

**Data Collection Survey on
Power Sector
in India**

Final Report

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PART I PUMPED STORAGE PROJECTS

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PART II COAL THERMAL PROJECTS

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ABBREVIATION

Abbreviation	Full Name
JICA	Japan International Cooperation Agency
MS	Maharashtra State
OD	Odisha State
TE	Telangana State
KA	Karnataka State
KS	Kerala State
TN	Tamil Nadu State
WB	West Bengal State
S & I	Survey & Investigation
PIR	Preliminary Investigation Report
PFR	Pre-Feasibility Report
DPR	Detailed Project Report
TEC	Techno Economic Clearance
EIA	Environmental Impact Assessment
ABR	Average Billing Rate
ACCF	Principal Chief Conservator of Forests
ACS	Average Cost of Supply
ADB	Asian Development Bank
AGC	Automatic Generation Control
AIADMK	All India Anna Dravida Munnetra Kazhagam
APERC	Andhra Pradesh Electricity Regulatory Commission
APFC	Automatic Power Factor Control
APGENCO	Andhra Pradesh Power Generation Corporation Ltd.
APM	Administrative Price Mechanism
APPC	Average Power Purchase Cost
ARR	Aggregate Revenue Realized
AT&C	Aggregate Technical & Commercial
BEE	Bureau of Energy Efficiency
BESCOM	Bengaluru Electricity Supply Company Ltd.
BEST	Bombay Electric Supply & Transport Undertaking
BFSI	Banking, Financial Services and Insurance
BGJY	Biju Gram Jyoti Yojana
BJP	Bharatiya Janata Party
BNHS	Bombay Natural History Society
BSP	Bulk Supply Price
BSPGCL	Bihar State Power Generation Company Limited
CBM	Capacity Benefit Margin
CCEA	Cabinet Committee on Economic Affairs
CCVT	Cable cum Ventilation Tunnel
CDM	Clean Development Mechanism
CEA	Central Electricity Authority

Abbreviation	Full Name
CERC	Central Electricity Regulatory Commission
CESC	Chamundeshwari Electricity Supply Company Ltd.
CESC	Calcutta Electricity Supply Company Ltd.
CESU	Central Electricity Supply Utility
CFL	Compact Fluorescent Light
CGS	Central Generating Stations
CGU	Cogeneration Unit
CO2	Carbon Dioxide
COD	Date of Commercial Operation
C/P	Counterpart
CPP	Coal-fired Power Plant
CR	Critically endangered
CSS	Cross Subsidy Surcharge
CSTEP	Center for Study of Science, Technology & Policy
CTU	Central Transmission Utilities, Central Transmission Utility
CWC	Central Water Commission
DAM	Day Ahead Market
DCC(s)	Distribution Control Centre(s)
DCF	Deputy Conservator of Forests
DD	Data deficient
DDUGJY	Deendayal Upadhyaya Gram Jyoti Yojana
DGF	Settlement Guarantee Fund
Discom(s)	Distribution Company(ies), Power Distribution Company
DMK	Dravida Munnetra Kazhagam
DMS	Distribution Management System
DoA	Department of Atomic Energy
DPL	Durgapur Projects Ltd
DPR	Detailed Project Report
DPSC	Dishergarh Power Supply Company
DRO	District Resettlement Officer
DSM	Deviation Settlement Mechanism
DVC	Damodar Valley Corporation
EA2003	Electricity Act 2003
EAC	Expert Appraisal Committee
EC	Environmental Clearance, Environment Certificate
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EN	Endangered
ERC(s)	Electricity Regulatory Commission
ERLDC	Eastern Regional Load Dispatch Center
ESDM	Electronic System Design and Manufacturing
ESA	Ecologically Sensitive Area
ESZ	Ecologically Sensitive Zone
FAC	Forest Advisory Committee
FC	Forest Clearance

Abbreviation	Full Name
FC	Financing Cost
FDI	Foreign Direct Inflow
FIT	Feed-in-Tariff
FRBM	Fiscal Responsibility and Budget Management
FRL	Full Reservoir Level
FRP	Financial Restructuring Package
FS	Feasibility Study
FY	Fiscal Year
GDP	Gross Domestic Product
GEDCOL	Green Energy Development Corporation of Odisha Limited
GENCO	Power Generation Company
GESCOM	Gulbarga Electricity Supply Company Ltd.
GHG	Greenhouse Gas
GIS	Geographic Information System
GOM	Government of Maharashtra
GOMWRD	Water Resource Department of Government of Maharashtra
GPP	Natural gas –fired Power Plant
GRIDCO	Grid Corporation of Orissa limited
GSDP	Gross State Domestic Products
GPS	Global Positioning System
GSI	Geological Survey of India
HESCOM	Hubli Electricity Supply Company Ltd.
HPP	Hydro Power Plant
HPPCL	Himachal Pradesh Power Corporation Limited
HT	High Tension
HVAC	High Voltage Alternating Current
HVDC	High-Voltage Direct Current
IBAs	Important Bird Areas
IBAT	Integrated Biodiversity Assessment Tool
IC	Installed Capacity
ICT	Information & Communication Technology
IDC	Interest During Construction
IEA	International Energy Agency
IEGC	Indian Electricity Grid Code
IEX	Indian Energy exchange Ltd.
INC	Indian National Congress
INDC	Intended Nationally Determined Contribution
IPCL	India Power Co. Ltd.
IPDS	Integrated Power Development Scheme
IPP	Independent Power Producer
IPR	Industrial Policy Resolution
IREDA	Indian Renewable Energy Development Agency
ISGS	Inter-State Generating Station
ISTS	Inter-State Transmission System
IT	Information Technology

Abbreviation	Full Name
IPP	Independent Power Producer
IPP	Indigenous Peoples Plan
IUCN	the International Union for Conservation of Nature
JETRO	Japan External Trade Organization
JKSPDC	Jammu & Kashmir State Power Development Corporation Limited
JNNSM	Jawaharlal Nehru National Solar Mission
KBA	Key Biodiversity Areas
KBK	Kalahandi Balangir Koraput
KEB	Karnataka Electricity Board
KERC	Karnataka Electricity Regulatory Commission
KFRA	Karnataka Fiscal Responsibility Act
KfW	Kreditanstalt für Wiederaufbau
KPCL	Karnataka Power Corporation Ltd.
KPTCL	Karnataka Power Transmission Corporation Ltd.
KREDL	Karnataka Renewable Energy Development Ltd.
KSEB	Kerala State Electricity Board
KSEBL	Kerala State Electricity Board Ltd.
KSERC	Kerala State Electricity Regulatory Commission
KWDT I	Krishna Water Dispute Tribunal I
KWDT II	Krishna Water Dispute Tribunal II
LDF	Left Democratic Front
LED	Light Emitting Diode
LI	Lift Irrigation
LIS(s)	Lift Irrigation Scheme(s)
LT	Low Tension
LVRT	Low Voltage Ride Through
MAB	UNESCO's Man and the Biosphere Program
MAHAGENCO	Maharashtra State Power Generation Corporation Limited
MAHATRANSCO	Maharashtra State Electricity Transmission Company Ltd
MAT	Main Access Tunnel
MCR	Maximum Continuous Rating
MDOE	Maharashtra State Department of Environment
MEDA	Maharashtra Energy Development Agency
MERC	Maharashtra Electricity Regulatory Commission
MESCOM	Mangalore Electricity Supply Company Ltd.
MIDC	Maharashtra Agro Industries Development Corporation
MoC	Ministry of Coal
MOD	Merit Order Dispatch
MoEFCC	Ministry of Environment, Forest and Climate Change
MOEF	Ministry of Environment and Forests
MOFA	Ministry of Foreign Affairs of Japan
MoNRE, MNRE	Ministry of New and Renewable Energy
MoP, MOP	Ministry of Power
MoPNG	Ministry of Petroleum and Natural Gas
MOSPI	Ministry of Statistics and Program Implementation

Abbreviation	Full Name
MOU	Memorandum of Understanding
MPPGCL	Madhya Pradesh Power Generating Company Limited
MSEB	Maharashtra State Electricity Board, MSEB Holding Company
MSEDCL	Maharashtra State Electricity Distribution Company Ltd.
MSERC	Maharashtra State Electricity Regulatory Commission
MSETCL	Maharashtra State Electricity Transmission Company Ltd.
MSLDC	Maharashtra State Load Dispatch Center
MSPGCL	Maharashtra State Power Generation Corporation Ltd.
MYT	Multi-Year Tariff
N/A	Not available (or not applicable)
NAPCC	National Action Plan on Climate Chang
NCA	National CDM Authority
NCEF	National Clean Energy Fund
NCP	Nationalist Congress Party
NCTPS	North Chennai Thermal Power
NEEPCO	North Eastern Electric Power Corporation Limited
NEF	National Electricity Fund
NEP	National Electricity Policy
NERLDC	North Eastern Regional Load Dispatch Centre
N.E.S	Non-conventional Energy Sources
NESCO	North Eastern Electricity Supply Company of Odisha Limited
NGO	Non Governmental Organization
NHDC	Narmada Hydroelectric Development Corporation
NHPC	National Hydroelectric Power Corporation
NIAS	National Institute of Advance Studies
NLC	Neyveli Lignite Corporation
NLDC	National Load Despatch Centre
N/P, NP	National Park
NPCIL	Nuclear Power Corporation of India Limited
NPV	Net Present Value
NRLDC	Northern Regional Load Dispatch Centre
NSDP	Net State Domestic Products
NT	Near threatened
NTPC	National Thermal Power Corporation
O&M	Operation and Maintenance
OA	Open Access
ODAFFP	Odisha Dedicated Agriculture & Fishery Feeder Project
ODSSP	Odisha Distribution System Strengthening Project
OERC	Odisha Electricity Regulatory Commission
OHPC	Odisha Hydro Power Corporation limited
OPGC	Odisha Power Generation Corporation limited
OPTCL	Odisha Power Transmission Corporation limited
OREDA	Odisha Renewable Energy Development Agency
OSEB	Orissa State Electricity Board
OSM	Open Series Map

Abbreviation	Full Name
OTC	Over The Counter
OTP	Other than RTC and Peak period
PAF	Plant Availability Factor
PAP	Project Affected Person
PC	Planning Commission
PCN	Project Concept Note
PDD	Project Design Document
PFA	Power For All
PFC	Power Finance Corporation
PGCIL	Power Grid Corporation of India Limited
PLF	Plant Load Factor
POSOCO	Power System Operation Corporation Limited
PP	Project Proponent
PPA	Power Purchase Agreement
PPP	Public Private Partnership
PSDF	Power Sector Development Fund
PSP	Pumped Storage Project (or Pumped Storage Plant)
PSU(s)	Public Sector Undertaking(s)
PV	Photo Voltaic
PXIL	Power Exchange India Ltd.
R&M	Renovation and Modernization
R&R	Rehabilitation & Resettlement
RAPDRP	Restructured Accelerated Power Development and Reforms Programme
RAP	Resettlement Action Plan
RBI	Reserve Bank of India
RCCF	Regional Chief Conservator of Forests
REC	Renewable Energy Certificate
REC	Rural Electrification Corporation Ltd.
REMC(s)	Renewable Energy Management Centre(s)
RGCCP	Rajiv Gandhi Combined Cycle Power Plant
RGVY	Rajiv Gandhi Grameen Vidyutikaran Yojana
RGO	Renewable Generation Obligation
RGPL	Ratnagiri Gas And Power Pvt. Ltd.
Rinfra	Reliance Infrastructure Limited
RLDC(s)	Regional Load Despatch Centres
RMU	Ring Main Unit
ROE	Return On Equity
RPC	Regional Power Committee
RPO	Renewable Power (Purchase) Obligation
RRAS	Reserves Regulation Ancillary Services
RRVUNL	Rajasthan Rajya Vidyut Utpadan Nigam Limited
RTC	Round the Clock
SAG	State Advisory Group
SCADA	Supervisory Control And Data Acquisition
SCCF	State Chief Conservator of Forests

Abbreviation	Full Name
SCRIPS	State Capital Region Improvement of Power System
SDL	State Development Loan
SEA	Strategic Environmental Assessment
SEAC	State Level Expert Appraisal Committee
SEB(s)	State Electricity Board
SECI	Solar Energy Corp. of India
SEIAA	State Environmental Impact Assessment Authority
SERC(s)	State Electricity Regulatory Commission
SEZ(s)	Special Economic Zone
SHR	Station Heat Rate
SJVNL	Satluj Jal Vidyut Nigam Limited
SLAO	Special Land Acquisition Officer
SLDC	State Load Despatch Centre
SLR	Statutory Liquidity Ratio
SOI	Survey of India
SOUTHCO	Southern Electricity Supply Company of Odisha Limited
SPCB	State Pollution Control Board
SRLDC	Southern Load Dispatch Centre
SSNML	Sardar Sarovar Narmada Nigam Limited
STU	State Transmission Utility
T&D	Transmission and Distribution
TANGEDCO	Tamil Nadu Generation and Distribution Corporation Ltd.
TAPI	Turkmenistan-Afghanistan-Pakistan-India
TEC	Techno Economic Clearance
THDC	Tehri Hydro Development Corporation Limited
TNEB	Tamil Nadu Electricity Board Ltd.
TNERC	Tamil Nadu Electricity Regulatory Commission
TNTRASCO	Tamil Nadu Transmission Corporation Ltd.
TOD	Time of Day
TOR	Terms of Reference
TPC	Tata Power Corporation
TPS	Thermal Power Plant
TRM	Transmission Reliability Margin
TSERC	Tekengana State Electricity Regulatory Commission
TSGENCO	Telangana State Power Generation Corporation Ltd.
TSNPDCL	Telangana State Northern Power Distribution Company Ltd.
TSSPDCL	Telangana State Southern Power Distribution Company Ltd.
TSTRANSCO	Transmission Corporation of Telangana Ltd.
T-TAP	Telangana Textile and Apparel Policy
UDAY	Ujwal DISCOM Assurance Yojna
UDF	United Democratic Front
UI	Unscheduled Interchange
UMPP(s)	Ultra Mega Power Project
UNESCO	United Nation Education, Scientific and Cultural Organization
UNFCC	United Nations Framework Convention on Climate Change

Abbreviation	Full Name
UPA	United Progressive Alliance
UPRVUNL	Uttar Pradesh Rajya Vidyut Utpadan Nigam Limited
UTPCC	Union Territory Pollution Control Committee
VRE	Variable Renewable Energy
VRP	Variable Renewable Power
VU	Vulnerable
VVNL	Visvesvaraiah Vidyut Nigam Ltd.
WAPCOS	Water and Power Consultancy Services
WBERC	West Bengal Electricity Regulatory Commission
WBPDCCL	West Bengal Power Development Corporation Ltd.
WBREDA	West Bengal Renewable Energy Development Agency
WBSEDCL	West Bengal State Electricity Distribution Company Ltd.
WBSETCL	West Bengal State Electricity Transmisson Company Ltd.
WESCO	Western Electricity Supply Company of Orissa Limited
WGEA	Western Ghats Ecological Authority
WGEEP	Western Ghats Ecological Expert Panel
WLS	Wild Life Sanctuary
WRD	Water Resource Department
WRLDC	Western Regional Load Dispatch Centre
WRPC	Western Regional Power Committee
ckm	circuit km
D/S	Downstream
U/S	Upstream
INR	Indian Rupee
km	kilometer
kWh	Kilowatt-hour
MVA	Mega Volt Ampere
MW	Megawatt
tmcf	thousand million cubic feet
TW(h)	Terawatt(s) (hour)

ABBREVIATION

Short Title	Official Term
AWRS	Ash Water Recycle System
BOP	Balance of Plant
CCL	Central Coalfields Limited
CEA	Central Electricity Authority
CIL	Coal India Limited
COD	Commercial Operation Date
C/P	Counterpart
DC	Designated Consumer
DPR	Detail Project Report
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement and Construction
ERP	Enterprise Resource Planning
ESP	Electric Static Precipitator
FGD	Flue Gas Desulphurization
GDP	Gross Domestic Product
IDC	Interest During Construction
JICA	Japan International Cooperation Agency
LE	Life Extension
MPPGCL	Madhya Pradesh Power Generating Company Limited
MSPGCL	Maharashtra State Power Generation Company Limited
MoEF	Ministry of Environment and Forest
MoP	Ministry of Power
NCL	Northern Coalfields Limited
NDCT	Natural Draft Cooling Tower
NSDP	Net State Domestic Product
O&M	Operation & Maintenance
ODA	Official Development Assistance
OEM	Original Equipment Manufacturer
OJT	On the Job Training
PGCIL	Power Grid Corporation of India Limited
PH	Power House
PLF	Plant Load Factor
R&M	Renovation & Modernization
RLA	Remaining Life Assessment
SCCL	Singareni Collieries Company Limited
SLC	Standing Linkage Committee
SPM	Suspended Particulate Matter
TANGEDCO	Tamil Nadu Generation and Distribution Corporation Limited
UMPP	Ultra Mega Power Projects
UPPTCL	Uttar Pradesh Power Transmission Company Limited
UPRVUNL	Uttar Pradesh Rajya Vidyut Utpadan Nigam Limited
WB	The World Bank

PART I

PUMPED STORAGE

PROJECTS

CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 INTRODUCTION

1.1.1 Purpose of Study

India still has been under the shortage of electric power supply, although at present it seems relaxed in several states reflecting the current stagnant global economies. Thus this relaxation shall not be understood as the substantial coming result of the elaborate power supply enhancement but on the contrary it is prudent to consider India still remains under the keen pressure to develop various power generation capacities to satisfy the ever rising power demands in the middle-long run. Numerous problems are still piling up. It gets insufficient to only develop base load power generations and peaking power facilities have been weighing values. Grid systems need to be enhanced meeting the growing intra- & inter-transmission needs. Flexible and more responsive functions must be installed into power trading market system, and financial restructuring of DISCOMs is utmost important. Above all the present BJP central Modi's government has made a drastic Variable Renewable Energy (VRE) Policy introducing a very large scale renewable power generation including solar power (100GW) as well as wind power (60GW) and has initiated applying and amending corresponding power acts, tariff regulations, etc. including the re-valuations of ancillary functions to balance power and stabilize grids meeting the rapid introduction of VREs.

Hydropower has long been put importance to be developed by the central government having its huge potential, its natural resource origin, capability as effective balancing power, etc. The peculiar factors in hydropower (potential impacts to natural environment, geological surprises, long term recovery, etc.) have hindered its development. However, Pumped Storage Power plant has comparably limited modification area in light of sizable installed capacity, and it is one of the reasons PSPs are expected to be enhanced. Pumped Storage Power Generation (PSP) is well known for its peaking power supply functions, grid stabilizing capability, values for power storage, spinning reserve, etc. but yet it had been regarded costly power to develop at first hand. In order to get consensus for its fair value evaluations of its "balancing power" in middle to long time range, it is considered that the regulations' revisions and state DISCOMs finances' recoveries are important. But above all each state government policy ie., state's power strategy and its judgments on PSP values (willingness in development) are most important as state power policy is the constitutionally protected state right. Not until recently, it was not so frequent for particular states to express their state firm decision to develop PSP. It is rare like West Bengal in doing so which successfully operates Purulia PSP for years.

The most recently, CEA has just released the latest "Draft National Electricity Plan"¹ on December 2016. In the plan, CEA strongly appeals the importance of PSPs, emphasizing Hydroelectric Power generation including PSPs can provide adequate peaking reserves, reliable grid operation and integration of variable renewable energy sources.

¹ Draft National Electricity Plan was submitted by CEA on December 2016. It has been collecting public comments during January 2017.

In the past there were issues that a) all peak powers (not only PSP) were not put fair valuation in the power market and they were not in the view of power regulations, that b) DISCOMs were left alone to suffer financial debt accumulation and they were not given any effective measures against it although EA2003 had been revised with renewals of tariff regulations, Unscheduled Interchange (UI) and other regulatory enforcements, and that c) DISCOMs were forced inevitably behave in ways in incompliant with their power purchase obligation as it only deteriorates its finances. Also d) Ancillary service was not yet properly implemented in the CERC system, and which has been unfavorable for PSPs.

Those issues now are under scope of re-evaluation and revision by BJP government. Not all effects have been demonstrated yet. Each movement needs to be carefully monitored and verified. This is one of the motives the Study was proposed.

1.1.2 Scope of Study

The scope of this study is to collect and verify data on the Indian power sector aiming at: to help developing PSP projects of affluent potentials in many states for peaking power, balancing power, etc., and also to promote Ultra Super Critical (USC) coal-fired power projects in India which the central government claims to develop further as the main base power generations of high efficiency.

In order to assist JICA forward the ODA strategy on PSPs in India, the JICA Study Team plans to collect/analyze/update the relevant data on Indian power sector and PSPs. Based on the outcome the Team will select/list up promising PSP projects on promising states and conduct preliminary level project evaluation based on the acquired information. The Team already is aware of the PSPs potential sites in India prepared by CEA (attached later. Note: that is originally by Central Board of Irrigation & Power, 1985) and the Team has concluded that it has limited value as it is old and many new PSP sites have been recognized ever since. So the Team plans to widely excavate and screen PSP candidates with fresh interviews on the state governments/agencies.

Likewise the Team will conduct screening USC sites in India from wide range information collected, and prepare promising site list.

For effective evaluation and screening of the potentiality of projects, the team will review power supply & demand update, power generation plans etc. as well on both the whole India and those states such candidate projects are located. The work also includes the environmental & social considerations, competency of nodal state agency on project development & on project administration, the current state fiscal conditions, etc. The list of most promising sites both for PSPs and UCSs will be prepared in the final stage.

The wide range previous study reports is reviewed during the study covering : 1) Data Collection Survey on Pumped Storage Hydropower Development in Maharashtra State, India, JICA, 2012, 2) Study on Renovation & Modernization/Complete Replacement of Old Coal based Thermal Power Stations in India, JICA, 2012, 3) Research on current Heavy industries in India (assumed title), METI, 2013, 4) Coal production, consumption and import trend in India and its impact on global coal trading

market (assumed title), JOGMEC, 2016, 5) Replacement of Old & Inefficient Sub-Critical Units by Supper Critical Units/Retirement/Renovation, CEA, 2015. The screening work may include additions of new candidate sites when and if required.

The Team compares multiple candidate sites from technical, economical, and environmental & social aspects and compiles the result in the report.

At the start of the Study, the 6 states nominated in the JICA bidding documents had been anticipated as the promising states for PSPs and USC.

- (1) Maharashtra (MS)
- (2) Karnataka (KN)
- (3) Kerala (KR)
- (4) Tamil Nadu (TN)
- (5) Uttar Pradesh (UP)
- (6) Telangana (TS)

As for PSP Study, the Study Team finds practically no candidate sites for PSP in state of Uttar Pradesh (UP) and some sites in Odisha (OD) and West Bengal (WB). Thereby, The Team commences the study in 6-1+2 =7 states for PSPs namely, Maharashtra (MS), Odisha (OD), Telangana (TS), Karnataka (KN), Kerala (KR), Tamil Nadu (TN) and West Bengal (WB).

As for USC Study, the Study Team, after the preliminary study, commences the study for the selected 15 sites in the states of Maharashtra (MS), Tamil Nadu (TN), Madhya Pradesh (MP), Uttar Pradesh (UP), Rajasthan (RJ) and West Bengal (WB).

