR with the US-based Bal Moral Capital Holding and Cross Industry Solution Inc to set up a 100 MW solar power plant.[49]
- As per JREDA, funds from the Ministry of New and Renewable Energy (MNRE) has been released for the implementation of the National Biogas and Manure Management Programme
- The Power Finance Corporation Ltd and Solar Energy Corporation have entered into a MoU on July, 2013 which envisages installation of 500 street lights in the seven blocks of Bokaro.[50]
- About 4,000 solar home lights and 620 solar street lights were installed. And nearly 450 villages have been covered through the solar system under the Remote Village Electrification Programme[51].
- The state has identified small, mini and micro hydel power sites with a generating capacity of 100MW and has 4.1 MW of installed small, mini and micro hydel power projects[52].
- The MNRE launched solar power station with installed capacity of 2 MW at Deoghar. The work on 11 such power stations is started with the aim of providing electricity in rural areas
- Two solar photovoltaic with a total capacity of 30.9kW has been installed by the Ranchi Raj Bhavan, which shall supply power to 62 acre campus to run office appliances at night.[53]
- In order to improve the response time of the remote 80 police stations, the State Home Department has proposed installation of solar power units.[54]
- Jharkhand has a large potential of developing geothermal energy, which can be gainfully utilised for power generation. Of the total recorded site of 340 in India, 60 sites could be in Jharkhand[55]. Most promising sites are listed below:

Name and location	Surface temperature (celsius)	Average subsurface temperature (celsius)
Surajkund, Hazaribagh District	87	165
Jarom, Palamu District	56	150
Thatha or Konraha, Palamu District	65	150
Tantolaya or Tantlol, Santhal Paragana	70	180

The power station size in the above sites can be in the range of 20 to 200 MW. The power generated could be directly utilised in surrounding areas, avoiding long transmission lines.[56]

49. The Times of India: timesofindia.indiatimes.com/city/ranchi/Jharkhand-to-set-up-300MW-power-plants-from-renewable-sources/articleshow/14436537.cms

50. Solar Energy Corporation of India: seci.gov.in/content/news_update/seci-and-pfc-sign-mou-for-installation-of-solar-streetlights-in-jharkhand.php
51. Source: MNRE
52. Energy Next: www.energynext.in/jharkhand-governers-residence-embraces-solar-energy/
53. Energy Next: www.energynext.in/jharkhand-governers-residence-embraces-solar-energy/
54. iGovernment: www.igovernment.in/igov/news/33813/solar-power-lit-jharkhand-rural-police-stations
55. Department of Industry, Jharkhand
56. Department of Industry, Jharkhand: jharkhandindustry.gov.in/opportunity_power.html

Bihar

Key indicators	
Requirement (MW)	2,465
Availability (MW)	2,312
Surplus(+)/deficit(-) (MW)	-153
Surplus (+)/deficit(-) (%)	-6.2
Population (in million)	103.80
Villages electrified (%)	95.50
Energy availability (MU)	14,759
Surplus(+)/deficit(-) (%)	-4.1
Per capita consumption (units)	142

Source: CEA, Census 2011 data

After the creation of Jharkhand, two thermal power stations at Barauni and Muzaffarpur fell under the Bihar state territory. Both of these power stations were in a dilapidated condition and generated almost no electricity. The state has a total capacity of 1833 MW, including its own installations and central sector generating stations. The energy shortage stood at 4.1% and with a peak deficit of 6.2%. The per capita consumption stands just above 140 units compared to the national average of 917 units. The planning department has targeted to reach 600 units per capita by the end of the 12th Five Year Plan. In the 12th Five Year plan the state is expected to add 4690 MW of generation capacity, by the government investment. UMPP is also planned in the state. Reform and restructuring of the sector has been initiated and independent Regulatory Commission BERC has been constituted in May 2005.

Though 88% of Bihar's population lives in rural areas making it one of the states which benefitted considerably from RGGVY initiatives, its inability to produce enough power at state level to meet the needs of its population poses serious challenges.

The state government has planned to strengthen the transmission and distribution infrastructure. A master plan has been prepared for transmission by the ADB and further updated by the PGCIL. Strengthening of T&D network has been initiated in seven towns funded by an ADB loan and replacement of old dilapidated 72000kms of conductors has been sanctioned.