1.2 STUDY SCHEDULE AND STUDY ITEMS

1.2.1 Study Schedule

The overall work schedule is shown in the following flow chart:

Table 1.2.1-1 Data Collection Survey on Power Sector and Pumped Projects in India

Month Series		1	2	3	4	5	6	7	8	9			
		Fy 2015			Fy 2016								
Month		3	4	5	6	7	8	9	10	11			
JICA Study Team	Pumped Storage Team	Work in JAPAN	1ST WORK PERIOD IN JAPAN 1) Data Collection, Analysis, Set up Method of Survey 2) Preparation of Inception Report 3) Preparation of Subcontracted Work		2ND WORK PERIOD IN JAPAN 1) Organize Collectrd Data 2) Planning 2nd Work in India			3RD WORK PERIOD IN JAPAN 1) Organize Collectrd Data 2) Study on Possibility of PSP Development 3) Planning 3rd Work in India		4TH WORK PERIOD IN JAPAN 1) Study and Analysis of Promising States of Projects 2) Preparation of Interim Report	5TH WORK PERIOD IN JAPAN 1) Organize & Conclude of Implementation issues 2) Preparation of Final Report		
		Work in INDIA	1ST WORK PERIOD IN INDIA 1) Explanation of Inception Report 2) Data Collection from Organizations in Delhi 3) Place Order of Subcontract (Basic Data Collection, 1st screening PSP)		2ND WORK PERIOD IN INDIA 1) Report to JICA INDIA 2) Data Collection from States & Central Government 3) Study on Possibility of Pumped Storage Power Development 4) Confirmation of Progress of Sub Contracted Survey			3RD WORK PERIOD IN INDIA 1) Data Collection from States & Central Government and Analysis 2) Study on Possibility of PSP Development 3) Inspection of Sub Contracted Study (Power Sector Survey and Candidate of PSP)		4TH WORK PERIOD IN INDIA 1) Report to JICA INDIA 2) Data Collection & Analysis of Most Promising Projects			
		Sub Contracted Survey (Power Sector Survey, 1st Screening of PSP)											
		Management of Sub Contracted Survey											
		Implementation											
	Coal Fired Team	Work in JAPAN	1ST WORK PERIOD IN JAPAN 1) Data Collection, Analysis, Set-up Method of Survey 2) Preparation of Inception Report	2ND WORK PERIOD IN JAPAN 1) Organize Collected Data 2) Planning 2nd Work in India		3RD WORK PERIOD IN JAPAN 1) Organize Collectrd Data 2) Study on Possibility of Coal Fired Power Development 3) Planning 3rd Work in India			4TH WORK PERIOD IN JAPAN 1) Study and Selection of Promising States of Projects 2) Preparation of Interim Report		5TH WORK PERIOD IN JAPAN 1) Organize & Conclude of Implementation Issues 2) Preparation of Final Report		
		Work in INDIA	1ST WORK PERIOD IN INDIA 1) Explanation of Inception Report 2) Data Collection & Analysis of Thermal Projects (Group A)	2ND WORK PERIOD IN INDIA 1) Data Collection & Analysis of Thermal Projects (Group B)		3RD WORK PERIOD IN INDIA 1) Data Collection & Analysis of Thermal Projects (Group C)			4TH WORK PERIOD IN INDIA 1) Data Collection & Analysis of Promising Projects				
		Reports	Inception Report								Interim Report		Final Report
		Meeting	Explanation of Inception Report			Report to JICA	Report to JICA INDIA		Report to JICA INDIA		Report to JICA INDIA		
		Team Leader / Power Development Planning	■	■		■	■		■	■		■	
Power Policy / Institution	■	■	■	■	■	■	■	■	■	■			
Financial Analysis	■	■	■	■	■	■	■	■	■	■			
Pumped Storage Power Planning	■	■	■	■	■	■	■	■	■	■			
Coal Fired Thermal Power Planning A	■	■	■	■	■	■	■	■	■	■			
Coal Fired Thermal Power Planning B	■	■	■	■	■	■	■	■	■	■			
Coal Fired Thermal Power Planning C	■	■	■	■	■	■	■	■	■	■			
Environmental & Social Consideration/Coordinator	■	■	■	■	■	■	■	■	■	■			
Power Market Survey/Analysis	■	■	■	■	■	■	■	■	■	■			
Month Series	1	2	3	4	5	6	7	8	9				
Month	Fy 2015			Fy 2016									
	3	4	5	6	7	8	9	10	11				

■ Work in JAPAN
■ Work in INDIA

1.2.2 Scope of Studies in Each Stage

The Study aims to: collect and examine the relevant basic data/information on Indian power sector, select the promising candidate states and sites for PSPs development, and prepare the PSP candidate list which Japanese ODA Loan is applicable using Japanese industries' and consultants' home fields of expertise desirably (for example, Adjustable Speed Pumped Storage Power System). The necessary tasks for the Project Formation Study in the next stage will be filled out for (some) most promising site(s) with concise project features.

The PSP study composes 3 stages of works.

Stage 1 Basic Data Collection & 1st Stage Screening

It is aimed to:

- Collect and analyze wide range of update data/information on Indian (central) power sector
- Collect and analyze wide range of update data/information on targeted States power sectors
- Review and screen (1st stage screening) the potential PSP candidate projects
- Find out undiscovered additional PSP projects (when required)

In this stage the Team plans to utilize the subcontract work. The Team will control and monitor the progress in due course of the Study. Along with the progresses, the JICA Team will make visits and interviews on each selected state agencies/government accompanying the subcontractor, and make the Team's own evaluation.

Stage 2 2nd Stage Screening – Further Screening for Promising Sites

In this stage, it is aimed to:

- Eliminate candidates which are judged un-exploitable (ie. behind other projects).
- Extract promising sites from technical, economical, and social environmental aspects.
- Conduct further state visits on candidate state agencies/governments for detailed necessary information and make evaluations on feasibility of each state/site for PSP development.

Stage 3 3rd Stage Screening - Selection of the most Promising Site(s) and Examination on the Candidate Development Site

It is aimed at:

- Select some (1-2) most promising states and project sites for PSP development.
- Evaluate the possibility of Project Formation using ODA Loan by detail consultations, discussions and interviews with corresponding state agencies/governments.
- Evaluate and compile requisite conditions for project development.

➤ Relevant agencies in considerations to visit:

In this Study there is no firm assigned counterpart. It is intended to make surveys and interviews from various governmental agencies. However, JICA already informed MOP about the initiation of the Study.

It is envisaged to cover the below agencies/governmental offices.

1. Central Government and related agencies

MOP, CEA, CERC, PFC, NLDC, PGCIL, IEX, etc.

Private companies (PTC, Infra research, etc.)

Social & Environmental agencies ; MOEFCC , DoLR (The Department of Land Resources), Ministry of Rural Development, The Ministry of Tribal Affairs, Department of Culture, Ministry of Tourism and Culture, etc.

2. States and state related agencies

RERC, RLDC, GENCO, TRANSCO, DISCOM, SERC, SLDC, etc.

Relevant provisions of MOEFCC,

State Level Expert Appraisal Committee: SEAC,

State Level Environmental Impact Assessment Authority: SEIAA (note: this is a case for MS state but similar functions for other states)

Revenue Administration (note: this is a case for MS state but similar functions for other states)

Tribal Research & Training Institute, Tribal Development Department Government of Maharashtra (note: this is a case for MS state but similar functions for other states)

Candidate state organizations of the environmental and social survey are Tribal Development Department, Forest Department, and Wildlife Department.

1.2.3 Study Details in Each Stage

Stage 1 Basic Data Collection & 1st Stage Screening of Potential PSPs

(1) 1st Work Period in Japan (Preparatory work in Japan)

1) Data collection in Japan & strategy building

Collect materials, information, literature, etc. available in Japan and collect data/information from research agencies when necessary. The Study Team will study fundamental objective of the works in India, actual methods of the research and plan for the skeleton of the report.

Following items will be taken into consideration and reflected into the Study. If collected materials etc. are not sufficient supplemental collection will be conducted during the First Work in India.

- Central Government level political strategies, financial status, energy policies, electric

power policies, climate change policies and other related policies and strategies

- Outline and financial of Power Sector related Central Government agencies, companies, institutes etc., Policies and Outline of Power Market (Demand & Supply, Current Power Plants, Power Development Plan, Interstate power grid, power losses, tariff, power exchange, etc.)
- Political, financial, and energy & power sector's current status and prospects of each State (State policies/regulations, Power demand & supply, Current Power Plants, Power Development Plan, power grid, power losses, tariff, power exchange, etc.)
- DISCOM's status (finances, restructuring program & prospects) of each State
- PSP plans, sites (existing, enhancement & renewal plans, fresh projects) of each State
- Renewables (status, state policies and prospects, etc.) of each State
- Status of Private Companies involved in the Power Sector (Japanese and Foreign),
- Status and policies of other aid providing agencies

Apart from the above, following items shall be added.

- Selection of the State and region of the Study with its justification
 - Finding possible Japanese Technology applicable to Power Projects in India
 - Operation results of PSPs at each State, especially the development status of PSPs in prospective States.
- 2) Preparation of Inception report for JICA
 - 3) Preparation for Sub-Contract Tendering
 - Conclude TOR for sub-contracting to local consultant

(2) 1st Work Period in India

- 1) Inception report submission & presentation to JICA India Office
- 2) Data/information collection and analysis of Central Government Agencies and Private Companies

The Study Team shall conduct Interview and data collection from central governmental agencies (CEA, CERC, PGCIL, PTC, IEX, other power industry related agencies) based on acquired information and queries compiled during preparatory works.

- Central Government level policies (Electric Act (proposed to be amended), land act (ditto), energy related regulations, tariff policies)
- Central Government level Power development policies (including Renewables),
- Central Government level PSP policies,
- Current status and plan for introduction of Ancillary Services concept and monetization,

- Current status and plan for studies and application of Grid stabilization measures
- Current status of Japanese power related companies in India and future plans
- Other Power sector related issues

(Priority for interviews shall be given to type of information/items which are necessary and difficult to obtain without conducting actual interviews. These information includes; “Positions”, “Interpretation”, “Prospective” and “Estimates”. Information/items which are available “open source” shall be omitted from the interview.)

3) Contract awarding for Information collection and Primary screening of pumped storage project (Sub-Contract)

In this Study, collecting wide range of local information is necessary.

For smooth collection of information from Governmental agencies and local private companies, we propose to sub-contract primary stage research to local consultant.

The outlines of sub-contracting work are as follow:

- i) Basic information collection of the Power Sector (Central and State level)
- ii) Primary screening of PSP projects
- iii) Support and arrangements of Visits to India by the Study Team

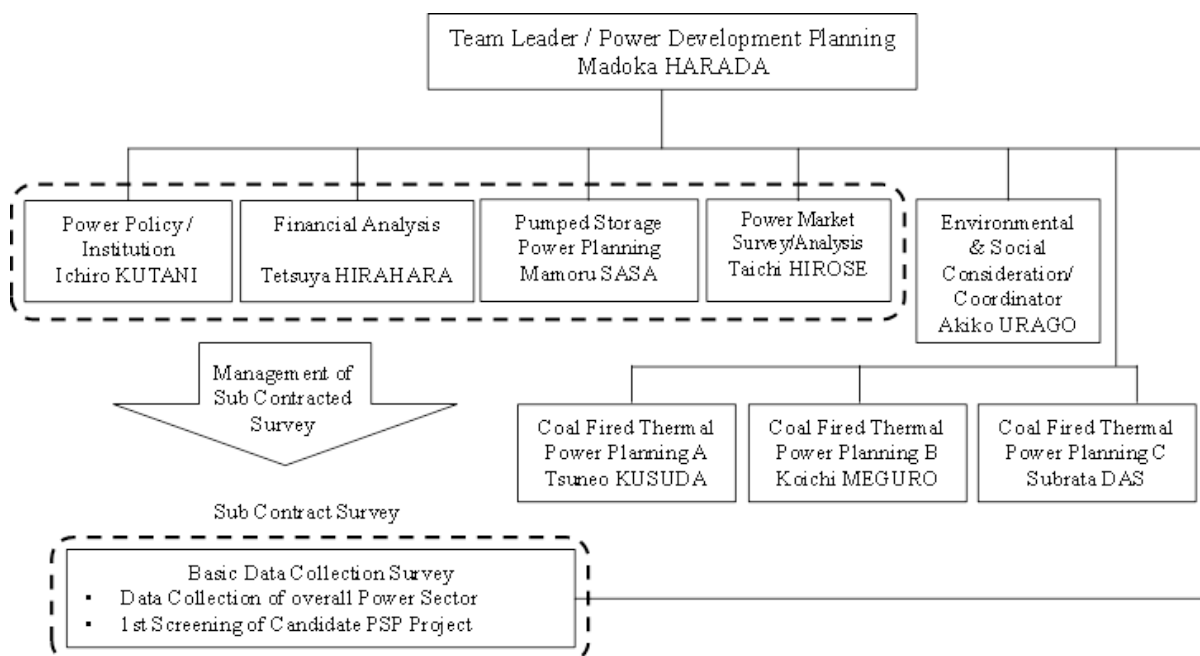
The reasons for necessity of sub-contracting are as follow:

- a) The intended research area for the power sector exists vastly. Therefore, it is necessary to have sufficient length of days to conduct the collection of information. If a Study Team member directly involves in this information collection, majority of his work will be consumed and he will not be possible to conduct the analysis and screening effectively.
- b) There exists much information of candidate sites of PSP. Some information is outdated, inaccurate or prospects. In order to conduct smooth and effective evaluation of candidate sites, it is preferable to conduct the confirmation of basic data and its authenticity before handling by the Study Team. To conduct this confirmation work, local consultants shall make visits to the prospective states.
- c) When the Study Team conducts the second visits stage to India for visiting prospective states, the team may not have the information about the states or candidate projects. If a local consultants conducts preliminary visits to the prospective states for the above work a) and b) beforehand, the Study Team will be possible to conduct the visit much more smoothly.

The selection and contracting of sub-contractor shall be governed by the guideline provided by JICA.

The content of the above mentioned work are not related to each other and if they are sub-contracted comprehensively, the duration of the work may become too long. Considering these factors, the work each shall be sub-contracted separately.

The sub-contracted works shall be governed and inspected for acceptance by the Study Team members as follow: The member shall check the progress status upon each visit to India. In addition to this, for surveillance during the period when the member is absent from India, the Study Team shall hire a consultant to monitor and survey the progress of the sub-contractors.



The Study Team currently estimates that the items to be collected are as follow: (Refer to TOR for sub-contracting to Local Consultant Clause 1. and 2.) the Study Team will consider and investigate these items, but concerning fields are vast, accuracy of the information/data is unknown, and there is no guarantee of obtaining smooth cooperation from the concerned parties yet. The Study Team will make best efforts to obtain these information/data through various investigation opportunities, but the Study Team may be forced to drop some of them in case if they were not available through sub-contracted Local Consultants nor through direct visits to concerning agencies by the Study Team.

We think that there are some information/data that are already “open source” which are easily available to the Study Team, while some may require very long time to obtain even by a local consultant. Also, the government policy of India shifts from time to time and is not entrenched.

As explain above, in order to maximize the data collection, we believe the most effective method is to precede some of the work by sub-contracting and closely adjust together during each steps.

Here we present draft TOR of sub-contract as below. Actual items and field to collect has been configured by the Study Team at 1st Work in India based on data collection and analysis during the preparatory works

TOR for Sub-contracting to Local Consultant

1. Basic Data Collection of Power Sector in India (Central Government and State Level)

Collecting Data and Information related to future of the Power Sector (These should be sorted by “Current status”, “Past trends”, “Plan” and “Future Estimate”)

Data shall basically be sorted separately into a) those related to Central government, and b) those related to each State level having potential PSPs.

We are aware that most of the targeted data/information can be collected from “open source” materials including publicly available websites, or can be subscribed from various sources (such as Infra Research). Upon collecting these data/information, local consultant is requested to investigate with efforts of his own and shall not, from the beginning, take easy compromise to interview Central government or local states for the intrinsically “openly available” data/information. Those actions will cause displeasures of and will give offense to concerned parties and may prevent their contribution to the whole study.

Outlooks of data/information shall be detailed derived from the collected information and interviews, and in any case those shall be clearly indicated with sources of such outlooks/prospects information.

In principle any subjective outlook/prospect formed by local consultant shall not be included.

“Outlooks/prospects” of data/information shall interview all concerning parties.

Local consultant shall refrain from contacting those potential stakeholders who may affect the project development, including local residence people, NPO, etc.

TOR for Sub-contracting to Local Consultant

1. Central government issues

- General

- Economic policy

- Economic growth, GDP (present, past performance, outlook)

- Energy (Power) policy

- Climate change policy (national action plan on climate change)

- Renewables

- Variable renewable energy (VRE) policy (current deployment policies of Central government)

- Regulations

- Electricity Act (EA) reform (objectives, details, effect, ex; 1) OA charge exemption for VRE, 2) VRE obligation on thermal, 3) stricter RPO, 4) ancillary services, etc.)

- Land Acquisition, Rehabilitation and Resettlement Act (LARR) reform (objectives, details, effect)

Tariff Policy

National Tariff Policy reform (objectives, details, effect)

CERC regulations reforms (objectives, details, effect)

Tariff regulations reform (objectives, details, effects for hydro, thermal, VRE, PSP tariffs)

Ancillary services regulation (changes of gov. stance for ancillary values)

Valuation of capacity market

Demand & supply

Power demand & supply performance, provision (all India, grid wise- esp. forecast assessment of W & E region gap/surplus)

Power generation

Power generation development plan (nation policy for nuclear, coal thermal, VRE, PSP, etc., diversification policy)

Power generation planning to meet rapid grid VRE enhancement (as balancing powers, system reserves)

Pumped Storage Hydro Power Plant (PSP) policy

Valuation of PSP (Central gov.'s wills to proceed PSP)

Grid operation

System operation performance

Frequency control standard

Power system planning (budget & actual performance)

PGCIL performance (operation, finance, reforms ex; privatization, trading & distribution business, PGCIL "green energy corridors" performance & forecast)

Independent transmission businesses

System planning & transmission improvement to meet rapid grid VRE enhancement

Power loss (AT&C loss), improvement policy, measures, outlook

Power market

Power trading market schemes (ex; DAM etc), performance (volume & price)

Power market reforms to meet VRE growth (objectives, details, forecast, ex; trading hours extension etc)

Forecast of power market

- Others

Key issues/obstacles which may have serious influence on PSP or hydro promotions both of quality and quantity as specified by Central government level

2. State government issues for PSPs potential states

- General

Political situations (Ruling party(ies), political & social stabilities, cooperativeness

with/or/its political exclusiveness from Central gov, prospection upcoming election outcome)

Economic policy

Economic growth, GSDP (present, past performance, outlook)

Financial situations (State Fiscal Deficit to date, FRBM (Fiscal Responsibility and Budget Management)

Debt Sustainability Clearance from Dept. of Expenditure, GOI for external borrowings of the State. (this limit binds the ODA applicability of state project. This is not openly available)

State (own) energy policy (apart from Central gov.)

- Power sector general

Power sector structures, sector reform updates

Private investor participation (incentives, present status, forecast)

- Renewables

State (own) variable renewable energy (VRE) policy (current deployment policies, forecast, target), incentives for VRE

Present status of VRE (solar, wind (MW)) & plans (movement of private investors participation)

RPO target (basis/reasons of target, actual achievement, forecast, state gov's compliance, penalties / incentives)

FIT regulation of VRE

VRE actual performances (lower PLF from system operation etc)

- Regulations

State (own) Land Acquisition policy, situations (state own predicaments for land issues)

SERC regulations reforms (objectives, details, effect)

State (own) Tariff Policy reforms (objectives, details, effect)

Tariff regulations (Average solar tariff, wind tariff, hydro tariff, coal thermal tariff etc.)

Tariff regulations reform by state (reasons of reforms & effects for hydro, thermal, VRE, PSP tariffs)

Ancillary services regulation (state gov. stance for ancillary valuation)

- Demand & supply

State power demand & supply performance & provision (state wise, region wise)

Demand characteristics, daily load curve, daily load factor (present, past, forecast), foreseen sharpening of peak loads

Demand supply gap & present measures taken to meet gaps (long term PPA, spot market, IPP power purchase, outage), resulting financial imbalance

Inter-state power procurement (volume & price) (present, forecast)

Open access (regulations, state assurance or hindrance of OA, payment security from users, forecast)

- Power generation
 - Power generation structures (hydro, thermal, etc) (state, private, etc)
 - Average Cost of generation & average tariff recovered (cost gap)
 - Financial performance of GENCO (ex; profit deterioration of coal thermal power)
 - GENCO's perspective on power supply scenario
 - Power generation development plan (state policy for coal thermal, VRE, PSP, etc., diversification policy), future forecast
 - Peaking power development (State gov. policy, present measures & forecast, ex; hydro, gas, PSP, thermal, procurement)
 - Power generation planning to meet rapid grid VRE enhancement (as balancing power & system reserves etc)
 - Present generation reserves utilized for meeting VRE generation
- PSP policy
 - State's valuation of PSP (state gov.'s wills to proceed PSP)
- Grid operation
 - Present transmission network
 - Financial performance of TRANSCO (revenue/deficit growth, revenue security of transmission charges)
 - System operation performance (stability control, congestion management)
 - Frequency control standard
 - Power system planning (budget & actual performance)
 - Independent transmission businesses
 - Present system operation to control grid frequency/voltage under VRE installation increase, actual fluctuations features, measures currently taken(ex; variant thermal for balance, procure Time of Day market, restrict VRE power, plan outage, etc) , resulting financial balance
 - Future System planning & transmission improvement to meet rapid grid VRE enhancement (control power with grid under large VRE), state gov. policy on this
 - Power loss (AT&C loss), improvement policy & outlook, state gov.
- Distribution
 - DISCOM structures (state, private,)
 - Financial performance of state DISCOMs, independent DISCOMs
 - Power procurement sources, their purchase rate levels & volume (market, long term PPA, UI etc)
 - DISCOM restructuring (UDAY) (state gov. commitment, wills to comply, forecast of success)
 - Gap between Power purchase cost & tariff, the reasons for discrepancy, Rationalization of tariff revision (hike) & forecast of tariff reforms, state commitment for resolution

State subsidy, state's policy (present, prospect)

- Power market

Utilization of Power trading market, performance (volume & price) by GENCO, DISCOM
Future forecast of power market utilization/growth by state GENCO, DISCOM

- Others

Key state regulations on environmental & social issues which may have serious influence on PSP or hydro promotions both of quality and quantity as specified by state government level
Key issues/obstacles which may have serious influence on PSP or hydro promotions both of quality and quantity as specified by Central government level

2. Primary Screening of Pumped Storage Project

Survey to find out viable pumped storage projects is executed to target the following seven states on the basis of JICA's TOR, discussion with JICA and our prior information:

- (1) Maharashtra (MS)
- (2) Karnataka (KN)
- (3) Tamil Nadu (TN)
- (4) Kerala (KR)
- (5) Telangana (TS)
- (6) Odisha (OD)
- (7) West Bengal (WB)

At the commencement of the Study, the site name of each pumped storage projects in the above states and their development stages is summarized in the following table.

Table 1.2.3-1 Potential Pumped Storage Projects in India gathered by JICA Study Team

(update on the basis of project list shown in the page 2-15 of the proposal)

No.	State	Region	Name of Project	Developer	Installed Capacity (MW)	Stage	Notes
1	Maharashtra	Western	Panshet	GOMWRD	1,400	DPR	Regarded as hopeful in JICA Survey in 2012.
			Warasgaon	GOMWRD	1,000	DPR	Ditto
			Varandah Ghat	GOMWRD	1,100	DPR	Ditto
			Nandgaon	GOMWRD	500	Unknown	Rejected in JICA Survey due to Reserved Forest.
			Kodali	GOMWRD	220	S & I / DPR	
			Humarli	THDC & NPCIL	400	S & I	Permission for S&I from MoEF is obtained recently according to CEA's information in October 2015.
			Malshej Ghat	THDC & NPCIL	700	DPR (prepared)	Implementation agreement hasn't yet been signed with State Govt. according to CEA's information in October 2015.
Except the above, considerable projects are identified according to list made by Central Board of Irrigation & Power in October 2015.							
2	Karnataka	Southern	Kali	KPCL	600	S & I	Most of area newly required for the project seems to exist in Kali Reserved Forest.
			Sharavathy	KPCL	800 (or 450)	S & I	Two existing reservoirs are used for the upper and the lower reservoirs.
			Varahi	KPCL	700	S & I	The existing reservoir is used for the upper reservoir.
			Mekadatu	Unknown	400 ???	???	Interstate issue against Tamil Nadu is outstanding.
			Except the above, several uncertain IPPs projects seems to be planned.				
3	Tamil Nadu	Southern	Kundha	TANGEDCO	500	DPR	Held up due to non-resolution of inter-state aspects according to information as of October 2015. And, the DPR is also returned due to the same reason.
			Mettur	TANGEDCO	500	Preliminary Stage as of 2011	Listed in "System Operation Report" by Southern Regional Load Dispatch Center
			Sillahara	TANGEDCO	2,000	Unknown (DPR stage ?)	Listed in the annexure of Minutes of the 49th Meeting of the forum of Regulators (Head)
			Vellimalai	???	200	Preliminary Stage as of 2011	Listed in "System Operation Report" by Southern Regional Load Dispatch Center
4	Kerala	Southern	Sholayar I	KSEB	810	Identified	Not advanced due to no Forest Clearance according to CEA's information in October 2015.
			Sholayar II	KSEB	390	Identified	Ditto
			Pringalkuthu	KSEB	80	Identified	Ditto
			Except the above, some uncertain projects using the existing reservoirs seem to be planned.				
5	Telanga	Southern	???	???	???	???	According to unofficial information on the web, Icchamally project seems to be envisaged being equipped pumped storage scheme.
6	Odisha	Eastern	Upper Indravati	OHPC	600	Unknown (DPR stage ?)	
7	West Bengal	Eastern	Turga	WBSEDCL	1,000	DPR	DPR is being reviewed by the central government.
			Bandhu (Bandu)	WBSEDCL	900	S & I (PFR completed)	
			Kathlajal	WBSEDCL	---	Identified	
			Kulbera	WBSEDCL	---	Identified	

In addition to the above, the survey is also executed using the following list of pumped storage projects in all India revised "India PSP potential site" shown in the page 2-16 of the proposal in the first domestic survey by JICA Study Team, which is made by Central Board of Irrigation & Power in October 2015 on the basis of project list originally organized by CEA in 1987. However, JICA Study Team regards the project list as unreliable since the original list has been organized on the basis of old information.

In the case that a potential pumped storage project is newly found out in a state unlisted in the Table, such state was added to the targeted state in addition to the above seven states after discussion with JICA. States to be focused on in the survey are revised as needed.

Table 1.2.3-2 Potential Pumped Storage Projects in India made on the basis of Project List prepared by Central Board of Irrigation & Power in October 2015

(revised the table in the page 2-16 of the proposal)

Region	State	Project Name	Head (m)	Probable Installed Capacity (MW)	Total in State-wise (MW)	Notes	
Northern	JAMMU & KASHMIR	Matlimarg	520	1,650	1,650		
	HIMACHAL PRADESH	Majra	221	1,800	3,600		
		Renuka	315	1,800			
	UTTAR PRADESH	Jaspalgarh	190	1,935	1,935		
	RAJASTHAN	Badrinagar	164	1,980	3,780		
		Barah	214	1,800			
	UTTARAKHAND	Tehri	347	2,100	2,100	Under Construction.	
	Total			13,065			
Southern	TELENGANA	Nagarjuna Sagar	95	700	700	Existing, but pumping doesn't work according to information by CEA in October 2015.	
	ANDHRA PRADESH	Tigaluru	246	1,650	1,650		
	KARNATAKA	Kollur	524	900	7,900		
		Minhole	507	2,200			
		Sitanadi	554	2,600			
	KERALA	Hulagi	293	2,200			
		Kuttiyadi	645	2,400	4,400		
	TAMIL NADU	Edamalyar	254	2,000			
		Kadamparai	377	400	3,100	Operational.	
		Nallar	590	2,700			
	Total			17,750			
Eastern	BIHAR	Lungupahar	363	2,800	2,800		
	ODISHA	Jharlama	263	2,500	2,500		
	WEST BENGAL	Boro	97	500	3,825		
		Kulbera	154	1,110		Identified	
		Bandhu	213	1,575		S & I Stage	
		Panchet Hill	427	600		Existing at the border between West Bengal and Jharkhand states. Pumping of either doesn't work according to information by Central Board of Irrigation & Power in October 2015.	
		Panchet	25	40			
	Total			9,125			
Northeastern	MANIPUR	Tuivai	138	2,100	4,350		
		Hengtam	168	2,250			
	ASSAM	Khuai Lui	187	2,100	2,100		
	MIZORAM	Lieva Lui	515	2,100	10,450		
		Pakwa	500	1,000			
		Tuihho Lui	530	1,050			
		Mat	308	1,400			
		Tuiphai Lui	643	1,650			
		Nghasih	318	1,250			
		Daizo Lui	1,070	2,000			
	Total			16,900			
Western	MADHYA PRADESH	Mara	205	1,100	11,150		
		Binauda	290	2,250			
		Dangari	341	1,500			
		Rauni	260	2,500			
		Kabra	182	1,200			
		Tanbia	223	1,600			
		Suini	322	1,000			
	MAHARASHTRA	Ulhas	584	1,000	27,094	Rejected in JICA Survey (due to Reserved Forest)	
		Pinjal	125	700		Rejected in JICA Survey (due to Reserved Forest)	
		Kengadi	225	1,550		Rejected in JICA Survey (due to Reserved Forest)	
		Jalong	598	2,400		Rejected in JICA Survey (due to Reserved Forest)	
		Kolmondapada	481	800		Rejected in JICA Survey (due to Reserved Forest)	
		Kahu	398	1,150		Rejected in JICA Survey (due to Reserved Forest)	
		Sidgarh	648	1,500		Rejected in JICA Survey (due to Reserved Forest)	
		Amba	495	2,500		Rejected in JICA Survey (due to Reserved Forest)	
		Chornai	452	2,000		Rejected in JICA Survey (due to Reserved Forest)	
		Savitri	1,065	2,250		Rejected in JICA Survey (due to Reserved Forest)	
		Madliwadi (Madhaliwadi)	512	900		Rejected in JICA Survey (due to Reserved Forest, Wildlife Sanctuary & IBA)	
		Baitarni (Vaitarni)	449	1,800		Rejected in JICA Survey (due to Reserved Forest, Wildlife Sanctuary & IBA)	
		Morawadi	407	2,320		Rejected in JICA Survey (due to Accessibility, Wildlife Sanctuary & IBA)	
		Gadgadi	541	600		Rejected in JICA Survey (due to Reserved Forest & Wildlife Sanctuary)	
		Kundi	537	600		Rejected in JICA Survey (due to Wildlife Sanctuary)	
		Aruna	465	1,950		Rejected in JICA Survey (due to Reserved Forest)	
		Kharari	675	1,050		Rejected in JICA Survey (due to Reserved Forest)	
		Jalvara (Jalware)	555	2,000		Rejected in JICA Survey (due to Reserved Forest)	
		Paithan	28	12		Operational.	
			Ujani	31	12		Operational.
		GUJARAT	Kadana	44	240	1,440	Existing, but pumping doesn't work according to information by CEA in October 2015.
			Sardar Sarovar	100	1,200		Existing, but pumping doesn't work according to information by CEA in October 2015.
			Total			39,684	
	GRAND TOTAL					96,524	

Viable pumped storage projects are selected in light of the following:

- A project is hopeful to set up as yen-denominated government credits;
- A project site is positioned in an area where Japanese company has advantage in comparison foreign company;
- Electric power supply in the targeted state is improved owing to a project;
- State isn't negative against foreign debt.

Before starting the primary screening, information on each pumped storage project as below is to be updated in the service to be outsourced in India, and the updated information is to be organized, too.

- (a) To confirm the current status of pumped storage projects shown in the above Tables (Cancellation of Project, Site Identification, Survey & Investigation, Pre-Feasibility Stage, DPR Stage, Under Construction or Completed);
- (b) To discover pumped storage projects unlisted in the above attachments and to confirm the current status in a similar manner as above;
- (c) To obtain information on the development plans of the above pumped storage projects through open sources provided by central government (MOP, CEA, CERC, etc.), state governments and agencies (GENCO, DISCOM, SERC), private investors, etc.;
- (d) To grasp which states have motivation to develop pumped storage power station and their development plan of pumped storage power plant;
- (e) To grasp purpose of each potential pumped storage project from state agencies, such as;
 - ✓ Securement of peak power;
 - ✓ Effective use of surplus off-peak power;
 - ✓ Capital gain by price difference between peak power and off-peak power;
 - ✓ Minimization of cost caused by suppression of base load power generation;
 - ✓ Improvement of quality of power (i.e. stabilization of grid);
 - ✓ Mitigation of variation of variable renewable energy.
- (f) To obtain the following particular information of each potential pumped storage project;
 - ✓ Site location (map, general layout, etc.);
 - ✓ Year to be programmed to be commissioned;
 - ✓ Technical Information such as;
 - Installed capacity (capacity per unit, number of units);
 - Effective Head;
 - Maximum Discharge for power generation and pumping up;
 - Output duration per day;
 - Height of a dam;

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- Length of a dam's crest;
 - Design flood discharge of a spillway;
 - Full reservoir level, maximum drawdown level and available depth of a upper & a lower reservoirs;
 - Internal diameter of a headrace, a penstock and a tailrace;
 - Thickness of lining or filling concrete of a headrace, a penstock and a tailrace;
 - Length of a headrace, a penstock and a tailrace;
 - Thickness of a steel penstock;
 - Plane area and height of a underground powerhouse;
 - Length of a main access tunnel;
 - Other features such as pure pumped storage or river pumped storage, pumped storage daily regulation or weekly regulation, utilizing the existing reservoir or not, etc.
- ✓ Capacity of transmission line planned to be connected and distance to the transmission line;
 - ✓ Natural environmental conditions such as;
 - Hydrology;
 - Geology
 - Distribution maps and related information of protected area such as national parks, animal sanctuaries, biosphere reserves, Important Bird Areas, reserved and protected forests, etc.;
 - Distribution maps and related information of forest areas required Forest Clearance (i.e. Protected Forest stipulated in Indian Forest Act 1927) ;
 - ✓ Social environmental conditions such as;
 - Land-use map;
 - Length of an newly-constructed access road to a dam or between a dam site and the existing road;
 - Necessity of resettlement (If yes, number of people to be resettled is also collected.);
 - Position of historical site and cultural heritage designated by government or international authority such as UNESCO;
 - Residential area of Indigenous Peoples with independent language and/or culture, etc.);
 - ✓ Logical reason why each pumped storage project is viable and its ground including economic analysis such as cost of power generation, economic efficiency against other power source, etc.

- ✓ Customers to sell electric power;
- ✓ With or without power purchase agreement and the situation of the negotiation;
- ✓ Situation to offer to Discom;
- ✓ Source of finance;
- ✓ Movement of aid agencies such as World Bank, ADB, etc., except JICA;

(g) To obtain other data/ information requested by JICA Study Team;

Site inspection isn't carried out in this stage. However, for execution of the above (d), (e), (f) and (g), interview(s) with the related states' governments or agencies who have plan(s) of potential pumped storage project(s) in their own state once at least in the service to be outsourced in India.

Depending on progress of the projects, several of the above information, especially information stipulated in (f), may not be obtained. In this case, reason not to obtain requested information shall be clarified (for example, the project is just identified, under survey & investigation stage, etc.)

After the above information of each pumped storage project planned in India is collected and/or updated, pumped storage projects are primarily screened in the service to be outsourced in India from the following viewpoints for our further study:

- ✓ Does a project site exist in a reserved forest ?
- ✓ Does a project site exist within ten (10) km from a national park or a sanctuary ?
- ✓ Does a project site exist in an Important Bird Areas ?

In the case of "yes" against the above, such pumped storage projects are eliminated from potential ones in this study since development possibility in consideration of restriction by law, natural and social environments is regarded as more important than economical and technical aspects in this study.

3. Assistance and of Interviews with States possessing Potential Pumped Storage Projects by the Study Team (2nd Field Survey)

- After the primary screening, JICA Study Team visits several states, which are currently expected to be almost six or eight utmost, for interview with states' governments and agencies on the basis of the result of the primary screening and information gathered by JICA Study Team to hear their policy, plan, etc., on pumped storage project;
- Assistance such as making appointments with states' governments and agencies, etc., is carried out by the same company executed the primary screening.

(3) 2nd Work Period in Japan

Data collected will be arranged & analyzed. Upon analysis of the data and grasping progress of the sub-contracted work, schedule and the contents of the 2nd Work Period in India will be reviewed.

(4) 2nd Work Period in India

- 1) Result of review and schedule of the 2nd Work Period in India will be reported to JICA India Office and discussion on the study policy will be made.
- 2) Based on the collected and analyzed information, data collection from the relevant state governments will be made for those states where the formations of pumped storage projects are promising. At the same time, data collection on the pumped storage projects promoted by the central government will be made.

At the Proposal, promising states were considered eight (8): Maharashtra (MS), Karnataka (KN), Tamil Nadu (TN), Uttar Pradesh (UP), Telengana (TEL), Kerala (KR), West Bengal (WB) and Odisha (OD). The target states are subject to change (Note: It has become actually 7 at the commencement of Study as UP was deleted).

Considering the effective implementation of the study, a maximum three states for a visit would be appropriate. Accordingly, the 2nd Work Period in India should be divided into three stages. (The third stage may not be implemented depending on the progress and the study result.) This will enable the Study Team to review the visiting states during each stage, and it is possible to grasp, direct, and supervise the subcontracted work. This is beneficial for close analysis of the information. Subcontractor will accompany the Study Team at the first visit to the state. Items for discussion at each state are mainly assumed as follows. Detailed items for discussion will be prepared beforehand:

- Electric power policy of the state
- Power demand and supply, demand estimate
- Power development plan
- System operation
- Power loss (such as: AT&C loss)
- Electricity tariff and its policy
- Electricity supply cost
- Characteristics of power demand
- Financial condition of the organizations concerned
- Operation of power market and its prospect
- State development policy regarding pumped storage project
- Operation of pumped storage plants
- Investment planning and schedule of pumped storage projects
- Intention of the state (GENCO, TRANSCO, DISCOM, SERC, etc.) to introduce Japanese ODA loan

(5) 2nd Work Period-2 in Japan and (7) 2nd Work Period-3 in Japan

Data collected will be arranged and analyzed. Upon analysis of the data and grasping progress of the sub-contracted work, schedule and the contents of the following Work Period in India will be

reviewed.

(6) 2nd Work Period-2 in India and (8) 2nd Work Period-3 in India

Basically the contents are the same with the 2nd Work Period in India. 2nd-3 Work Period in India will target to visit the states not covered before. Destination for visit may be reviewed depending on the latest information available.

➤ Environmental and Social study on Stage-1

Regarding Environment and Social Study on Stage-1, information and data listed below a. and b. will be gathered in Delhi. Target areas of (3) to (9) of a. are candidate project site including coal fired plant based on literature survey and hearing survey in Delhi. Site visit, survey through consignment (sub-contract work), hearing survey to the state organizations will not be conducted.

a. Basic information survey

1) Procedure of Environmental Impact Assessment

The Study Team will review The Environmental Impact Assessment Notification (2006 and further amendments in Jan 2009, Dec 2009, Apr 2011, and Jan 2012) and confirm the required documents, locations to be submitted, and procedures for the candidate projects.

2) Procedure of resettlement and land acquisition

The Study Team will review Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013, The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Amendment) Bill, 2015, and The Electricity Act, 2003 and confirm the procedure of land acquisition, requirement of Social Impact Assessment, required agreement of the affected people, and compensation rules.

3) Scheduled caste and scheduled tribe

The Study Team will gather list, distribution area, population of the scheduled caste and scheduled tribe in the candidate states based on Scheduled Caste and Scheduled Tribe (Prevention of Atrocities) Act, 1989.

4) Cultural asset and tourism

The Study Team will gather the name, location, and protection level of the cultural assets in the candidate states based on The Ancient Monuments and Archaeological Sites and Remains Rules 1959. The survey team will check the location of the important tourism site based on the Tourist Map Series (On 1:50,000 scale), by Survey of India.

5) Public security

The Study Team will collect the information about the deteriorating security area and the level of the risk. If there are any conflicts histories caused by developments, the Study Team will try to confirm the locations.

6) Habitation area and land use

Habitation areas and land use around the project site will be confirmed based on 1:50,000 Topographical Maps or Open Series Maps (OSM) by Survey of India.

7) Protected areas and forest area

The Study Team will confirm the boundaries of the National parks and Sanctuaries in the target states based on Environment (Protection) Act 1986. In addition to that the boundaries of forest areas defined by Indian Forest Act, 1927 will be obtained by 1:50,000/1:25,000 Topographical Maps/Open Series Maps (OSM) of Survey of India or by Forest Policy Division, Ministry of Environment, Forests and Climate Change. Information of International protected area such as Key Biodiversity Area (KBA), World Heritage, and UNESCO's Man and the Biosphere Programme (MAB) will be gathered.

8) Habitat of Protected Species

The Study Team will acquire habitat and distribution area of the protected species stipulated by The wildlife (Protection) Act 1972 and IUCN red list species, including terrestrial mammals, amphibians, Reptiles, and fishes, in target states.

b. Project related information survey

The Study Team will obtain SEA reports, EIA reports of candidate projects and Environmental and Social monitoring reports of similar projects if any.

Stage 2 2nd stage screening – further screening for promising sites

Based on the result of information obtained in the Stage-1, narrow down of promising states having possible projects will be made.

(7) 3rd Work Period in Japan

Arrangement of collected information will be made. Based on the result of the study, examination on promising states and candidate projects will be made. Examination of the possibility of introducing pumped storage power source will be made from the viewpoints of the central government, state, power sector, site characteristics, etc.

Further preparation for 3rd work in India (visiting place and contents) based on the progress of the subcontracted work will be made.

(8) 3rd Work Period in India

Complementing the result of the past data collection, the second visit will be made to the selected promising states for the purpose of additional data collection for pursuing possibility of development of pumped storage projects. During this visit, result of the subcontracted work will be received after inspection.

➤ Environmental and Social study during Stage- 2

Regarding Environment and Social study during Stage-2, the Study Team will conduct confirmation of candidate projects, scoping, impact prediction and impact assessment.

1) Confirmation of candidate projects

Locations of dam site, boundaries of inundation area, and routes of transmission line will be examined on the map scale 1:50,000 or 1:25,000.

2) Scoping

The Study Team will examine the gathered information and select available items for prediction. Candidate items might be Number of resettlement, Land acquisition area, Affected farm land, Scheduled tribe, Public security area, Impact on cultural asset, Affected protected area, Affected forest area, and affected habitat of protected species. The items which reliability is low or accuracy varies much by location might be excluded.

3) Impact Prediction

Simple impact prediction for all the candidate projects will be conducted by overlaying the project layout and Environmental and Social information. The quantitative prediction will be preferentially selected.

4) Impact Assessment

Based on the result of prediction, relative comparison will be done and arranged in the comparative table.

Stage 3 3rd stage screening – selection of the most promising site(s) and examination on the candidate development site

Based on the result of study for each state up to Stage-2, selection of promising state will be implemented.

(9) 4th Work Period in Japan

1) By analyzing the result of work in India, a long list of candidate pumped storage projects by state, composed of project site, capacity, study level, EIA status, will be prepared, and the most promising state(s) and project(s) will be selected. Number of the most promising projects is assumed to be four: two for pumped storage project, and two for coal-fired thermal power project. The final number depends on the study results.

2) Preparation of Interim Report

Result of the study will be incorporated in Interim Report. It will be discussed with JICA and the comments will be reflected.

(10) 4th Work Period in India

1) Discussion with JICA India

Confirmation and consultation for the final work in India will be made with JICA India Office.

2) Study on the most promising state

The following information will be collected for the most promising projects:

- Rough schedule for development of the project
- Economy of the project
- Progress of environmental approval (especially land acquisition)
- Capacity and applicable technique
- Organization of development, operation and maintenance
- Items to be further studied for project formation

This examination is made to the organizations in the promising state(s), regarding intention for development, intention for using Japanese ODA loan. Confirmation is also made for the support for implementation for Japanese ODA, estimated project plan & schedule, development scale, implementation organization, etc.

➤ Environmental and social study during Stage-3

Environmental and social study during Stage-3, the Study Team will suggest mitigations in FS, consideration in preparing EIA, Resettlement Action Plan (RAP), and Indigenous Peoples Plan (IPP) for the selected candidate projects based on the assessed impact.

1) Mitigation suggestions in FS

Possible mitigations such as Avoidance mitigation, Minimizing mitigation, Compensation mitigation, Offset mitigation will be suggested.

2) Considerations on EIA process

Some considerations such as items to be studied in detail how to identify the survey area, stakeholders who should be selected, and methods of predictions will be suggested.

3) Considerations on RAP preparation

Suitable timing for starting RAP survey, RAP procedures, survey areas, organizations that should be contacted will be suggested.

4) Considerations on IPP

Necessity of IPP, considerations for IPP study will be suggested.

(11) 5th Work Period in Japan

The following work will be made:

- 1) Arrangement of issues for materialization of the project to be followed-up by JICA
- 2) Preparation of the Final Report

1.2.4 Study Details in Each Stage of Coal Thermal Power fired projects Study

The scope of this study is to collect and verify data on the Indian power sector so as to identify promising coal-fired thermal power stations which have possibility of installing new facilities and/or replacing the old & inefficient thermal power generating units by Ultra Supercritical (USC) units.

Based on the previous J-Power's survey results, the fifteen candidates were originally proposed in the proposal documents to JICA including Maharashtra state (MS), Uttar Pradesh state (UP), West Bengal state (WB) and Madhya Pradesh state (MP). Furthermore, Haryana state had been requested to add a new candidate state. Finally the total 16 candidates have been selected.

There are a large variety of survey items as screening criteria.

The team will start with the screening work from the prospective of the fundamental project formation condition including the intention of the concerned state governments/agencies/utilities, availability of Land, Water, Coal and so on. Based on the result of the initial screening, the team will narrow down the candidate project to promising projects through interviews with the concerned state governments/agencies/utilities etc. This screening work will include the confirmation of information on Coal Linkage application, coal production/import and environmental regulation on coal-fired power plants and Indian market prospects for Japanese firms.

(1) 1st Work Period in Japan

A target area will be divided into four regions for field surveys. The Study Team will collect /analyze the existing data/information before the field survey and collect basic information on promising projects through local partners.

Based on the result of above-mentioned preliminary work, the Study Team will formulate questionnaire to the concerned utilities.

(See; Appendix Project Selection List)

In addition, the Study Team will interview Japanese power sector suppliers to collect information about application needs in India for Japanese technology.

(2) 1st Work Period in India

The Study Team will conduct the first field survey in the States of Uttar Pradesh, Haryana (A-Group) which are located near New Delhi. The Study Team will narrow down the candidate projects to promising projects through interviews with the concerned state governments/agencies/utilities following the questionnaire mentioned-above.

(3) 2nd Work Period in Japan

The Study Team will summarize the collected data/information through 1st field survey.

And the Study Team will make arrangement for the 2nd field survey.

(4) 2nd Work Period in India (early June, around 1 week)

The Study Team will conduct the second field survey in the States of West Bengal (B- Group).

The Study Team will narrow down the candidate projects to promising projects through interviews with the concerned state governments/agencies/utilities following the questionnaire mentioned-above.

(5) 3rd Work Period in Japan

The Study Team will summarize the collected data/information through 2nd field survey.

And the Study Team will make arrangement for the 3rd field survey.

(6) 3rd Work Period in India(August, around 1 week)

The Study Team will conduct the third field survey in the States of Madhya Pradesh (C-group)

The Study Team will narrow down the candidate projects to promising projects through interviews with the concerned state governments/agencies/utilities following the questionnaire mentioned-above.

(7) 4th Work Period in Japan

The Study Team will summarize the collected data/information from 1st field survey to 3rd field survey. And the Study Team will make arrangement for the 4th field survey.

The Study Team will narrow down the candidate projects to promising projects to make a long-list which includes the project summary description. The long-list will be formulated mainly based on availability of Land which is being made available by suitable readjustment of land in their own premises.

(8) 4th Work Period in India (September, around 1 weeks) (to be fixed)

The Study Team will conduct the fourth field survey in the States of Rajasthan etc (C-group) or further survey for promising projects which were nominated as the result from 1st field survey to 3rd field survey if necessary.

The following information of the most promising projects will be summarized.

- Summary schedule of project development
- Economic aspect

- Environmental licensing status (possession of land)
- Project Scale and applied technology
- Implementation and maintenance management organization
- Issues which are required to elaborate to proceed with future project formation.

(9) 5th Work Period in Japan

The Study Team will summarize the follow-up issues of the future project development including a study on the environmental social matters in coal-fired power plants project, when preparing for the final report.

1) Information collection on the promising project

Information on the promising project will be collected to do the survey to make assessment on present state of air pollution, land use, preserved areas and the possibility of resettlement.

2) Review of the project business plan

The team will review the following data/information on 1/50,000 or 1/25,000 topographical map.

- Business plans of each candidate's location
- Area, raw material transportation route, coal ash storage and transportation routes

3) Scoping

The Study Team will make a scoping based on data/information collected and specify the predicted work items.

4) Impact prediction and evaluation

The Study Team will make a simple prediction of the cumulative effect on the atmosphere and impact on protected areas based on the results of the scoping.

5) Study on conservation measures

The Study Team will summarize the follow-up issues of the future project development at the next stage of Feasibility Study, and conservation measures for a coal-fired power plants project.

1.3 JICA SURVEY TEAM MEMBER AND WORK DESCRIPTION

The Survey Team members and their work descriptions are shown in the table below.