DSM and energy efficiency measures

The Bihar Renewable Energy Development Agency (BREDA) has been appointed as the state designated agency. Some of the key actions undertaken are as follows:

- A sum of 18.32 crore INR has been allocated for replacement of CFL under the Bachat Lamp Yojana (BLY) scheme in 11th Five Year Plan. More than 250 lakh CFLs have been distributed in the state under this scheme[57].
- BERC has framed a DSM regulation in 2010 by adopting the Model DSM regulation issued by the Forum of Regulators for undertaking the following initiatives:
  - Use of electrical energy in an efficient manner within buildings, especially government buildings
  - Provision for building by-laws for urban local bodies for the installation of solar water heater
  - Implementation of the Bachat Lamp Yojana Scheme
  - Improvement of power factor of consumers
  - Use of energy efficient water pumping system
  - Off-grid renewable energy application
  - Implementation of energy efficient street lights

57. bihar.newstrust.in/2012/04/bachat-lamp-yojana.html

Renewable energy and sustainability

Renewable energy sources such as hydro, biomass, solar, wind, etc can meet the energy requirements, to some extent, for lighting, minor irrigation within villages, and captive power generation for industries since there is a significant potential of renewable energy within the state. Rice-husk-based biomass gasification may be one of the important sources for power generation in the state. Greenpeace has been campaigning for using renewable energy as a means to improve per capita consumption of power within the state. In order to promote renewable energy, Urja Kranti Kendra, a four-storey-high dome powered by renewable energy has been installed in the centre of Patna.

BREDA is the state nodal agency responsible for the development as well as implementation of renewable energy programmes. For hydropower development, the state has a dedicated corporation namely, the Bihar State Hydro Electric Power Corporation (BSHPC).

Regulatory developments

BERC in July 2010 passed a regulation for promoting renewable energy development within the state, which was later amended in 2012.

Fixed RPO

Year	Solar	Total
2014-15	0.75%	5.00%

- Every distribution licensee, captive users and open access consumer has to meet the renewable purchase obligation as mentioned by the commission. The RPO as fixed by the commission is shown alongside.
- The RPO mentioned above can be met by the purchase of renewable energy certificates from the power exchange as mentioned in the Renewable Energy Certificate for Renewable Energy Generation Regulations, 2010
- If any distribution licensee, captive users and open access consumer fails to meet the RPO requirements, the commission may direct the party to deposit an equivalent amount (as decided by the regulator) in a separate fund. This fund shall be used for renewable energy development within the state.

Some of the notable developments of the state in the area of renewable energy development are as follows:

- SEWA Bharat and SELCO undertook a pilot project in Munger district, which electrified 57 off-grid homes with solar home lighting and mobile phone charging systems.[58]
- BREDA has agreed in principle to set up solar power plants in the state. These plants will be set up under the power purchase agreement with the state utility. In total, 10 shortlisted promoter firms have submitted a proposal to generate a total of 198 MW of power across different parts of the state.[59]
- The new solar-powered drip irrigation system initiative is expected to come up in Champaran at an investment of 4.5 crore INR.[60]
- More than 90 sites suitable with a total capacity of 195 MW for small hydropower projects have been identified within the state, and six small hydropower projects with a total capacity of 46.1 MW has been installed within the state.
- BREDA is in the process of taking up a wind resource assessment programme in association with Centre for Wind Energy Technology, in order to identify suitable potential sites to set up wind energy based power projects.
- Bihar has the potential of more than nine lakh family size biogas plants, out of which 1.25 lakh plants have already been installed.
- BREDA has identified 500 unelectrified remote villages for the implementation of the village electrification programme from renewable sources.
- Thirty rice-husk-based biomass projects are under execution, and 30 similar plants are already operational in the west Champaran district.[61]

58. Case study: the potential for off-grid solar
59. The Times of India: timesofindia.indiatimes.com/city/patna/Govt-to-promote-eco-friendly-energy-in-Bihar/articleshow/14809174.cms
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Conclusion

With the increasing demand for reduction in carbon emission and protection of scarce natural resources, globally, renewable energy and sustainability measures are gaining increasing importance. Amidst the prevailing constraints in India for rapidly increasing renewable capacities, and making such sources of energy easily available to the consumer for use through grid or off-grid, key stakeholders can increase the pace of their efforts on energy efficiency improvement and demand side measurement. There is a need to bolster the development of renewable-based energy sources by each state within the region in order to match the pace with leading state. Initiatives in PPP implementation have seen acceleration in some states in the region, and by leveraging the experiences, better models may be explored in the other states as well. Role of state designated agencies is vital in achieving renewable and energy efficiency related measures, and necessary capacity building initiatives of key stakeholder will play a critical role in developing a sustainable power sector. Solution providers can support the movement by providing innovative as well as cost-effective solutions. These efforts will reduce the pressure on the inclusion of additional conventional generation capacities, thereby reducing the pressure on environment degradation through increased level of mining and deforestation.

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The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering industry, Government, and civil society, through advisory and consultative processes.

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