Table 1.3-1 Work Description of Team Member

Name/Assignment	Principal Work Description
<u>Madoka HARADA</u> Team Leader/Power Development Planning	<ul style="list-style-type: none"> - Decision of policy of works and overall coordination of works - Explanation, discussion and agreement with concerned organizations - Management of progress of works - Planning and execution of state survey

Name/Assignment	Principal Work Description
	<ul style="list-style-type: none"> - Study on possibility of Pumped Storage Power Project Development (Development Plan) - Survey other necessary aspects for development of Pumped Storage power project (over all)
<p><u>Ichiro KUTANI</u> Power Policy/Institution (Note; replaced by Mitsuru MOTOKURA at the 3rd Work in India)</p>	<ul style="list-style-type: none"> - Collecting data and evaluate/study (Power Sector) - Execution and evaluation of state survey (Power Sector) - Study of possibility of Pumped Storage Power Project Development (Policy and Institution of Central Government and State Government) - Evaluation of promising projects (Policy/Institution) - Management of sub-contracted basic data collection survey in India (Overall data collection of power sector, policy/institution) - Execution of study on other aspects, if required
<p><u>Tetsuya HIRAHARA</u> Financial Analysis</p>	<ul style="list-style-type: none"> - Collecting data and evaluation/study (Economical/Financial aspects) - Execution and evaluation of state survey (Economical/Financial aspects) - Establishment of assessment criteria for selection of project and evaluation (Economical/Financial aspects) - Study of possibility of Pumped Storage Power Project Development (Financial Condition of state government and power sector) - Evaluation of promising projects (Economic and financing aspects) - Management of sub-contracted basic data collection survey in India (Overall data collection of power sector, economic and financing aspects) - Execution of study on other aspects, if required
<p><u>Mamoru SASA</u> Pumped Storage Power Planning</p>	<ul style="list-style-type: none"> - Collecting data and evaluation/study (Hydropower Planning) - Execution and evaluation of state survey (Hydropower Planning) - Establishment of assessment criteria for selection of project and evaluation (Hydropower Planning) - Study on possibility of Pumped Storage Power Project Development (Hydropower Planning) - Evaluation of promising projects (Possibility of Pumped Storage Power Development) - Management of sub-contracted basic data collection survey in India (1st Screening of Pumped Storage Power candidate sites) - Execution of study on other aspects, if required
<p><u>Taichi HIROSE</u> Power Market Survey / Analysis</p>	<ul style="list-style-type: none"> - Collecting data and evaluation/study (Survey and analysis of Power Market) - Execution and evaluation of state survey (Survey and analysis of Power Market) - Establishment of assessment criteria for selection of project and evaluation (Survey and analysis of Power Market)

Name/Assignment	Principal Work Description
	<ul style="list-style-type: none"> - Study on possibility of Pumped Storage Power Project Development (Survey and analysis of Power Market) - Evaluation of promising projects (Survey and analysis of Power Market) - Management of sub-contracted basic data collection survey in India (Order and management of overall sub-contracted surveys including collecting overall power sector information)
<p><u>Tsuneo KUSUDA</u> Coal Fired Thermal Power Planning A (Note; replaced by Mikihisa SAKURAI at the 2nd Work in India)</p>	<ul style="list-style-type: none"> - Collecting data and evaluation/study (Thermal Power Planning) and discussion with C/P (such as State power sector organization, CEA, Coal India) - Execution and evaluation of site survey (Thermal Power Planning) - Establishment of assessment criteria for selection of project and evaluation (Thermal Power Planning) - Evaluation of promising projects (Possibility of Thermal Power Development) - Execution of study on other aspects, if required
<p><u>Koichi MEGURO</u> Coal Fired Thermal Power Planning B</p>	<ul style="list-style-type: none"> - Collecting data and evaluation/study (Thermal Power Planning) and discussion with C/P (such as State power sector organization, CEA, Coal India) - Execution and evaluation of site survey (Thermal Power Planning) - Establishment of assessment criteria for selection of project and evaluation (Thermal Power Planning) - Evaluation of promising projects (Possibility of Thermal Power Development) - Execution of study on other aspects, if required
<p><u>Subrata DAS</u> Coal Fired Thermal Power Planning C (Note; Withdrawn at the commencement and substituted by Kouich MEGURO & Tsuneo KUSUDA)</p>	<ul style="list-style-type: none"> - Collecting data and evaluation/study (Thermal Power Planning) and discussion with C/P (such as State power sector organization, CEA, Coal India) - Execution of site survey (Thermal Power Planning) (company members of thermal power survey team coming from Japan) - Establishment of assessment criteria for selection of project (Thermal Power Planning) - Execution of study on other aspects, if required
<p><u>Akiko URAGO</u> Environmental & Social Consideration/Coordinator</p>	<ul style="list-style-type: none"> - Collecting data and evaluation/study (Environmental & Social aspects) - Execution and evaluation of state survey (Environmental & Social aspects) - Establishment of assessment criteria for selection of project and evaluation (Environmental & Social aspects) - Study on possibility of Pumped Storage Power Project Development (Environmental & Social aspects) - Execution of study on other aspects, if required

1.4 RECORD ON DISPATCH OF STUDY TEAM

The JICA team commenced the Study in April 2016, and has dispatched the Study Team to India so far as described below. During the course of the Study, the team added 5th Work in India after 4th Work in India.

- | | |
|----------------------|----------------------------------|
| - 1st Work in India; | April 18 to April 28, 2016 |
| - 2nd Work in India; | |
| - 2-1 Work in India | June 13 to June 30, 2016 |
| - 2-2 Work in India | July 13 to July 30, 2016 |
| - 2-3 Work in India | August 15 to August 24, 2016 |
| - 3rd Work in India | September 20 to October 1, 2016 |
| - 4th Work in India | October 24 to October 27, 2016 |
| - 5th Work in India | November 14 to November 22, 2016 |

The JICA team submitted the following reports during the Study to JICA:

- | | |
|---------------------|--------------|
| - Inception Report; | April 2016 |
| - Interim Report; | October 2016 |

CHAPTER 2

CURRENT SITUATION AND FUTURE TREND IN POWER SECTOR IN INDIA

CHAPTER 2 CURRENT SITUATION AND FUTURE TREND IN POWER SECTOR IN INDIA

2.1 POLITICAL AND ECONOMIC SITUATION

2.1.1 Political and Economic Situation

(1) Political Situation

The Modi government made significant changes to certain barriers to trade and investment described in India 2014. The Modi government also announced several new trade and investment-related policies between May 2014 and July 2015. Significant changes or new policies are announced in four areas: foreign direct investment; tariffs and customs procedures; local-content requirements, particularly concerning information and communications technology goods; and standards and technical regulations.

The Modi government faced legislative challenges in passing other key policy reforms—notably changes in India’s land acquisition laws, taxation policies, and other measures affecting the overall business climate—and, as a result, many of India’s policies and practices that were identified in India 2014.

India’s parliament has approved a Goods and Services Tax (GST) bill in August 2016. The bill will give the central government unprecedented powers to set tax rates on goods and services, and streamline the country’s convoluted tax laws into a uniform system. The GST, an indirect tax policy, will subsume an array of federal- and state-imposed taxes such as service tax, entertainment tax, excise duty and value-added tax across the vast country. This will help in getting rid of the cascading effects of those taxes making the tax structure more effective.

1) Make in India

According to the Make in India website (www.makeinindia.com/home), Prime Minister Narendra Modi launched the Make in India initiative in September 2014, with the primary goal of making India a global manufacturing hub, by encouraging both multinational as well as domestic companies to manufacture their products within the country. Led by the Department of Industrial Policy and Promotion, the initiative aims to raise the contribution of the manufacturing sector to 25 % of the Gross Domestic Product (GDP) by the year 2025 from its current 16 %. Make in India has introduced multiple new initiatives, promoting foreign direct investment, implementing intellectual property rights and developing the manufacturing sector.

It targets 25 sectors of the economy which range from automobile to Information Technology (IT) and Business Process Management (BPM) as follows:

Automobiles	Construction	IT and BPM	Pharmaceuticals	Space
Automobile Components	Defense Manufacturing	Leather	Ports	Textiles and Garments
Aviation	Electrical Machinery	Media and Entertainment	Railways	Thermal Power
Biotechnology	Electronic Systems	Mining	Renewable Energy	Tourism and Hospitality
Chemicals	Food Processing	Oil and Gas	Roads and highways	Wellness

Since the launch of Make in India in September 2014 to March 2016, cumulative FDI inflows of USD 79.1 billion has been received along with a cumulative amount of equity inflows of USD 56.5 billion, representing about a 45 % increase over the same corresponding period.

2) Major achievement during the past two years

According to Center for Strategic & International Studies, major achievement during the past two years of Modi administration is summarized in Table 2.1.1-1.

Table 2.1.1-1 Major Achievements of Modi Administration

Status / Difficulty	Purpose and explanation on current status
Yes / LOW	<ul style="list-style-type: none"> - Relax the rules specifically governing foreign investment in construction projects, including minimum built-up space and lock-in periods. - Update: DIPP Press Note 12 removed almost all restrictions on FDI in construction, including minimum project size, and reduced the lock-in period for capital to three years (or as soon as trunk infrastructure is completed, whichever comes first).
Partially/ MEDIUM	<ul style="list-style-type: none"> - Allow foreign investors to own a majority stake in defense production firms. - Update: On 6/20/16 India announced that it would drop the requirement of "state of the art" technology before allowing 100 % FDI in defense via the government approval route.
No / MEDIUM	The World Bank's "Doing Business" report notes that it takes on average 29 days to start a business in India. That's nearly double the South Asia average (15.7 days). The OECD average is 8.3 days.
No / MEDIUM	The World Bank's "Doing Business" report notes that India requires 12.9 procedures to start a business—well above the South Asian average (7.9 procedures).
Yes / MEDIUM	<ul style="list-style-type: none"> - Deregulating diesel pricing will lower government subsidies and also encourage the expansion of private hydrocarbon production. - Update: The government deregulated diesel pricing on 10/18/2014.
No / HIGH	- Deregulating kerosene pricing will lower government subsidies and also encourage the expansion of private hydrocarbon production.

Partially / MEDIUM	<ul style="list-style-type: none"> - Deregulating natural gas pricing will encourage the expansion of private hydrocarbon production. - Update: On March 10, the Cabinet announced a new energy policy that switches to a revenue-sharing model (from a profit-sharing model), allows substantial pricing freedom for difficult fields, and eliminates minimum acreage requirements for new fields. While not total price deregulation, the policy offers new incentives for private hydrocarbon exploration.
No / HIGH	<ul style="list-style-type: none"> - The national Goods & Services Tax will combine most of India's state and local taxes into a streamlined tax system, easing compliance, ending cascading taxes, and expediting transportation. - Update: A draft of the model law is in circulation, but the Rajya Sabha has yet to vote on the necessary constitutional amendment.*)
Partially / MEDIUM	<ul style="list-style-type: none"> - Eliminate the Revenue Department's ability to retrospectively apply new tax laws. This provision, introduced in 2012, creates uncertainty for foreign investors. - Update: In his February 29 Budget Speech Finance Minister Jaitley announced that the Revenue Secretary would chair a high-level committee that must approve all retrospective tax demands and offered a one-time dispute resolution opportunity for parties to current cases.

source: Modi's Reform Scorecard, Center for Strategic & International Studies (<http://indiareforms.csis.org/>)

*) Parliament has approved a Goods and Services Tax (GST) bill in August 2016.

(2) Economic Situation

1) GDP and economic growth

As per the Advanced Estimates released by the Central Statistics Office, the economy is estimated to grow at 7.6 % in 2015-16, higher than growth of 7.2 % achieved in 2014-15. The growth in agriculture, industry and services is estimated at 1.1 %, 7.3 % and 9.2 % in 2015-16 as opposed to (-) 0.2 %, 5.9 % and 10.3 % respectively in 2014-15. This shows a pick-up in industrial growth, driven by manufacturing which is estimated to grow at 9.5 % (in 2015-16), as compared to 5.5 % registered in 2014-15. The growth in agriculture remained low on account of second consecutive year of subdued monsoon. GDP growth during April - December 2015 (first 3 quarters) was 7.5 %, compared to 7.4 % in the same time period in 2014-15.

From the demand angle, the growth in private final consumption expenditure at 7.6 % in 2015-16 has been the major driver of growth. The growth of fixed investment improved from 4.9 % in 2014-15 to 5.3 % in 2015-16. The exports and imports are both estimated to decline by 6.3 % in 2015-16, the former mainly on account of subdued global demand and the latter largely reflecting the decline in international petroleum prices.

Economic Survey 2016-2017 describes that economic growth is projected in an unusually wide range of 7-7.75 % for fiscal year 2017, which encompasses a scenario of a possible slowdown from the current rate or a slight pickup. More importantly, it says that given the changed realities of the world economy there might be a need for recalibration of growth expectations and

standards of assessment. The government expects growth to move up marginally to around 7.6 % over the next year based on continued softness in the global economy and a normal monsoon. Table 2.1.1-2 shows GDP amounts and its growth rates.

Table 2.1.1-2 GDP and Growth Rate

Item	2012-13	2013-14	2014-15	2015-16
GDP (Crore) 2011-12 prices	9,226.879	9,839,434	10,552,151	11,350,962
Growth Rate	5.6 %	6.6 %	7.2 %	7.6 %

source: Economic Survey 2015-16

2) Fiscal management ¹

Three major fiscal indicators – fiscal deficit, revenue deficit and primary deficit – are analyzed, and compared their relative performance since 2007-08 with the targets set under the FRBM Act and the revised roadmap of fiscal consolidation given by the FC-XIII.

The FRBM Act had laid down the target of bringing the fiscal deficit down to 3 % of GDP and eliminating revenue deficit by 2008-09. Table 2.1.1-3 brings out the profile of different fiscal indicators in respect of the Union Government and the performance as well as the targets set by the 13th Finance Committee.

Table 2.1.1-3 Performance of Fiscal Indicators

	Fiscal Deficit	Revenue Deficit	Primary Deficit	Effective Revenue Deficit	Ratio of Revenue Deficit to Fiscal Deficit
2010-11	4.8 (5.7)	3.2 (3.2)	1.8 (--)	2.1	67.52
2011-12	5.7 (4.8)	4.4 (2.3)	2.7 (--)	2.9	76.43
2012-13	4.8 (4.2)	3.6 (1.2)	1.8 (--)	2.5	74.31
2013-14	4.6 (3.0)	3.3 (0.0)	1.3 (--)	2.0	70-.59
2014-15	4.1 (3.0)	2.9 (-0.5)	0.8 (--)	1.6	71.23

note: Figures in parenthesis indicate the targets in the 13th Financial Commission.

source: Report on the 14th Financial Commission

i) Fiscal Deficit

The fiscal deficit of the Union Government relative to GDP declined steadily from 6.1 % in 2001-02 to 4.5 % in 2003-04. The FRBM Act mandated reducing the fiscal deficit to 3 % by 2008-09. The Union Government achieved this target in 2007-08, with the fiscal deficit declining to 2.5 % of GDP. However, in 2008-09 the Union Government undertook several fiscal expansionary measures such as revision of pay scales based on the recommendations of the Sixth Pay Commission, waiver of farm loans and the expansion of the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) to all districts from the 200 districts it was

¹ Report on the Fourteenth Finance Commission, February 2015
(<http://fincomindia.nic.in/ShowContentOne.aspx?id=9&Section=1>)

originally slated to cover. In addition, oil prices escalated sharply, leading to a rise in subsidy. As a consequence of all this as well as the global crisis, the fiscal deficit of Union Government increased to 6 % in 2008-09 and 6.5 % in 2009-10.

Another consequence was that the total expenditure as a ratio of GDP increased by 1.5 %age points from 14.3 % in 2007-08 to 15.8 % in 2009-10. At the same time, the gross tax revenues declined by more than 2 %age points from a peak of 11.9 % of GDP in 2007-08 to 9.6 % in 2009-10. Though the fiscal deficit declined in 2010-11 to 4.8 % of GDP, this was mainly on account of additional revenue from the proceeds of the auction of telecom spectrum.

Most of the expansionary measures were irreversible. Further, rising expenditure on major subsidies and stagnant tax-GDP ratios limited the return to the fiscal correction path laid down by the FC-XIII. The fiscal deficit again increased sharply to 5.7 % of GDP in 2011-12. In 2012, the Union Government amended the FRBM Act and laid down a revised fiscal adjustment path of achieving fiscal deficit of 3 % of GDP by 2016-17 and reducing revenue deficit to below 2 % of GDP by 2014-15.

The growth rate of the economy, which was initially maintained after the global crisis through the expansionary measures, registered a rapid decline after 2011-12. In the two consecutive years of 2012-13 and 2013-14, the growth rates were 4.5 % and 4.7 %, respectively. In this situation, the Union government severely compressed expenditures to achieve the budgeted levels of fiscal deficit. The fiscal deficit was contained at 4.8 % in 2012-13 and 4.6 % in 2013-14 largely by compressing Plan expenditure. In 2014-15 (budget estimates), the Union Government proposes to bring down the fiscal deficit to 4.1 % of GDP.

ii) Revenue Deficit

The revenue deficit of the Union stood at 4.3 % of GDP in 2001-02 and was brought down to 2.5 % of GDP in 2004-05 and 1.1 % of GDP in 2007-08. It then rose to 5.2 % in 2009-10 because of a substantial increase in revenue expenditures on subsidies, interest payments and salaries and pensions. Plan transfers to the States and implementing agencies also showed increases due to the expansion of existing schemes and launching of major new schemes.

The revenue deficit remained high at 3.3 % in 2013-14 (revised estimates) and is projected to decline marginally to 2.9 % in 2014-15 (BE). Thus, there was a slippage of 3.4 %age points over the FC-XIII fiscal correction path of a revenue surplus target of 0.5 % of GDP in the terminal year.

The Union Government introduced the concept of effective revenue deficit through an amendment to the FRBM Act in 2012. Effective revenue deficit makes a distinction between the grants given to the States and implementing agencies for the creation of capital assets and grants for meeting revenue expenditures. Note that the concept of effective revenue deficit is not recognized in the standard government accounting process.

The amended FRBM Act has revised the target of revenue deficit – it is now to be brought below

2 % of GDP by 31 March 2015 against the original goal of eliminating it entirely. However, it appears that even this revised target may not be met. The projected budget estimates for 2014-15 has a revenue deficit of 2.9 %, indicating a clear revenue imbalance in Union finances.

iii) Primary Deficit

The primary deficit of the Union Government improved substantially between 2001-02 and 2007-08, moving from a deficit of 1.5 % of GDP in 2001-02 to a primary surplus of 0.9 % of GDP in 2007-08. However, like other deficit indicators, primary deficit of the Union Government increased to a deficit of 2.6 % of GDP in 2008-09 and a deficit of 3.2 % of GDP in 2009-10. It was kept under 2 % of GDP in the last two financial years and is projected at 0.8 % of GDP in 2014-15 (BE).

The ratio of revenue deficit to fiscal deficit broadly measures the extent of borrowings used for revenue expenditure. Table 2.1.1-3 also brings out this imbalance and shows that the ratio had improved from almost 71 % in 2001-02 to 41 % in 2007-08. However, this ratio almost doubled within a span of two years to over 81 % in 2009-10 and has since remained consistently above 70 % (with the exception of 2010-11), thereby reflecting the levels of persistent structural imbalance in Union Government expenditures.

3) Monetary policy ²

The agreement on monetary policy framework signed between the Government and Reserve Bank of India (TBI) in February 2015 has shaped the monetary policy stance in 2015-16. The RBI further eased its monetary policy stance during the year 2015. Headline inflation based on the consumer price index (CPI) fell to below 6 % much ahead of the January 2016 target. The RBI reduced the statutory liquidity ratio by 0.5 % to 21.5 % in February 2015 and further eased the policy repo rate during the year to 6.75 %, in all making a substantial cut of 125 basis points between January 2015 and September 2015. In the bank's latest monetary policy review held on February 2, 2016, the policy repo rate remains unchanged.. Table 2.1.1-4 indicates revision in policy rate.

Table 2.1.1-4 Revision in Policy Rate

Date	Bank rate	Repo rate	Reverse repo rate	Cash reserve ratio	Statutory liquidity ratio
09-08-2014	9.00 %	8.00 %	7.00 %	4.00 %	22.00%
15-01-2015	8.75 %	7.75 %	6.75%	4.00 %	22.00 %
07-02-2015	8.75 %	7.75 %	6.75%	4.00 %	21.50 %
04-03-2015	8.50 %	7.50 %	6.50%	4.00 %	21.50 %
02-06-2015	8.25 %	7.25 %	6.25%	4.00 %	21.50 %
29-09-2015	7.75 %	6.75 %	5.75 %	4.00 %	21.50 %

source: RBI / Economic Survey 2015-16

² Economic Survey, 2015-16, Ministry of Finance, February 2016.

As to the Consumer Price Index, it is expected to trend downwards in the region of 4.5-5 % in view of the current deflationary scenario. Given the rigidities in the supply side of the economy, especially in the services category, and the possible impact of the 7th Pay Commission, CPI could end up being higher than forecast by the government.

Calculations show that CPI is likely to remain at around current levels, as the positive base effect from last year has faded while commodity prices globally are likely to stabilise or experience a slight uptick during the year. This is primarily due to food inflation, an area still not under control. However, if this forecast were to come true, another 50-75 basis points of cuts in the repo rate can be expected. (Economic Survey 2016-2017) Table 2.1.1-5 shows average inflation rates. (note: On Oct 4 2016, RBI changed repo rate down to 6.25%, Reverse repo rate 5.75%)

Table 2.1.1-5 Average inflation rates

	2012-13	2013-14	2014-15	2015-16
Inflation (WPI) average	7.4 %	6.0 %	2.0 %	-2.8 %
Inflation (CPI) average	10.2 %	9.5 %	5.9 %	4.9 %

source: Economic Survey 2015-16

4) Non performing and stressed assets

The Reserve Bank of India reckons that non-performing and stressed assets at the country's lenders are equivalent to 14.5 % of total loans. That implies bad loans have reached US\$146 billion - or 7 % of India's gross domestic product - based on corporate debt figures compiled by the Bank for International Settlements. The situation is even worse at government-controlled banks, which account for over two-thirds of the industry's assets.

The government estimated that India's public sector banks will have to raise 1.8 trillion rupees (\$26.8 billion) in order to have a safe buffer under global bank capital rules that come into force in 2019. The government will provide one third of that sum itself and expects banks to raise the rest on their own.

Background of the accumulation of non-performing and stressed assets is that, in addition to the inefficient management of the public sector banks, decline in earnings in the industrial sector due to slowdown of demand and commodity price, as well as stagnation of infrastructure projects due to problem in land and license acquisition.

Central bank and the government have taken comprehensive measures to grasp the economic value of the bad assets, to strengthen risk management, to accelerate the bad-debt disposal and to increase earning power of both banks and enterprises for the purpose of overcoming the problem of bad-debts.

5) Land acquisition

President Modi gave up modification of land acquisition law on August 30, 2015. According to the new bill, a mandatory social impact assessment and a consent clause 70 % consent from

landholders for public-private partnership (PPP) projects, and 80 % for private projects - were done away with in the case of five categories of projects. These included defense, rural infrastructure, affordable housing, industrial corridors, and infrastructure. The new bill is expected by private companies and investors to accelerate the development of social infrastructure, but there has been a strong opposition from the farmers.

6) Budget Proposals for 2016-17

Budget proposals for 2016-17 are built on 'Transform India' agenda with nine distinct pillars, which include:

- i) Agriculture and Farmers' Welfare: with focus on doubling farmers' income in five years;
- ii) Rural Sector: with emphasis on rural employment and infrastructure;
- iii) Social Sector including Healthcare: to cover all under welfare and health services;
- iv) Education, Skills and Job Creation: to make India a knowledge based and productive society;
- v) Infrastructure and Investment: to enhance efficiency and quality of life;
- vi) Financial Sector Reforms: to bring transparency and stability;
- vii) Governance and Ease of Doing Business: to enable the people to realise their full potential;
- viii) Fiscal Discipline: prudent management of Government finances and delivery of benefits to the needy; and
- ix) Tax Reforms: to reduce compliance burden with faith in the citizenry.

a) Infrastructure and Investment

In the energy sector, Government has achieved the highest coal production growth in over two decades, highest ever capacity addition in generation, highest ever increase in transmission lines and in distribution of LED bulbs.³

Government is drawing up a comprehensive plan, spanning next 15 to 20 years, to augment the investment in nuclear power generation, to diversify the sources of power generation for long term stability. Budgetary allocation up to `3,000 crore per annum, together with public sector investments, will be leveraged to facilitate the required investment for this purpose.

To augment infrastructure spending further, Government will permit mobilisation of additional finances to the extent of 31,300 crore by PFC, REC, IREDA, etc. through raising of Bonds during 2016-17.

b) Financial Sector

To tackle the problem of stressed assets in the banking sector, Asset Reconstruction Companies (ARCs) have a very important role. Therefore, necessary amendments are proposed in the Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest (SARFAESI) Act 2002 to enable the sponsor of an ARC to hold up to 100 % stake in the ARC

³ Budget Speech 2016-17 (<http://indiabudget.nic.in/ub2016-17/bs/bs.pdf>)

and permit non-institutional investors to invest in Securitization Receipts.

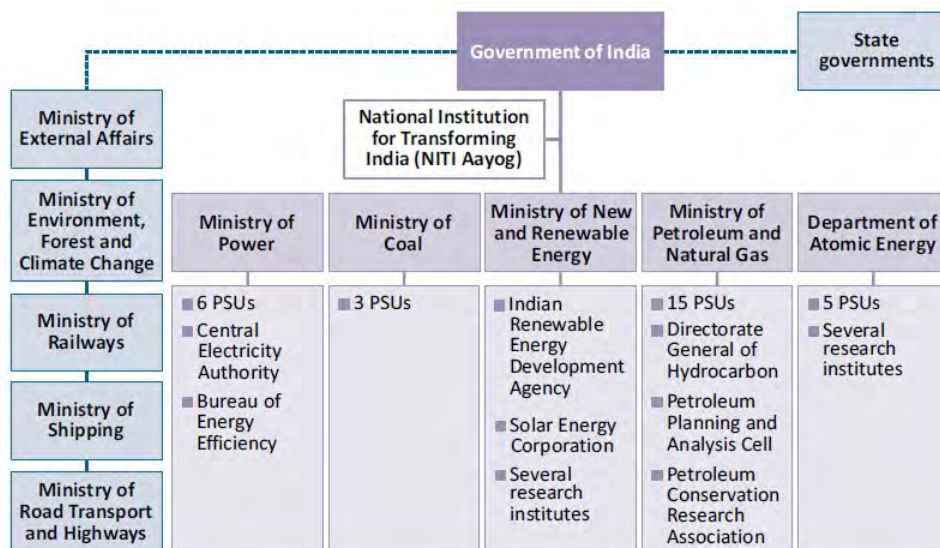
For speedier resolution of stressed assets, the Debt Recovery Tribunals will be strengthened with focus on improving the existing infrastructure, including computerized processing of court cases, to support reduction in the number of hearings and faster disposal of cases.

2.1.2 Energy Policy in India

(1) Energy Policy ⁴

Energy Statistics 2016 indicates that India has several ministries and other bodies, each with partial responsibility for aspects of energy policy and the related infrastructure. Effective co-ordination has been improved by the appointment of a single Minister for Power, Coal, New and Renewable Energy, although the individual ministries themselves continue to exist as separate entities. The institutional structure requires constant effort to achieve co-ordination and resolve disputes.

The Ministry of Power (MOP) is responsible for the power sector along the entire value chain; the Ministry of Coal (MOC) has responsibilities for policies on exploration and development of coal reserves; and the Ministry of New and Renewable Energy (MNRE) carries out national programmes to increase renewables including wind, solar and small hydro. In addition, the Ministry of Petroleum and Natural Gas (MOPNG) oversees all aspects of the oil and natural gas sector, including exploration, production, marketing and import/export. The Department of Atomic Energy (DAE) is responsible for all aspects of India’s nuclear policy. Figure 2.1.2-1 shows main institutions in India with influence on energy policy



Notes: PSU = Public sector undertaking (state-owned enterprise). Other ministries with responsibilities relevant to the energy sector include the Ministry of Urban Development, Ministry of Water Resources, Ministry of Agriculture, Ministry of Finance and the Department of Science and Technology.

source: India Energy Outlook 2015, IEA

Figure 2.1.2-1 Main Institutions in India with Influence on Energy Policy

⁴ Energy Statistics 2016, Central Statistics Office, April 2016
 (www.mospi.gov.in/sites/default/files/publication_reports/Energy_statistics_2016.pdf)

India's substantial and sustained economic growth is placing enormous demand on its energy resources. A long-term energy policy perspective is provided by the Integrated Energy Policy Report 2006 which provided policy guidance on energy sector growth. India's crude oil and natural gas production has been stagnating in recent years. The widening of the demand supply gap has increased the dependency on imports. Presently, almost 83 % of India's crude oil availability is through imports. To reduce dependency on imports, India's strategy is the encouragement of the development of renewable sources of energy by the use of incentives by the Federal and State governments including the use of nuclear energy, promoting windfarms and solar energy.

1) Coal and Lignite

- Coal deposits are mainly confined to eastern and south central parts of the country. The states of Jharkhand, Odisha, Chhattisgarh, West Bengal, Madhya Pradesh, Telangana and Maharashtra account for 99.08 % of the total coal reserves in the country. The State of Jharkhand had the maximum share (26.44 %) in the overall reserves of coal in the country as on 31st March 2015 followed by the State of Odisha (24.72 %).
- As on 31.03.15, the estimated reserve of coal was 306.60 billion ton, an addition of 5.04 billion over the last year. There has been an increase of 1.67 % in the estimated coal reserves during the year 2014-15 with Chattisgarh accounting for maximum increase of 4.53 %.
- The estimated total reserve of lignite as on 31.03.15 was 43.25 billion ton which is equivalent to the total reserve as on 31.03.14.

2) Petroleum and Natural gas

- The estimated reserve of crude oil in India as on 31.03.2015 stood at 763.48 million ton (MT).
- Geographical distribution of Crude oil indicates that the maximum reserves are in the Western Offshore (43.67 %) followed by Assam (22.19 %), whereas the maximum reserves of Natural Gas are in the Eastern Offshore (37.10 %) followed by Western offshore (29.34 %).
- There was increase of 0.10 % in the estimated reserve of crude oil for the country as a whole during 2014-15 as compared to the position a year ago. During the same period, estimated reserves of crude oil in Arunachal Pradesh, Rajasthan and Assam decreased by 44.75 %, 17.04 % and 2.11 % respectively, while the same in Tamil Nadu, Andhra Pradesh, Gujarat, Western Offshore and Eastern Offshore increased by 18.42 %, 15.30 % , 2.58 %, 1.88 % and 0.59 % respectively.
- The estimated reserves of natural gas in India as on 31.03.2015 stood at 1488.49 billion m³ (BCM).
- In case of Natural Gas, the increase in the estimated reserve over the last year was 1.40 %. The maximum contribution to this increase has been from Eastern Offshore (37.10 %), followed by Western Offshore (29.34 %).

3) Renewable energy sources

- There is high potential for generation of renewable energy from various sources- wind, solar, biomass, small hydro and cogeneration bagasse.
- The total potential for renewable power generation in the country as on 31.03.15 is estimated at 896,603 MW . This includes wind power potential of 102,772 MW (11.46 %), SHP (small-hydro power) potential of 19,749 MW (2.20 %), Biomass power potential of 17,538 MW (1.96 %), 5,000 MW (0.56 %) from bagasse-based cogeneration in sugar mills and solar power potential of 748,990 MW (83.54 %).
- The geographic distribution of the estimated potential of renewable power as on 31.03.2015 reveals that Rajasthan has the highest share of about 17 % (148,518MW), followed by Jammu and Kashmir with 13 % share (118,208MW) and Gujarat with 8 % share (72,726MW), mainly on account of solar power potential.

source: Energy Statistics 2016, MOSPI

(2) Electric Power Policy

Electric power policy elaborated by the Ministry of Power is shown in the Table 2.1.2-1

Table 2.1.2-1 Electric Power Policy

1. A tenfold increase in solar installation rates to 100 GW by 2022, trebling to 60 GW of new wind farms, 10 GW of biomass and 5 GW of small scale, run-of-river hydro. These initiatives, which total 175 GW of new renewable-energy installations, require an investment of over US\$200bn, with new national legislative support currently proposed under the National Renewable Energy Act;
2. Opening up access to international debt and equity markets to assist with a proposal to price power purchase agreements (PPAs) in U.S. dollars as a way to fund low-cost, long-duration loans with centralized currency hedging;
3. US\$50bn in investments toward upgrading the capacity and efficiency of the electricity transmission and distribution grid, with an associated smart-meter program aimed at significantly reducing the Indian electricity grid's 23-25 % transmission and distribution (T&D) loss rate and to drive a 6 % energy efficiency saving for 2015 alone (reducing in the process the frequency and duration of blackouts);
4. A doubling of Coal India Ltd's production output to 1,000Mtpa by 2021/22, with a focus on greater integration and co-ordination with Indian Railways to reduce logistical bottlenecks;
5. A more than doubling of India's overall coal production in 5-7 years to 1,500 Mtpa with the intention to expand domestic private coal-mining capacity to 500 Mtpa building competition;
6. Reducing railway inefficiencies, increasing railway capacity and better aligning coal mine-mouth power plants, all aimed at reducing coal transportation distances;
7. Improving utilization rates of existing thermal power plants to reduce the need for more

capacity which could then progressively allow a phase out old, inefficient coal-fired power capacity and replacing it with the latest, highest-efficiency technology;

8. Re-evaluating the merits of pursuing the country's now stalled Ultra Mega Power Project (UMPP) plan;

9. Pursuing Rural Electrification by an accelerated off-grid or distributed-energy solution with the longer term aim of "24X7 electricity supply for all";

10. Developing more hydro-electricity capacity;

11. Promoting the government's National Mission on Enhanced Energy Efficiency;

12. Resolving the electricity distribution company (Discom) sector's ongoing operating losses of more than US\$10bn annually, a situation that chronically undermines the financials of the whole system and that makes many PPAs unbankable.

source: Indian Electricity Sector Transformation, IEEFA

Following achievements and initiatives has been accomplished during the last 2 years by the Ministries for Power, Coal and New & Renewable Energy with respect to power sector reform are summarized in Table 2.1.2-2.

Table 2.1.2-2 Major achievements and initiatives for Indian power sector

- **Ujwal DISCOM Assurance Yojana (UDAY)**, the most comprehensive power sector reform ever, to turnaround DISCOMs through efficiency improvements. UDAY bonds worth Rs. 1 lakh crore issued in 2015-16
- **Landmark amendments in the Tariff Policy** to promote electricity for all, efficiency to ensure affordable tariffs, environment for a sustainable future and ease of doing business to attract investments
- **State specific Action Plans for 24 X 7 'Power for All'** signed for 18 states and union territories, and finalized for another 15 states and union territories
- **Rationalized movement** of 23 million tons coal leading to potential annual savings of Rs. 1,371 crore
- **Mobile applications and websites** to ensure accountability and transparency –
 - **Grameen Vidyutikaran (GARV)** app to help citizens track rural electrification under Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY)
 - **Vidyut PRAVAH** app created to provide real time information of electricity price and availability
 - **Unnat Jyoti by Affordable LEDs for All (UJALA)** app to keep track of LED distribution under the Domestic Efficient Lighting Program (DELP)
 - **Coal Allocation Monitoring System (CAMS)** to give information regarding coal price, availability and utilization

(3) Countermeasures for Climate Change

In continuing efforts to safeguard the environment and reduce emissions from power sector, India has made the following commitments in COP 21:

- India intends to reduce the emissions intensity of its GDP by 33 to 35 % by 2030 from 2005 level.
- To achieve about 40 % cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030 with the help of transfer of technology and low cost international finance.
- Introducing new, more efficient and cleaner technologies in thermal power generation.

Further, to reduce emissions from Thermal Power Stations, Ministry of Environment, Forest and Climate Change has also issued new environmental norms in December 2015 regarding Suspended Particulate matter (SPM), SO_x, NO_x, Mercury. Norms for specific water consumption by Thermal Power Stations have also been notified to conserve water. The present installed capacity of coal based thermal power plants is 185,172 MW as on 31.03.2016 and 72,355 MW is under construction which is likely to be affected by the new norms.

Table 2.1.2-3 shows new emission norms as notified on December 7, 2015.

Table 2.1.2-3 New Emission Norms

Emission parameter	TPPs (units) installed before 31st December, 2003	TPPs (units) installed after 31st December 2003 and upto 31st December 2016	TPPs (units) to be installed from 1st January 2017
Particulate Matter	100 mg/Nm ³	50 mg/Nm ³	30 mg/Nm ³
Sulphur Dioxide (SO ₂)	600 mg/Nm ³ for units less than 500MW capacity 200 mg/Nm ³ for units 500MW and above capacity	600 mg/Nm ³ for units less than 500MW capacity 200 mg/Nm ³ for units 500MW and above capacity	100 mg/Nm ³
Oxides of Nitrogen (NO _x)	600 mg/Nm ³	300 mg/Nm ³	100 mg/Nm ³

To be complied within 2 years by existing stations and w.e.f 01.01.2017 for new stations
source: New Environmental Norms for Thermal Power Stations in India, CEA 2015

2.1.3 Policy for External Finance

(1) External Debt ⁵

According to Government Debt Status Paper, 2016, External debt (3.66 trillion, 2.9 % of GDP as at end-March 2015) constituted 7.1 % of the public debt of the Central Government. As State Governments are not empowered to contract external debt under Article 293 of the Indian Constitution, all external debt is contracted by the Central Government and those intended for state government projects are on-lent to States. Most of the external debt is from multilateral agencies such as IDA, IBRD, ADB, etc. External debt also originates from official bilateral agencies. There is no borrowing from international private capital markets. The entire external debt is originally long-term and a major part is at fixed interest rates.

Under Article 292 of the Constitution of India, the Central Government may borrow from within as well as outside the territory of the Country. The Central Government receives external loans largely from multilateral agencies and to some extent from foreign countries also. External debt at current exchange rates, as at end-March 2015, for the Central Government decreased to 366,384 crore (US\$58.5 billion; 2.9 % of GDP) from 374,483 crore (US\$62.5 billion; 3 % of GDP) at end-March 2014. This amounts to 6.2 % of Central Government's total liabilities and 4.4 % of General Government Debt.

The net funding, i.e. fresh borrowing less repayment of earlier loans, from external debt is minimal in recent years. Accordingly, External debt (at current, i.e. end-of-the financial year, exchange rate) as %age of GDP has consistently declined in the recent years, indicating that reliance on external debt for financing of deficit is declining. This implies that debt portfolio of Government has low currency risk and its impact on balance of payments also remains insignificant. A major portion of the external debt is from multilateral institutions (73.6 % of total external debt at end-March 2015), while bilateral sources account for the remaining 26.4 %. Loans from multilateral institutions are largely on concessional terms. The Central Government does not borrow directly in international capital markets.

Table 2.1.3-1 shows transition of donor-wise sovereign external debt amount.

Table 2.1.3-1 Donor-wise Sovereign External Debt

(unit: Crore Rs)

Category	2011	2012	2013	2014	2015	Total	%
A. Multilateral							
IDA	119,066	136,822	141,119	161,165	152,169	710,341	59.9
IBRD	39,219	45,328	48,239	53,433	57,107	243,326	20.5
ADB	30,455	38,560	44,301	51,469	57,935	222,720	18.8
Others	1,584	1,875	2,012	2,404	2,410	10,285	0.9
Sub-total	190,324	222,585	235,671	268,471	269,621	1,186,672	100.0

⁵ Government Debt Status Paper, January 2016, Ministry of Finance
(http://finmin.nic.in/reports/govt_debt_status_paper_2016.pdf)

Category	2011	2012	2013	2014	2015	Total	%
B. Bilateral							
Japan	65,907	76,401	73,120	79,825	75,253	370,506	75.9
Germany	11,899	13,765	13,826	16,085	12,611	68,186	14.0
Russia	7,485	6,953	6,396	6,099	5,504	32,437	6.6
France	1,750	1,657	1,514	2,517	2,058	9,496	1.9
USA	1,489	1,516	1,460	1,453	1,329	7,247	1.5
Others	21	20	16	14	8	79	0.0
Sub-total	88,552	100,312	96,333	105,993	96,763	487,953	100.0

source: Government Debt Status Report, 2016

(2) Guidelines for Examination of Proposals

Ministry of Finance issued an Office Memorandum on July 22, 2015 regarding Guidelines for examining proposals of States availing external loan for clearance from debt sustainability angle. The States are required to remain within the borrowing ceiling fixed by the Ministry of Finance each year and also the fiscal deficit limits & debt to GSDP norms prescribed by Finance Commissions, which is incorporated in the FRBMA of States.

Loan under External loan Assistance for Projects (EAPs) would be considered by Department of Economic Affairs (DEA) subject to States confirming/self certifying on the following aspects at the time of submitting their proposals to DEA mentioned in Table 2.1.3-2.

Table 2.1.3-2 Items to be Confirmed/Certified for Application of External Loan

- | |
|---|
| <p>i) Support through EPA loans would generally be utilized in areas within the overall national priorities & harmonize with national objectives and that such proposals do not overlap with an already available source of funding.</p> <p>ii) The State's contribution for such projects (i.e. counterpart funding) is clearly indicated by the State at the time of submitting the project proposal to DEA.</p> <p>iii) For the EAP loans passed on to the States, the commitment charges, foreign exchange risks, etc. are borne by the States concerned.</p> <p>iv) In case, requirement of loans tend to breach the overall borrowing ceiling of the State during the loan disbursement period, the State will be required to substitute an otherwise agreed source of borrowing so as to remain within the net borrowing ceilings.</p> |
|---|

The book value of External debt has increased from 17,088 crore in 2011-12 to 194,286 crore in 2014-15, while the percentage in GDP has decreased from 1.9 % to 1.5 %, with the expansion of the Indian economy. Trend in the amount of external debt is shown in Table 2.1.3-3.

Table 2.1.3-3 Trends in External Debt

(unit: Crore Rs)

	2011-12	2012-13	2013-14	2014-15
External Debt (at book/historical Value)	170,088	166,289	184,581	194,286
Percentage of GDP	1.9 %	1.8 %	1.6 %	1.5 %
External Debt (at current exchange rate)	322,897	332,004	374,483	366,384
Percentage of GDP	3.7 %	3.3 %	3.3 %	2.9 %

source: Government Debt Status Paper, Ministry of Finance, Jan. 2016

(3) System and Process on Bilateral ODA ⁶

One of the major functions of the Department of Economic Affairs (DEA) is to access external assistance from all multilateral as well as bilateral partners. DEA published “Handbook on Systems and Processes on Bilateral Official Development Assistance”, which documented the Government of India’s policies and procedures with regard to external development assistance from bilateral sources. Here a procedure focused on state undertaking is shown hereunder ~~below~~:

It should be noted that the handbook describes the practices when it was prepared, but according to the reasons shown below, it has been regarded as a mere reference document at present:

- Stipulated procedures are not necessary taken.
- Necessary amendment has not been made according to the current situation. (Planning Commission, for example, has been reorganized into NITI Aayog which has no budget authority. It is now deemed as a think tank.)
- State Financial Department has more involvement in screening the projects.

1) Preparation of the Preliminary Project Report (PPR)

The project cycle under the bilateral official development cooperation programs starts with project implementing agency (PIA) preparing preliminary project report. The PIA should ensure that the project ideas/programs are consistent with the priorities of the Government of India and State Governments enunciated in the current Five Year Plan. Central sectorial line ministries and/or the Planning Commission may be consulted for shaping up the idea.

The PIAs should send preliminary project report and all the requisite details in the prescribed format to DEA through their central line ministry. PIAs implementing state sector projects can send advance copy to DEA.

PIAs for the state sector projects should have obtained necessary approval of their State Governments before forwarding their proposal/preliminary project report to the relevant central line ministry.

⁶ Bilateral Development Assistance: A Handbook on Systems and Processes, Department of Economic Affairs (www.dif.mp.gov.in/DEA_Handbook_BDA.pdf)

State Government/Public Sector Undertakings / semi-Government agency should generally refrain from directly or indirectly approaching any bilateral development agency for accessing the bilateral development assistance before the formal proposal is forwarded by DEA to a bilateral development agency. Further discussions between the PIA and the bilateral development agency on the proposal will be facilitated by DEA after formal communication is forwarded to the bilateral development agency. PIAs shall ensure the following approvals before forwarding their proposals to DEA:

State Government or its agency seeking Project Finance or Sector Program Finance ⁷:

- i. Approval of the central line Ministry on the Preliminary Project Report.
- ii. Assurance of the State Government to make adequate budget provisions in the State Plan for implementing the project.
- iii. Debt-sustainability clearance from the Department of Expenditure for any borrowing proposed from the external development agency.

2) Examination of the Preliminary Project Report in DEA

DEA shall carry out due diligence of the Preliminary Project Reports with due diligence before forwarding it to the foreign Governments/development agencies for external development assistance, giving consideration to equity factors in the allocation of the available resources through external assistance.

Once the PPR is cleared, the State Government or the concerned Ministry/Department of the Central Government should submit a detailed project proposal (DPR). The DPR should adequately reflect following dimensions in measurable terms:

- Techno-economic features - economic viability, social cost benefit, value addition, etc.
- Ecological features - land use, ecological sustainability, etc.
- Socio-cultural features - target population and gender matters, participation, social impact, etc.
- Institutional features - institutional and organizational analysis, capacity building, training, etc.

An objective oriented project design in a matrix format along with work plan, cost and time schedule indicating target/output, cash flow statement, etc. should also be a part of DPR. The proposal of the State government should reach DEA through the Ministry concerned in the Central Government along with their appraisal/comments. DEA would process on the basis of the comments of the Central sectoral Ministry and Planning Commission. DPR should be submitted with the approval of the competent authority in the State Government. It should also have all the necessary statutory and non-statutory clearances.

⁷ There exist other approvals required for States of Jammu & Kashmir and/or North-Eastern region, but these have been omitted here.

3) Sovereign guarantees

The decision on providing sovereign guarantee is taken by the Budget Division who examine the proposal of providing sovereign guarantee on the basis of 'headroom' available under Fiscal Responsibility and Budget Management (FRBM) Rules. The FRBM Rules prescribe a cap of 0.5 % of GDP in any financial year on the quantum of guarantees that the Central Government can assume in the particular financial year. The 'headroom' thus created is consumed by the Central government in extending guarantees primarily on loans from multilateral/bilateral agencies, bond issues and other loans raised by various Public Sector Undertakings. For obtaining the final approval for sovereign guarantee, the concerned Central Public Enterprise/Financial Institution shall have to send request through their central administrative ministry to concerned Credit Section in DEA for forwarding the request to the Budget Division. The sovereign guarantees for externally aided projects are provided with guarantee fee at 1.2 % p.a. on the loan component, however, no guarantee fee is charged on the grant component. A back-to-back Counter-Guarantee Fee Agreement is signed between the Central Public Enterprise/Financial Institution and concerned central administrative ministry to ensure the terms and conditions specified by the Budget Division for providing sovereign guarantee.

2.1.4 Financial condition of State Power Utilities

Government of India has public sector enterprises in power sector among others:

- NTPC Limited was established in 1975 to develop thermal power projects, but it has forayed into generating electricity via hydro, nuclear and renewable energy sources.
- NHPC Limited is a hydropower generation company, incorporated in 1975 with an objective to plan, promote and organize an integrated and efficient development of hydroelectric power in all aspects. Later on NHPC expanded its objects to include other renewable energy sources like Solar, Geothermal, Tidal, Wind, etc.
- Power Grid Corporation of India Limited (PGCIL) was incorporated in 1989, in charge of planning, executing, owning, operating and maintaining high-voltage transmission systems in the country.

Report on Fourteenth Finance Commission analyzed the profile of the largest twenty-five Central public sector enterprises, and gave an illustrative categorization in terms of Net Turnover / Revenue for the year 2012-13. It may be seen that such categorization helps not only in indicating the scope for disinvestment but also suggests the importance of fresh investments. NTPC is positioned at No.7 and PGCIL at No.22 with respect to the amount of annual turnover, and both categorized as "High Priority", due to the fact that they are profit making firms and other aspects. It should be noted that the priority is not put only from a viewpoint of annual turnover, therefore, there are only nine firms categorized as "high priority".

Financial situation of power utilities under central government is shown in Tables 2.1.4-1, 2.1.4-2 and

2.1.4-3. Generally speaking any of these utilities has shown good performance in their financial position:

Table 2.1.4-1 Financial Statements of NTPC (Consolidated)

(unit: Crore)

	2011-12	2012-13	2013-14	2014-15	2015-16
Operating Income	65,893.68	67,952.89	78,921.66	80,622.04	78,705.50
Operating Expenses	53,559.70	55,017.59	64,010.27	68,674.37	65,695.75
Operating Profit	12,333.98	14,359.23	14,911.39	11,947.67	13,009.75
Profit before tax	13,137.26	16,610.95	14,485.76	10,456.21	10,103.54
Net Profit	9,814.66	12,586.22	11,403.40	9,992.37	10,162.43
Earnings per share*	11.90	15.27	13.83	12.11	12.35
DSCR**	3.21	3.17	2.77	2.27	1.66
ISCR**	9.81	10.39	8.62	5.54	4.96

*) Rupee/share of Rupee 10 each

***) Figures for 2011-2014 shows those for NTPC only (standalone)

source: Financial statements at NTPC website

Table 2.1.4-2 Financial Statements of NHPC Ltd. (Consolidated)

(unit: Lakh)

	2011-12	2012-13	2013-14	2014-15	2015-16
Operating Income	692,033	640,617	741,594	824,407	862,784
Operating Expenses	329,594	337,020	502,927	468,809	516,577
Operating Profit	362,439	303,597	238,667	355,598	346,207
Profit before tax	435,126	389,492	252,885	371,835	384,814
Net Profit	398,558	287,264	163,315	279,805	291,959
Earnings per share*	2.51	2.13	1.02	2.25	2.43
DSCR	3.81	3.88	2.28	3.48	2.96
ISCR	10.11	10.30	4.50	7.48	9.10

*) Rupee/share of Rupee 10 each

source: Financial statements at NHPC website

Table 2.1.4-3 Financial Statements of PGCIL (Consolidated)

(unit: Lakh)

	2011-12	2012-13	2013-14	2014-15	2015-16
Operating Income	1,044,046	1,316,390	1,567,543	1,765,851	2,135,232
Operating Expenses	438,526	537,785	653,346	775,283	904,981
Operating Profit	605,520	778,605	914,197	990,568	1,230,251
Profit before tax	468,966	577,563	635,900	639,898	764,495
Net Profit	330,299	431,261	454,758	504,625	601,456
Earnings per share*	7.14	9.32	9.47	9.64	11.50
DSCR**	2.25	2.28	2.14	2.04	1.98
ISCR**	5.14	4.73	4.5	4.06	3.87

*) Rupee/share of Rupee 10 each

***) Figures for PGCIL only (standalone)

source: Financial statements at PGCIL website

2.2 ELECTRICITY INDUSTRY AND ELECTRICITY REGULATION IN INDIA

2.2.1 Outline of electricity sector in India

(1) India's Administrative System for Electricity

The Central Government body that controls India's electricity business is the Ministry of Power (MoP), which carries out the formulation of electricity policies and regulations. In terms of the main government agencies under the Ministry of Power, there are such agencies as the Central Electricity Authority (CEA), which implements electricity policies and formulates technical standards for electricity, as well as the Bureau of Energy Efficiency (BEE), the independent agency that formulates and advances India's energy-saving policies. The main companies under the MoP's jurisdiction are thermal power generation companies, hydro power generation companies, transmission companies, and power-focused finance companies.

The Central Government agencies involved in fuel for electricity generation are the Ministry of Petroleum and Natural Gas (MoPN), the Ministry of Coal (MoC), and the Ministry of New and Renewable Energy (MNRE). The Department of Atomic Energy (DoA), which is under the direct jurisdiction of the Prime Minister, is in charge of nuclear power.

In terms of states, the energy departments of state governments are in charge of the electricity businesses within states.

The Electricity Regulatory Commissions (ERCs) are the agencies that implement electricity regulations such as electricity tariff determination and the issuing of licenses. The ERCs consist of the Central Electricity Regulatory Commission (CERC) and the State Electricity Regulatory Commissions (SERCs). The CERC is under MoP jurisdiction and is in charge of companies that are owned or controlled by the Central Government and inter-state electricity companies, while the SERCs are under the jurisdiction of state energy departments, and control only the electricity businesses within states.

(2) India's Major Electricity Companies

The players in India's electricity sector are made up of the Central Government, the state governments, and the private sector. The Central Government is responsible for power plants connected with inter-state transmission lines, otherwise, the State Governments are responsible for power plants dedicated to within their demand. The roles of each player are organized as shown below largely.

Table 2.2.1-1 Role of Indian Electricity Players (Outline)

Business	Central	State	Private
Generation	Large Scale Thermal Large Scale Hydro Nuclear	Medium-Small Thermal Medium-Small Hydro	Other than Nuclear
Transmission	○	○	○
Distribution	-	○	○

The number of electricity companies as of March, 2013 is shown below.⁸

State Electricity Board (Vertically integrated)	2 states ⁹
Generation/ Transmission/ Distribution Undertakings	106 companies
Private sector (Generation)	59 companies
Private sector (Distribution)	22 companies
Private sector (Generation & Distribution)	9 companies
Power Trading Companies	42 companies

In terms of the major generation companies, there are the National Thermal Power Corporation (NTPC) and the National Hydroelectric Power Corporation (NHPC), which are under the jurisdiction of the MoP, and Essar Power, Adani Power, Tata Power, Torrent Power, and Reliance Energy, which are in the private sector.

With regard to transmission, state transmission companies handle matters within those states, but the Power Grid Corporation, which is under the jurisdiction of the MoP, handles the inter-state transmission business. The Power Grid Corporation operates the National Load Despatch Centre (NLDC) and the Regional Load Despatch Centres (RLDCs).

(3) Electricity Demand Outlook in India

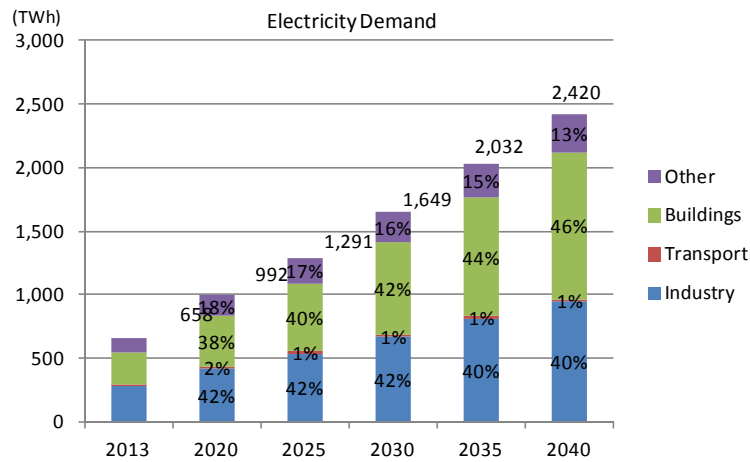
1) Electricity Demand Outlook in India

The outlook for India's electricity demand according to the IEA's World Energy Outlook 2015 (Appendix 2-64) is shown below.

It is predicted that India's electricity demand will increase at an annual average of 4.9% from the figure of 658TWh in 2013, and will reach 2,420TWh in 2040. Looking at the annual average growth rates from 2013 to 2040 by sector, the prediction is 4.6% for industry, 2.5% for transport, and 5.8% for buildings. The electricity demand for buildings is greatly boosting India's electricity demand.

⁸ All India Electricity Statistics General Review 2014

⁹ These are the states of Kerala and Jharkhand, but Jharkhand SEB was unbundled in 2014.



source: New Policy Scenario, World Energy Outlook 2015, IEA (Appendix 2-64)

Figure 2.2.1-1 Electricity Demand Outlook in India

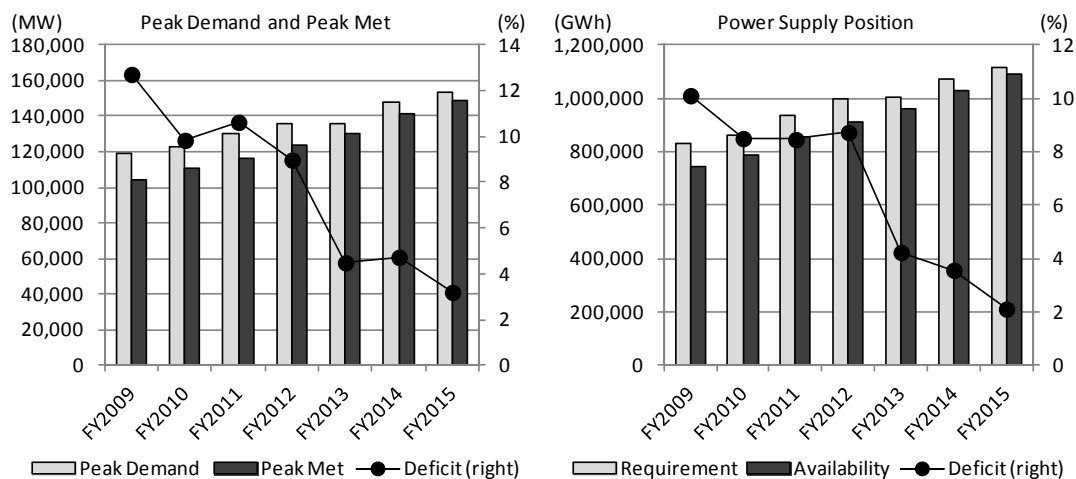
2) Current State of the Electricity Supply Position

The below figures show the situation of the electricity supply position both for India as a whole and by region. In the past, there was around a 10% deficit for both peak demand and energy, but since FY 2013, the situation has become greatly mitigated. Looking at this by region, there were great improvements in both the western region and the southern region, where both peak demand and energy had reached a deficit near 0% by FY 2015.

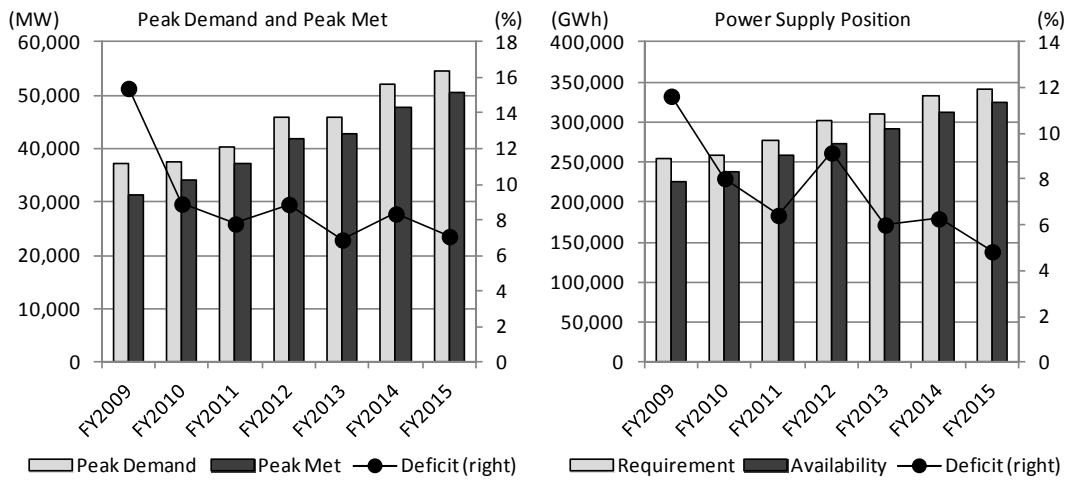
This situation continues even after entering FY 2016, and as of June, 2016, the deficit for India as a whole is 2% for peak demand and 0.9% for energy. Looking at this regionally, the regions with deficits greater than 1% are the northern region for peak demand, and the northern region and the north-eastern region for energy.

It should be noted that those not having access to electricity and those demand from them – latent demand – is not included in demand calculations of the CEA data.

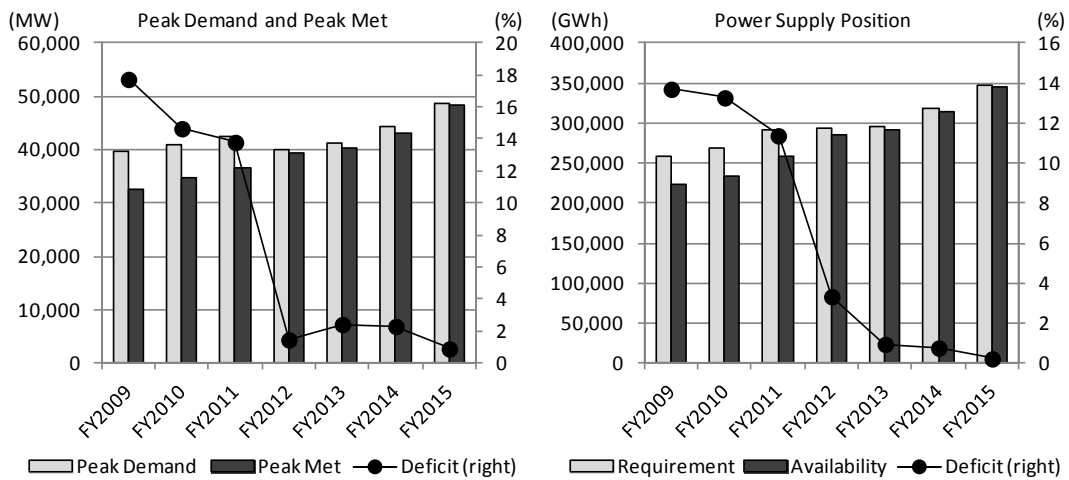
All India



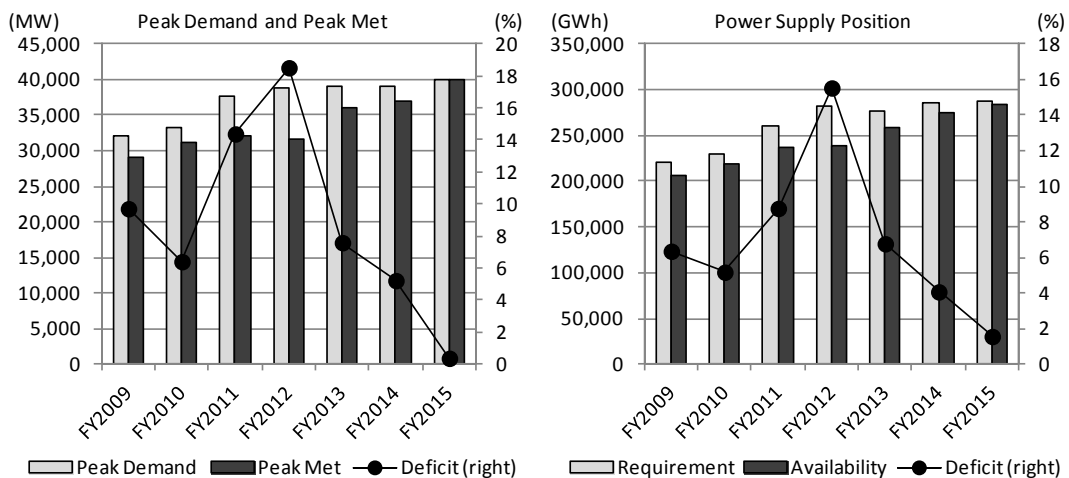
Northern Region



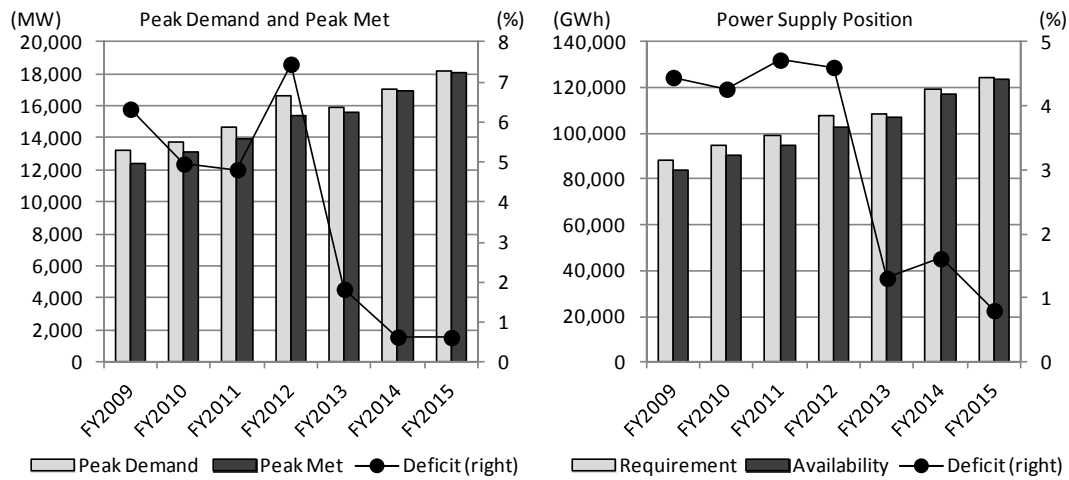
Western Region



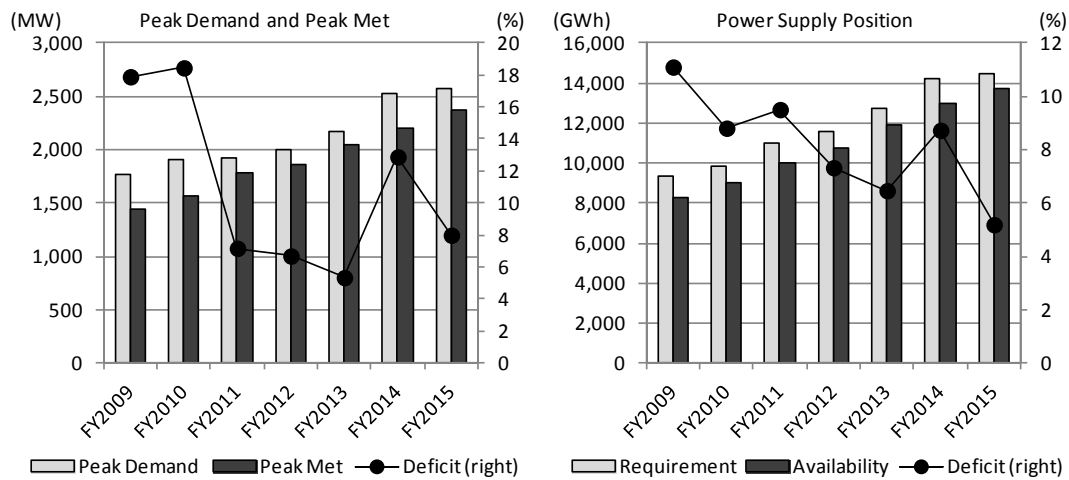
Southern Region



Eastern Region



North-Eastern Region



source: Power Supply Positions, CEA Monthly Report (Appendix 2-1~14)

Figure 2.2.1-2 Power Supply Position in India (Peak and Energy)

3) Generation Capacity

The below figures show the situation regarding generation capacity by both sector and fuel from the end of March, 2012 to the end of March, 2016. For India as a whole, the generation capacity has gone from 200GW to 298GW in a span of five years, an increase of 98GW, or roughly 50%.

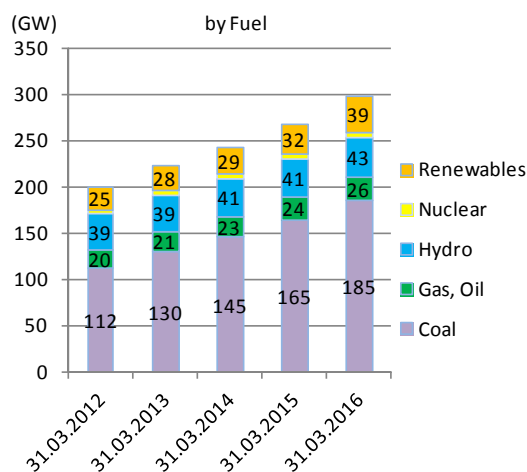
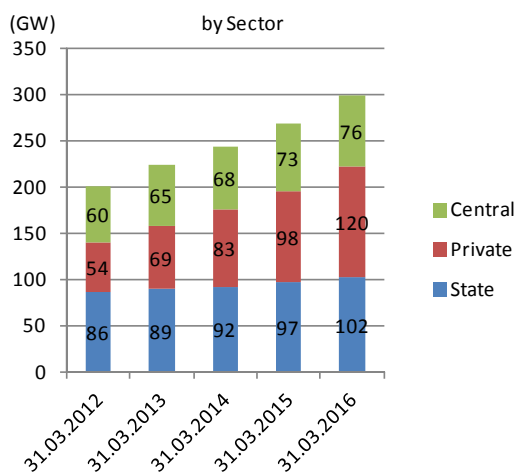
Looking at this by sector, the capacity for state governments has gone from 86GW to 102GW, an increase of 16GW, or just under 20%. The private sector has gone from 54GW to 120GW, an increase of 66GW, or over 120%. The Central Government has gone from 60GW to 76GW, an increase of 16GW, or 27%. The private sector accounted for roughly two-thirds of the increase in the generation capacity of India as a whole. The Ultra Mega Power Projects (UMPPs), which the MoP began in FY 2005, are one major factor for the increase in the private sector's generation capacity. These are projects in which coal-fired power plants with generation capacities of over

4GW per location are constructed in the mine openings of coal mines and in coastal areas. The system is such that mainly the private sector participates through bids. UMPPs have been allocated in 4 locations, ie., Mundra in Gujarat (Tata Power), Sasan in Madhya Pradesh (Reliance Power), Krishpattnam in Andhra Pradesh (ditto) and Tilaya in Jharkhand (ditto) but are currently in operation in two locations in Mundra and Sasan. Although UMPP was expected, it remains at the current two projects, and now the necessity is being debated.

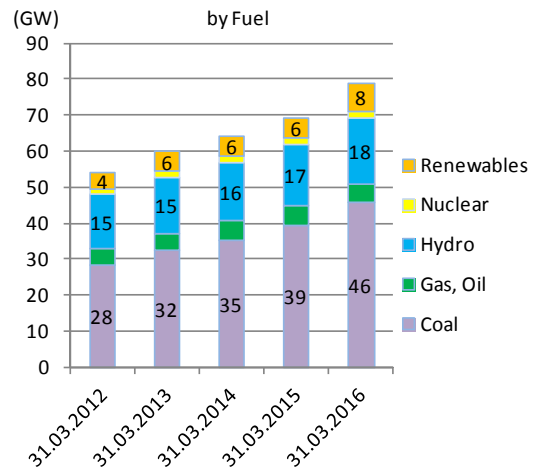
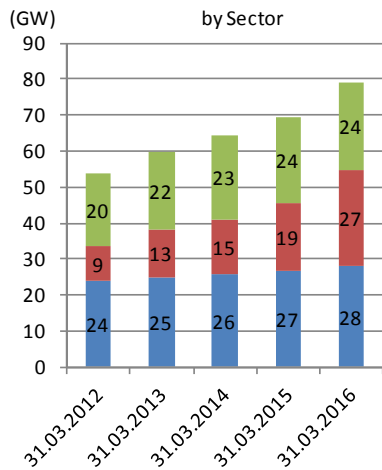
Looking at this by fuel, coal went from 112GW to 185GW, an increase of 73GW, or 65%. Natural gas/oil went from 20GW to 26GW, an increase of 6GW, or 30%. Hydroelectric power went from 39GW to 43GW, an increase of 4GW, or 10%. Nuclear power went from 25GW to 39GW, an increase of 14GW, or 56%. Coal accounted for roughly three-fourths of the increase in the generation capacity of India as a whole.

Looking at this by region (including the allocation from the Central Government), the northern region went from 54GW to 79GW, an increase of 25GW, or 46%. The western region went from 64GW to 106GW, an increase of 42GW, or 66%. The southern region went from 53GW to 74GW, an increase of 21GW, or 40%. The eastern region went from 26GW to 36GW, an increase of 10GW, or 38%. The north-eastern region went from 2.5GW to 3.5GW, an increase of 1GW, or 40%. In terms of the proportion of the generation capacity increase of India as a whole, the northern region accounted for 25%, the western region accounted for 43%, the southern region accounted for 21%, and the eastern region accounted for 10%.

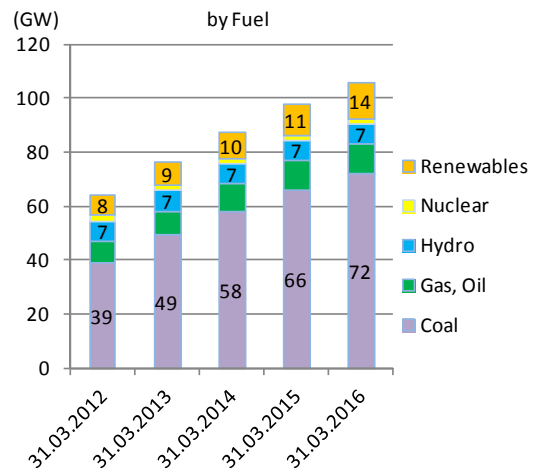
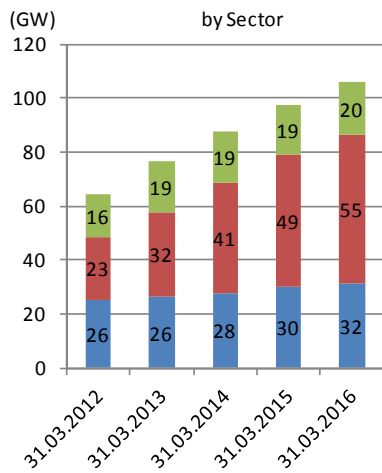
All India



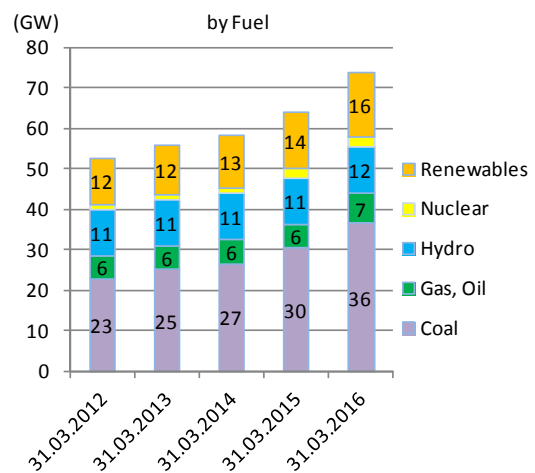
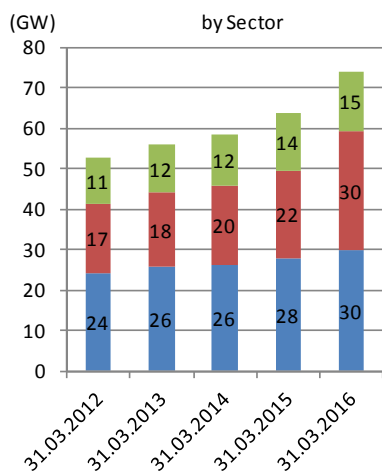
Northern Region



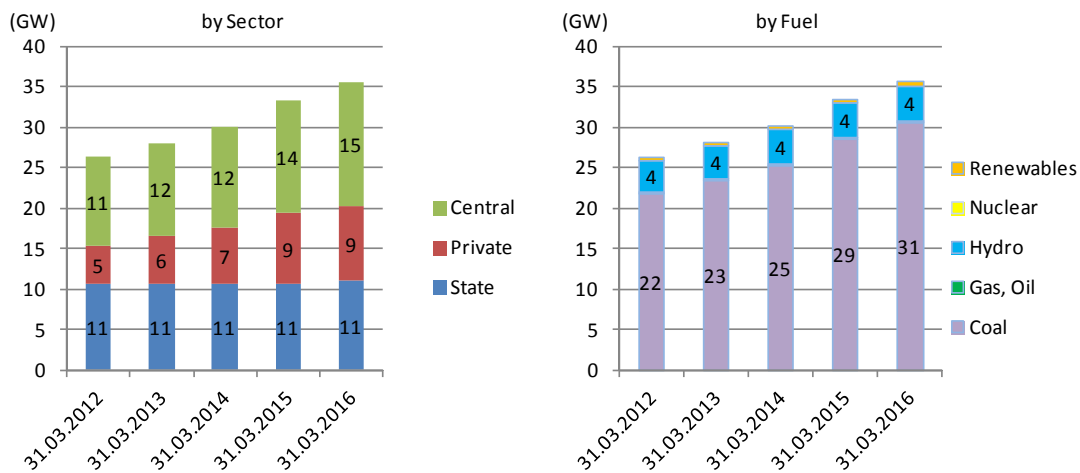
Western Region



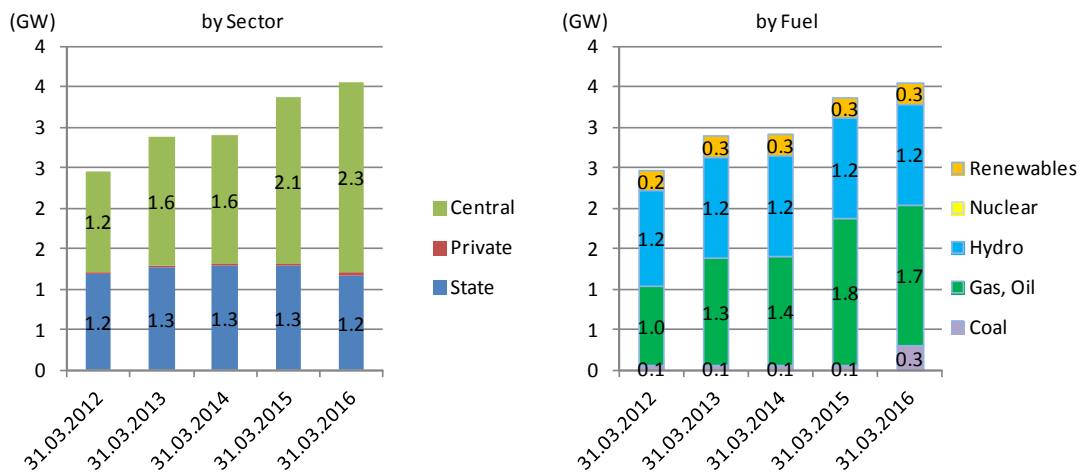
Southern Region



Eastern Region



North-Eastern Region

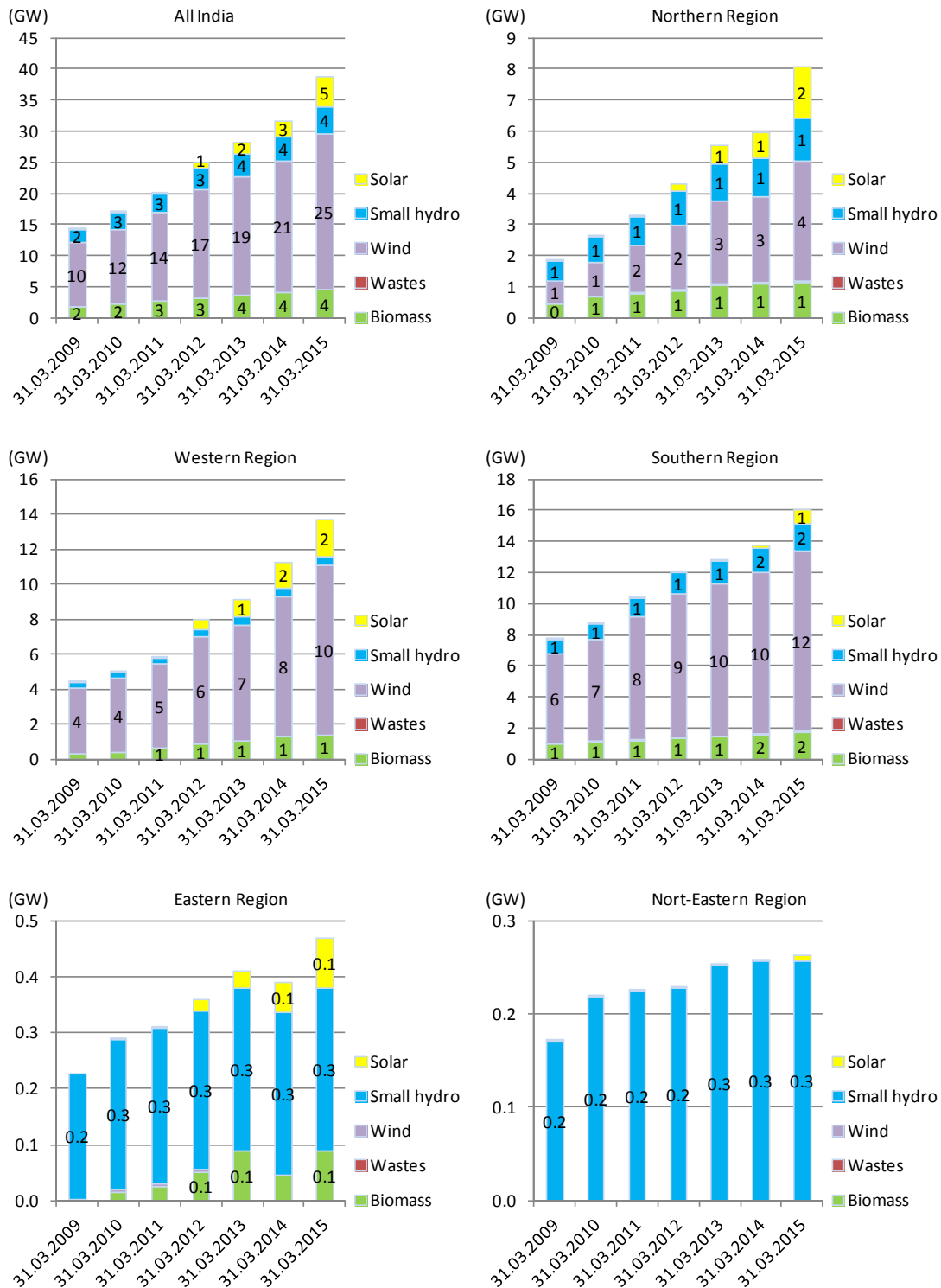


source: Executive Summary, CEA Monthly Report (Appendix 2-15~19)

Figure 2.2.1-3 Power Generation capacity in India

The below figures indicate the changes in the non-conventional renewable power generation capacity under MNRE's jurisdiction from the end of March, 2009 to the end of March, 2015. For India as a whole, at the end of March, 2009, the capacity was 14GW, but that figure grew to 39GW by the end of March, 2015, an increase of 25GW, or roughly 180%. Looking at this by fuel, there is a high proportion of wind, but in recent years, solar PV has been increasing rapidly.

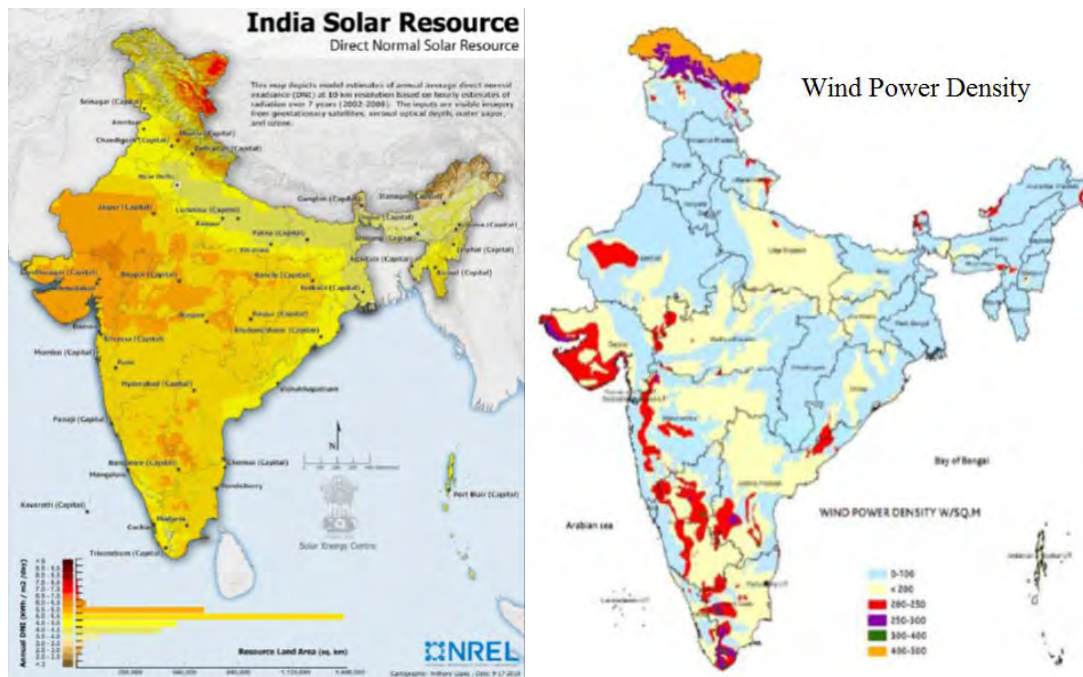
Looking at this by region, the northern region, the western region, and the southern region account for 97% of the non-conventional renewable power generation capacity of India as a whole.



source: Energy Statistics 2011-2016, Ministry of Statistics and Programme Implementation, GOI (Appendix 2-20~25)

Figure 2.2.1-4 Non-Conventional Renewable Power Generation Capacity in India

Figures showing the distribution of India's solar resources and wind power density are shown below.



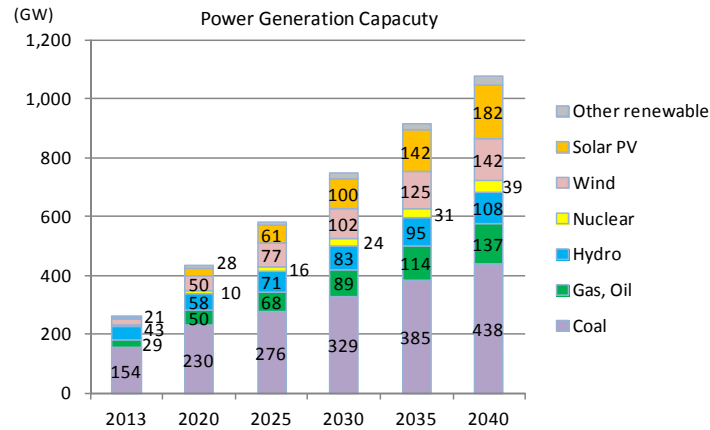
source: Energy Statistics 2011, 2012, Ministry of Statistics and Programme Implementation, GOI (Appendix 2-20 ~21)

Figure 2.2.1-5 Solar Resources and Wind Power Density in India

The below figures show India's predicted generation capacity according to the IEA's World Energy Outlook 2015 (Appendix 2-64). One of the policy assumptions in New Policy Scenario includes the target to reach 175 GW of installed renewable capacity (excluding large hydro) by 2022.

It is predicted that India's generation capacity, which was 263GW in 2013, will reach 1,076GW in 2040.

In 2040, the fuel with the greatest generation capacity will be coal, with 438GW. Coal accounted for roughly 60% of the generation capacity in 2013, but it is predicted that by 2040, it will become roughly 40%. Meanwhile, it is predicted that solar PV and wind will greatly increase, with solar PV going from 3GW in 2013 to 182GW in 2040 and wind similarly going from 21GW to 142GW.



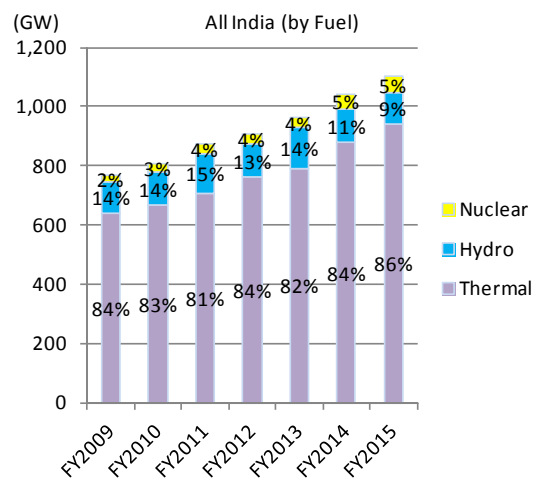
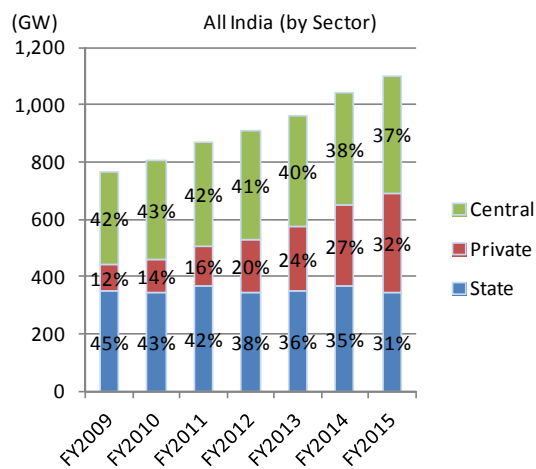
source: New Policy Scenario, World Energy Outlook 2015, IEA (Appendix 2-64)

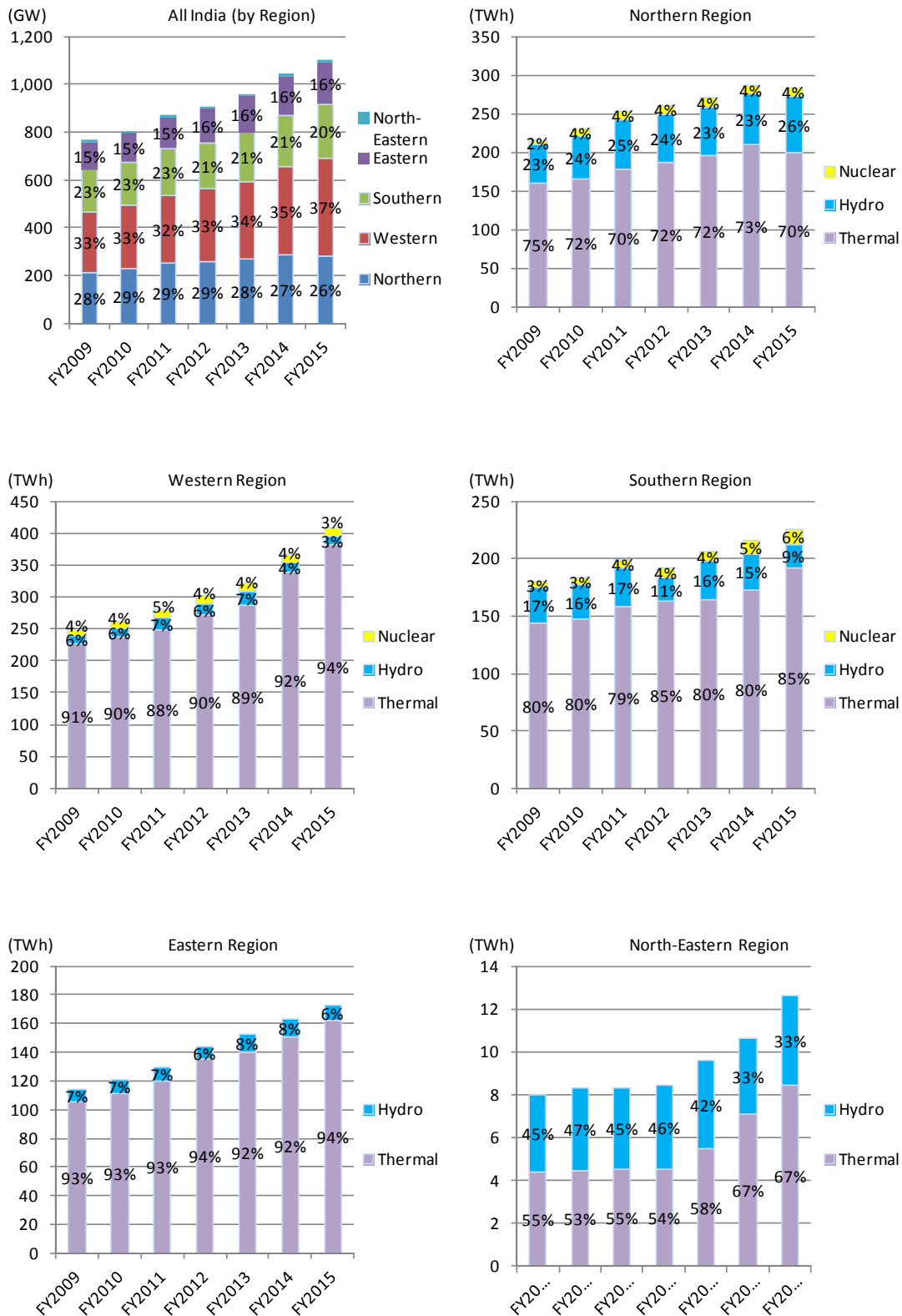
Figure 2.2.1-6 Power Generation Capacity Outlook in India

4) Power Generation

The below figures show the changes in India's power generation (with the exception of non-conventional renewable power generation under MNRE's jurisdiction) from FY 2009 to FY 2015 by sector and fuel. The power generation for India as a whole went from 766TWh in FY 2009 to 1,103TWh in FY 2015, an increase of 337TWh, or 44%. Looking at this by sector, the power generation in the private sector has greatly increased, with the generation ratios of state governments, the private sector, and the Central Government being nearly equivalent in FY 2015. Looking at this by fuel, the share of coal exceeds 80%.

Looking at the shares of the generated amount in FY 2015, the western region had the highest share with 37%, with the northern region coming next with 26%, followed by the southern region with 20% and the eastern region with 16%. Looking at this by region and fuel, the share of coal is in the 90% range in the western region and the eastern region, in the 80% range in the southern region, and in the 70% range in the northern region.

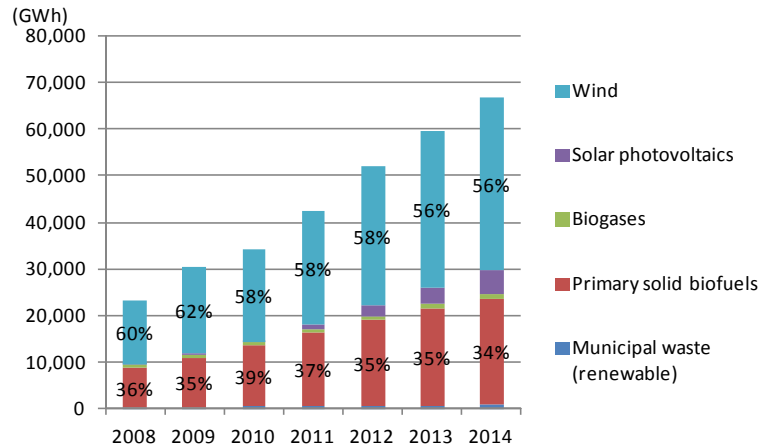




source: Generation Review, CEA Monthly Report (Appendix 2-26-32)

Figure 2.2.1-7 Power Generation in India (excluding Non-Conventional Renewables)

Based on the IEA's statistics, the below figure looks at the changes in power generation from renewable energy, with the exception of hydroelectric power, from 2008 to 2014. The renewable energy power generation for India as a whole, with the exception of hydroelectric power, went from 23TWh in 2008 to 67TWh in 2014, an increase of 44TWh, or almost 190%. Looking at this by fuel, the share of biomass and wind combined was 90%.



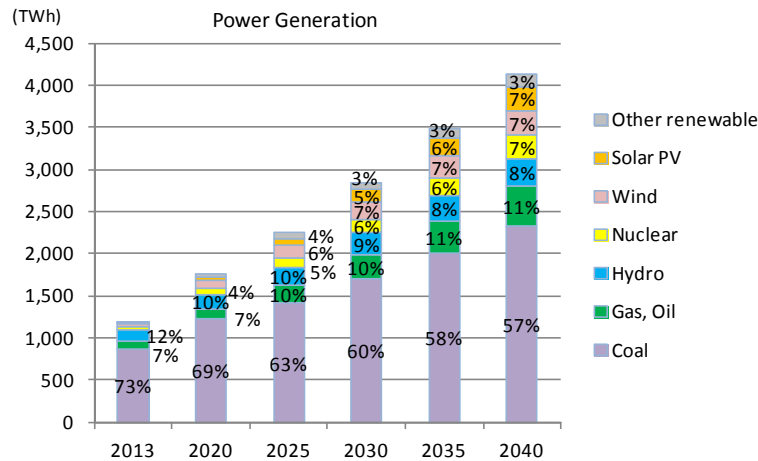
source: World Energy Balances 2016, IEA database

Figure 2.2.1-8 Non-Conventional Renewable Power Generation in India (excluding Hydro)

The below figure shows India's predicted power generation according to the IEA's World Energy Outlook 2015 (Appendix 2-64).

It is predicted that India's power generation, which was 1,193TWh in 2013, will experience an average annual increase of 4.7%, reaching 4,124TWh in 2040.

Comparing the shares by fuel in 2013 and 2040, it is predicted that coal will decrease from 73% to 57%, natural gas/oil will increase from 7% to 11%, hydroelectric power will decrease from 12% to 8%, and nuclear power will increase from 3% to 7%. Meanwhile, looking at non-conventional renewable energy in the same fashion, it is predicted that solar PV will increase from 0.3% to 7%, and wind will increase from 3% to 7%.



source: New Policy Scenario, World Energy Outlook 2015, IEA (Appendix 2-64)

Figure 2.2.1-9 Power Generation Outlook in India

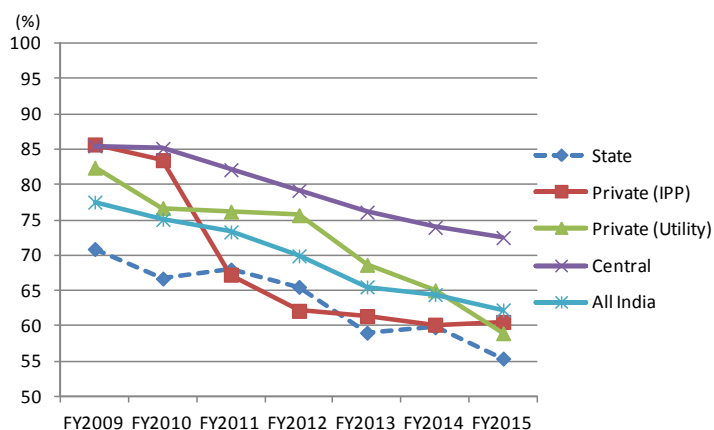
5) Annual Plant Load Factor of Coal-Fired Power Plants

The below figures show India's annual plant load factor for coal-fired power plants from FY 2009 to FY 2015.

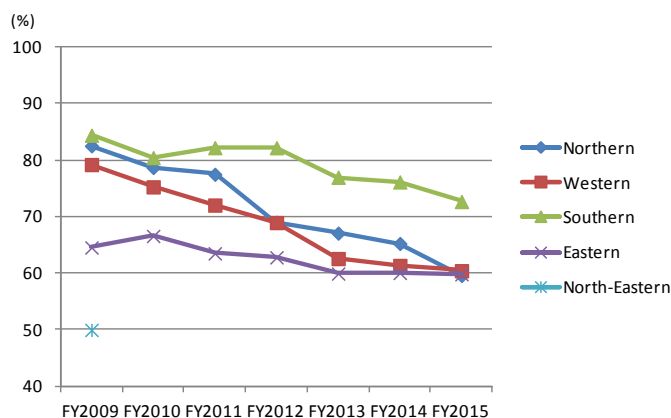
The annual plant load factor for coal-fired power plants is in a decreasing trend for all sectors. In addition, looking at this by region as well, the annual plant load factor for coal-fired power plants is in a decreasing trend in all regions.

In the past, it had been noted that was due to the insufficient coal linkages/allocations to generators, unwillingness of debt distributors to offtake powers. However the background for the recent trend is said that despite a rapid increase in generation capacity, the peak demand and energy did not greatly increase. Looking at the generation capacity of India as a whole, while the figure increased by 149%, going from 200GW in March, 2012 to 298GW at the end of March, 2016, the peak demand only increased by 118%, going from 130GW in FY 2011 to 153 GW in FY 2015, and the energy only increased by 119%, going from 937GWh in FY 2011 to 1,114GWh in FY 2015.

All India



By Region



note: North-Eastern Region: Data is not available from FY2010.
 source: Generation Review, CEA Monthly Report (Appendix 2-54)

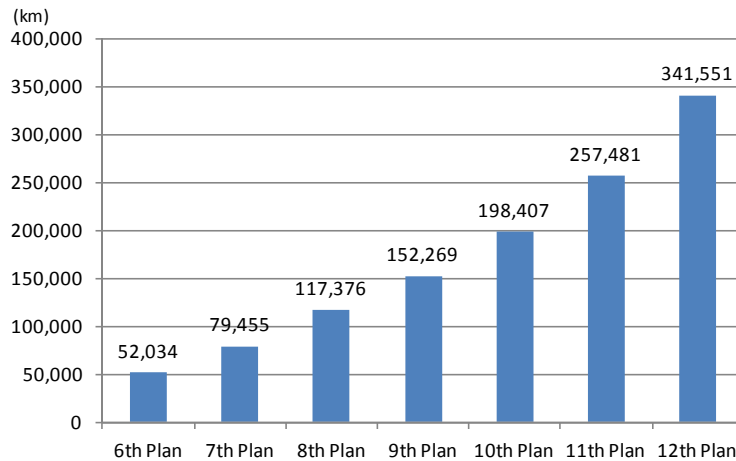
Figure 2.2.1-10 Coal-fired power plant Load Factor in India

6) Transmission

According to the MoP¹⁰, there are 36 state transmission companies and 1 central transmission company in India.

The below figure shows the installation distance by voltage from the end of the 6th Five Year Plan to the end of March, 2016. The total transmission line distance for all voltages was 52,034km at the end of the 6th Five Year Plan, but it increased to 79,455km at the end of the 7th Five Year Plan (an increase of 27,421km), 117,376km at the end of the 8th Five Year Plan (an increase of 37,921km), 152,269km at the end of the 9th Five Year Plan (an increase of 34,893km), 198,407km at the end of the 10th Five Year Plan (an increase of 46,138km), 257,481km at the end of the 11th Five Year Plan (an increase of 59,074km), and 341,551km at the end of the 12th Five Year Plan (an increase of 84,070km).

¹⁰ <http://powermin.nic.in/en/content/transmission-companies>



note: 12th Plan: up to March 2016

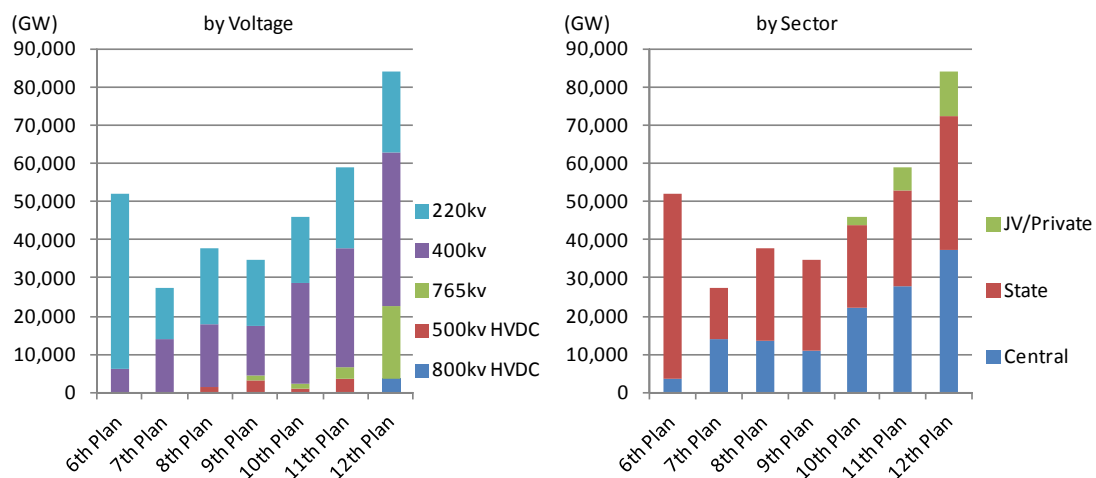
source: Transmission Reports, CEA Monthly Report (Appendix 2-54)

Figure 2.2.1-11 Progress of Transmission Lines in India (Cumulative)

The below figures show the transmission line distances added in each Five Year Plan.

±500kv HVDC lines were introduced in the 8th Five Year Plan, and ±800kv HVDC lines were introduced in the 12th Five Year Plan.

Looking at this by sector, the state governments were previously the main bodies that prepared transmission lines, but in recent years, the role of the Central Government has increased. With the objective of developing and strengthening the transmission system through private participation, the MoP is deploying independent transmission projects through a tariff-based competitive bidding process, and transmission line preparation has also been taking place through joint ventures and the private sector since the 10th Five Year Plan. Sterlite Power Transmission Limited is a company that is participating in transmission projects in the private sector.



source: Transmission Reports, CEA Monthly Report (Appendix 2-54)

Figure 2.2.1-12 New Transmission Line addition in Each Five Year Plan

7) Distribution

Distribution is subject to the exclusive jurisdiction of state governments, but the Central Government provides varied support for aspects such as efficiency improvements in the distribution field.

- Integrated Power Development Scheme (IPDS)
 - ✓ Strengthening of sub-transmission and distribution networks in the urban areas
 - ✓ Metering of distribution transformers / feeders / consumers in the urban area
 - ✓ IT enablement of distribution sector and strengthening of distribution network
- Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY)
 - ✓ Separation of agriculture and non-agriculture feeders
 - ✓ Strengthening of sub-transmission and distribution networks in the rural areas
 - ✓ Metering of distribution transformers / feeders / consumers in the rural area
 - ✓ Rural Electrification
- National Electricity Fund (NEF)
 - ✓ To promote investment in the distribution sector, GoI has set up National Electricity Fund (Interest Subsidy Scheme) in March 2012 to provide interest subsidy on loans disbursed to the Distribution Companies (DISCOMS) – both in public and private sector, to improve the distribution network for areas not covered by RGGVY and R-APDRP project areas.
- Financial Restructuring Scheme
 - ✓ Several attempts were made by UPA in the past to improve the deficits of distribution companies. In October 2012, when the total debt of discoms was 2.4 lakh crore, Government of India (UPA) notified the scheme for Financial Restructuring of State Distribution Companies (Discoms) for achieving their financial turnaround by restructuring their short term liabilities with support through a Transitional Finance Mechanism from Central Government (the Financial Restructuring Package (FRP)). In the scheme, the states were asked to take 50% outstanding short-term liabilities, whereas discoms were asked to issue bonds backed by the state governments, and the states were asked to rationalize tariffs. This scheme did not work as expected as there were no strict penalties for non-compliance of the state government and many discoms increased debts without outstanding regular tariff hikes.
 - ✓ In 2015, government of India (BJP) has initiated a new restructuring scheme (Ujwal DISCOM Assurance Yojana (UDAY)). It is the financial turnaround and revival package for discoms with the intent to find a permanent solution to the financial deficit. It allows state governments to take over 75 percent of their debt as of September 30, 2015, and pay back lenders by selling bonds. Discoms are expected to issue bonds for the remaining 25 percent of their debt. Discoms must comply with the Renewable Purchase Obligation (RPO) and must perform as per operational milestones such as tariff hikes and AT&C loss reductions. Such States meeting requirements shall accept

additional coal at notified prices and low cost power from NTPC and other Central Public Sector Undertakings (CPSUs), and States not meeting operational milestones shall be liable to forfeit their claim on IPDS and DDUGJY grants.

The UDAY is still underway.

a) The Situation of Electrification in Rural Areas

The proportion of electrified villages at the end of each fiscal year (the end of March) is shown below. As of the end of FY 2015 (March, 2016), the proportion of electrified villages has reached 98.1%¹¹.

Table 2.2.1-2 Villages electrified in India

	FY2010	FY2011	FY2012	FY2013	FY2015	FY2015
Villages electrified	92.1%	93.9%	95.9%	96.5%	96.9%	98.1%

source: Electrification Report, CEA (Appendix 2-55-59)

However, the above table illustrates the proportion of electrified villages, and does not indicate that all residents in the electrified areas are able to access electricity. According to the IEA, the situation is such that as of the end of 2013, there are still over 200 million citizens who are unable to access electricity, as shown in the below table.

Table 2.2.1-3 Electricity Access in India

Description	2011	2013
Population without electricity (million)	306.1	237.4
National Electrification rate	75%	81%
Urban electrification rate	94%	96%
Rural electrification rate	67%	74%

source: Electricity Access Database, World Energy Outlook 2013 & 2015, IEA (Appendix 2-60-61)

b) State-Run Distribution Company (DISCOM) Ratings

From 2013 the MoP has been contracting a rating company and assigning ratings to 40 state-run DISCOMs in 21 states. It was intended to help banks and other financial institutions lending to discoms to guess their financial risks as the utilities were under heavy financial crunch at the time of Financial Restructuring Package (FRP). An overview of the 4th survey, which was presented in June, 2016, is shown below. Note that even for the three highest-ranking companies, there is still support from state governments.

¹¹ Definition of "Villages electrified": see the section '2.3.5 Rural Electrification: DDUGJY.'

Table 2.2.1-4 Grading scale and grades of state DISCOMs

Score Distribution	Grade	No. of Utilities	States	Grading Definition
Between 80 and 100	A+	3	GJ (DGVCL, MGVCL, UGVCL)	Very High Operational and Financial Performance Capability
Between 65 and 80	A	6	KN (MESCOM, BESCOM, CHESCOM), UK(UT.PCL) TS(TSSPDCL)	High Operational and Financial Performance Capability
Between 50 and 65	B+	10	PJ (PSEB), HP(HPSEB), AP(APEPDCL), CH(CSPDCL), MS(MSEDCL), WB(WBSEDCL), TS(TSNPDCL) BH(SBPDCL), KR(KSEB), KN(HESCOM)	Moderate Operational and Financial Performance Capability
Between 35 and 50	B	8	MP(MP Purv Keshetra VVCL, MP Mad Keshetra VVCL), AP(APSPDCL), AS(APDCL), BH(NBPDCL), UP(Pash VVNL), KN(GESCOM)	Below Average Operational and Financial Performance Capability
Between 20 and 35	C+	8	HA(DHBNL), UP(KESCO, DVVNL), RJ(JDVVNL), HA(UHBNL), RJ(AVVNL, JVVNL), TN(TANGEDCO),	Low Operational and Financial Performance Capability
Between 0 and 20	C	5	TR(TSECL), JH(JBVNL), UP(PVVNL, MVVNL), Me(MPDCL)	Very Low Operational and Financial Performance Capability

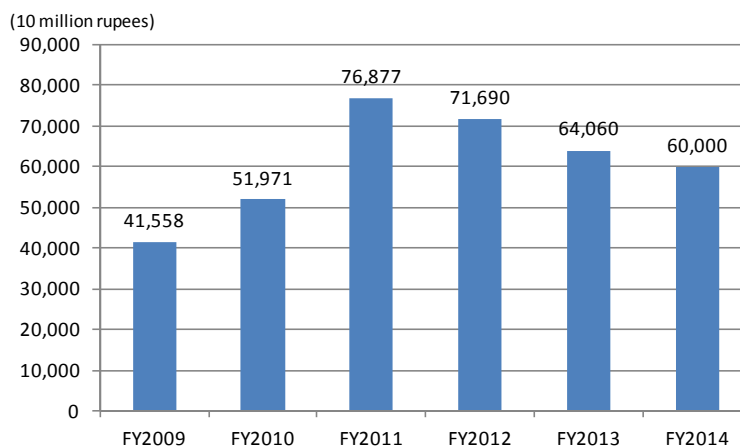
source: State Distribution Utilities Fourth Annual Integrated Rating, Ministry of Power, June 2016 (Appendix 2-65)

c) Plan to Improve the Accumulated Deficit of DISCOMs

In India, tariffs for the agricultural industry are held to low levels as a matter of policy, and as the DISCOMs in each state are forced to have a tariff system that operates at a loss, the structure is such that many companies fall into a deficit. For this reason, DISCOMs that are in deficits are unable to purchase sufficient electricity to fulfill demand, and as a result, an irrational vicious cycle continues in which outages occur despite there being a surplus of power at power plants.

The losses of DISCOMs from FY 2009 to FY 2014 are shown in the below figure. The total losses over the past six years have reached 3,662 billion rupees,¹² despite the state Discom Financial Restructuring Package (FRP) by former NPL government in 2003 and 2012.

¹² Total loss 4.9 Lakh Crores at March 2015 (Financial Cronicles, Oct.29, 2015)



source: Towards UjwalBharat UDAY: The Story of Reform, November 2015, MOP, MOC, MNRE (Appendix 2-66)

Figure 2.2.1-13 Annual DISCOM losses and debt

For this reason, in succession of the Financial Restructuring Package (FRP) by former NPL government, in November, 2015, the BJP government presented the UDAY Programme, which aims to improve the total deficits of state DISCOMs. Under this program, state governments take over 75% of the debt amount of DISCOMs as of the end of September, 2015, and securitize and sell it over two years. The DISCOMs themselves securitize and sell the remaining 25%. As of June, 2016, 20 states have expressed the intention to participate in UDAY, and of these, 12 states have entered into agreements. The Central Government has extended the deadline for states to participate in UDAY to March, 2017, and is appealing to the remaining states to participate.

The prospect has been released that discoms of 15 states joined the UDAY would more than halve to 28 paise/U by FY 2019 from 64 paise in FY2016, thus the aggregate losses of these discoms will decline 46% to Rs 20,000 crore from Rs 37,000 crore.¹³

As of December, 2016, a total of 18 states so far (*) have entered the MOU (Jharkhand, Rajasthan, Uttar Pradesh, Gujarat, Bihar, Punjab, Jammu & Kashmir, Haryana, Uttarkhand, Goa, Karnataka, Andhra Pradesh, Chattisgarh, Madhya Pradesh, Himachal Pradesh, Maharashtra, Puducherry, Manipur). The PSP targeted states of the Study, West Bengal, Odisha, Telangana, Tamil Nadu, and Kerala haven't made MOU yet.

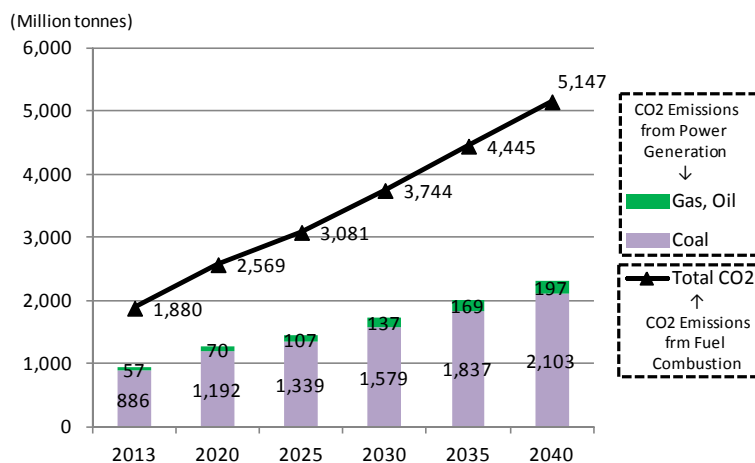
(*However, as on January 2017, Telangana and Assam joined UDAY (as on 4th Jan., 2017). Also, Tamil Nadu joined MOU as on 9th Jan., 2017 as 21st state,)

8) Outlook for CO₂ Emission Amount Due to Generation

The below figure shows the predicted CO₂ emissions from power generation according to the IEA's World Energy Outlook 2015 (Appendix 2-64).

¹³ Business Standard, Oct 20th, 2016

It is predicted that the CO₂ emissions from fuel combustion will increase from 1.88 billion tons in 2013 to 5.147 billion tons in 2040. Of this, the CO₂ emissions from power generation is predicted to increase from 943 million tons in 2013 to 2.3 billion tons in 2040. It is predicted that the share of power generation within the CO₂ emissions from fuel combustion will fall from 50% in 2013 to 45% in 2040. This is due to an increase in the share of non-fossil fuels within generation mix in 2040 compared to 2013.



source: New Policy Scenario, World Energy Outlook 2015, IEA, (note: New Policy Scenario as Central case in India showing 7.5% GDP growth until 2020, 6.3% by 2030s). (Appendix 2-64)

Figure 2.2.1-14 CO₂ Emissions Outlook in India

2.2.2 Regulations of India's Electricity Sector

(1) Past Regulations of India's Electricity Business

Prior to India's independence from Great Britain, the country's electricity business was regulated by The Indian Electricity Act, 1910. The Indian Electricity Act, 1910 was a fundamental framework for the provision of electricity, and prescribed the growth of the electricity sector through the private sector. Accordingly, the private sector was the main constituent of India's electricity industry prior to the country's independence.

In 1947, India gained its independence as a socialist nation. Following this, through The Electricity (Supply) Act, which was enacted in 1948, the State Electricity Board (SEB), in which the steps from generation to distribution were vertically integrated, assumed control of the electricity industry. Legislative reform was conducted in 1975, and it became possible for the Central Government to participate in the generation business. In 1990, the Gulf War, which would become a great turning point, broke out. As it became difficult to work in the Middle East due to the Gulf War, the Indian economy was dealt a blow, and the government at that time began to open the economy, which had to that point been insular, to the outside. In reforms in 1991, generation by the private sector became possible, and at the same time, the Regional Load Despatch Centres were established. In reforms in 1998, private sector participation in the field of transmission became possible. Further, through The

Electricity Regulatory Commissions Act, which was enacted in 1998, the Central Electricity Regulatory Commission (CERC) and the State Electricity Regulatory Commissions (SERCs) were established, and the right to electricity tariff determination was granted.

In addition, electricity reform laws were also enacted in some states.

However, with the laws that had been enacted to that point concerning electricity regulation, it was no longer possible to deal with the below issues.¹⁴

- Requirement of harmonizing and rationalizing the provisions in the existing laws to create competitive environment for benchmark competition which will result in enhancing quality and reliability of service to consumer.
- Distancing regulatory responsibilities of Government.
- Reform legislation by several States separately.
- Obviating need for individual States to enact their own reform laws.
- Requirement of introducing newer concepts like power trading, open access, Appellate Tribunal etc.
- Special provision for the Rural areas.

(2) India's Current Electricity Business Regulations (Electricity Act 2003)

In order to address the above-stated problems with the regulations in the electricity sector in India, an act was newly enacted in 2003 to regulate the electricity sector in India. Electricity Act 2003 regulates the electricity business not only for the Central Government, but for state governments as well, and stipulates aspects such as the roles and authority of the Central Government, state governments, and government agencies. A main overview of Electricity Act 2003 (Appendix 2-68) is contained below.¹⁵

1) Roles of Government

- Central Government to prepare National Electricity Policy and Tariff Policy.
- Central Govt. to notify a National Policy for rural areas permitting stand alone systems based on renewal and Non-Conventional energy sources in consultation with States.
- Central Govt. to formulate a National Policy in consultation with the concerned State Govts. for bulk purchase of power and management of local distribution through Users' Association, Cooperatives, Franchisees and Panchayat Institutions etc.

2) Rural Electrification

- Appropriate Govt to endeavor to extend supply of electricity to all villages/hamlets.
- No requirement of licence if a person intends to generate and distribute power in rural area.

3) Licenses

a) Generation

¹⁴ Main Features of Electricity Act, 2003, MoP <http://powermin.nic.in/en/content/electricity-act-2003>

¹⁵ Main Features of Electricity Act, 2003, MoP <http://powermin.nic.in/en/content/electricity-act-2003>

- Generation free from licensing.
 - Requirement of TEC for non-hydro generation done away with.¹⁶
 - Captive Generation is free from controls. Open access to Captive generating plants subject to availability of transmission facility.
 - Clearance of CEA for hydro projects required. Necessary due to concern of dam safety and inter-State issues.
 - Generation from Non-Conventional Sources / Co-generation to be promoted. Minimum percentage of purchase of power from renewables may be prescribed by Regulatory Commissions.
- b) Transmission
- Transmission companies to be licensed by the Appropriate Commission. The CERC issues licenses for companies that are owned or controlled by the Central Government and businesses engaged in the inter-state transmission of electricity, and the SERCs issue licenses for businesses that are only within a state.
 - There would be Transmission Utility at the Centre and in the States to undertake planning & development of transmission system.
 - Load despatch to be in the hands of a govt company/organisation. Flexibility regarding keeping Transmission Utility and load despatch together or separating them.
 - The Load Despatch Centre/Transmission Utility / Transmission Licensee not to trade in power. Facilitating genuine competition between generators.
 - Open access to the transmission lines to be provided to distribution licensees, generating companies.
- c) Distribution
- Distribution to be licensed by SERCs.
 - Distribution licensee free to take up generation & Generating co. free to take up distribution licence.
 - Retail tariff to be determined by the Regulatory Commission.
 - Metering made mandatory.
 - Open access in distribution to be allowed by SERC in phases.
 - In addition to the wheeling charges provision for surcharge if open access is allowed before elimination of cross subsidies.
- 4) Consumer Protection
- Every distribution licensee shall supply electricity to consumers within one month after the receipt of the application, or immediately after extension of distribution mains or commissioning new sub-stations.
 - Penalty in the event of failure to give connection

¹⁶ Legal scheme defines no TEC required except Hydro power projects. However in actual operations, both thermal projects and transmission projects require the reviews of CEA. (This is due to technical inability of MoP)

5) Trading/ Market Development

- Trading distinct activity permitted with licencing.
- Regulatory Commission may fix ceiling on trading margin to avoid artificial price volatility.
- The Regulatory Commission to promote development of market including trading.

6) Regulatory Commissions/Appellate Tribunal

- State Electricity Regulatory Commission to be constituted within six months.
- Provision for Joint Commission by more than one State/UT.
- Provision for constitution of Appellate Tribunal consisting of Chairman and three Members.
- Appeal against the orders of Appellate Tribunal to lie before the Supreme Court.

7) Tariff Principles

- Regulatory Commission to determine tariff for supply of electricity by generating co. on long/medium term contracts.
- No tariff fixation by regulatory commission if tariff is determined through competitive bidding or where consumers, on being allowed open access enter into agreement with generators/traders.
- Consumer tariff should progressively reduce cross subsidies and move towards actual cost of supply.
- State Government may provide subsidy in advance through the budget for specified target groups if it requires the tariff to be lower than that determined by the Regulatory Commission.
- Regulatory Commissions may undertake regulation including determination of multi-year tariff principles, which rewards efficiency and is based on commercial principles.
- Regulatory Commission to look at the costs of generation, transmission and distribution separately.

8) Function of Central Electricity Authority (CEA)

- CEA to continue as the main technical Advisor of the Government of India/ State Government with the responsibility of overall planning.
- CEA to specify the technical standards for electrical plants and electrical lines.
- CEA to be technical adviser to CERC as well as SERCs.
- CEA to specify the safety standards.

9) Measures Against Theft of Electricity

- Focus on revenue realisation rather than criminal proceedings.
- Penalties linked to the connected load and quantum of energy and financial gain involved in theft.
- Provisions for compounding of offences.

- Assessment of electricity charges for unauthorised use of electricity by the assessing officer designated by the State Government.
- Theft punishable with imprisonment.
- Punishment provision for abetment of theft.
- Special Courts

10) Restructuring of SEBs

- Provision for transfer scheme to create one or more companies from SEB.
- States given flexibility to adopt reform model/path.
- In addition, the SEBs have been dissolved or unbundled in the majority of States and Union Territories, but as of the end of June, 2016, the SEB still exists in only the state of Kerala.

(3) Amendment of Electricity Act 2003

Electricity Act 2003 went into effect in June, 2003, but it has been amended multiple times since then. The major amendments are detailed below.

1) 2004 Amendment (Appendix 2-69)

- It was stipulated that the SERCs would enact regulations concerning any consumer to open access to transmission within five years of the amended act coming into effect.

2) 2007 Amendment (Appendix 2-70)

- There were many revisions to the wording, but amendments that greatly change electricity business regulations cannot be seen.

3) 2010 Notification (Appendix 2-71)

- Provisions concerning licenses in Special Economic Zones were added.

4) THE ELECTRICITY (AMENDMENT) BILL, 2014 (Electricity (Amendment) Act 2014 (Approved by the Lok Sabha [the Lower House of the Parliament of India] in December, 2014)) (Appendix 2-72)

A Working Group on Power was constituted by the Planning Commission on the 4th March, 2011 for the purpose of development of power sector. The below viewpoints were contained in the Working Group's proposal, and it became necessary to substantially reexamine Electricity Act 2003.

- To bring in further competition and efficiency in the distribution sector by giving choice to the consumers
- Promotion of renewable energy
- Maintenance of grid security
- Rationalisation of tariff determination
- Strengthening of the Regulatory Commissions

The amendments to the said Act have been proposed to segregate the carriage (distribution

sector/network) from the content (electricity supply business) in the power sector by introducing multiple supply licensees in the content based on market principles and continuing with the carriage (distribution network) as a regulated activity. The proposed amendments also provide for recovery of revenue by licensees without any revenue gap, timely filing of tariff petitions by utilities and disposal of the same by the Appropriate Commission within a specified time period and empowering the Appropriate Commissions for initiating suo-motu proceedings for determination of tariff in case the utility or generating companies do not file their petitions in time.

Moreover, it is felt necessary to improve accountability and transparency in the working of the Appropriate Commissions. Further, granting deemed licensee status to companies notified by the Central Government, the provision of composite electricity bills, installation of smart meters beyond a consumption level to be prescribed by the Central Government.

While this bill passed through India's Lok Sabha, it has not passed through India's Rajya Sabha (the upper house of the Parliament of India). Accordingly, it remains at the bill stage, but as it stipulates numerous important changes to India's electricity business and there is a possibility that it will become law in the near future, the changes seen as important have been provided below.

- "Ancillary services" shall be added to the term definitions.
- "National Renewable Energy Policy" shall be added to the policies (National Electricity Policy and Tariff Policy) formulated by the Central Government.
- The below items shall be added to the National Electricity Plan.
 - Optimal utilisation of resources
 - Promotion of Renewable Energy
 - "Solar power" shall be specified in stand alone systems.
- When establishing or expanding the capacity of a generating station, it shall be an obligation to submit a detailed project report.
- **When establishing a coal and lignite based thermal generating station, there shall be a requirement to establish a renewable energy generation capacity (not less than 10% of the thermal power installed capacity) under the Renewable Generation Obligation.**
- **Distribution utilities can face stiffer penalties for non-compliance of Renewable Purchase Obligations.**
- "Multipurpose hydro facilities with power generation" shall be added to the definition of "hydro generating station."
- "Supply of electricity to consumers" shall be added to businesses required to have licenses. In addition, a chapter related to the supply of electricity shall be added after "Distribution." Upon consulting with the Central Government within one year of the commencement of Electricity (Amendment) Act 2014, state governments shall have the ability to decide to separate distribution and the supply of electricity. The charges and prices for the supply licensees shall be calculated using a method stipulated by the SERCs and shall be publicly released, but these must be determined by looking at market trends.
- CERS/ SERCs shall not grant licence to more than one distribution licensee in any area of

distribution. Provided that where two or more distribution licensees within the same area of distribution are existing on the date of the commencement of the Electricity (Amendment) Act, 2014, they shall continue their operation till such period as specified in their licence. The Central Government in consultation with the Appropriate Commission may, in public interest, permit more than one distribution licensee to operate in any area, if it is considered necessary.

- SERCs shall introduce open access for use of distribution system in such phases and subject to such conditions, as may be specified within one year of the appointed date by it and in specifying the extent of open access in successive phases. The open access consumers procuring electricity from renewable energy sources shall not be required to pay the surcharge for open access for such period as may be prescribed by the Central Government. the open access consumer shall not switch over to any other supplier except by giving the notice of minimum time period as may be specified by the Appropriate Commission.
- All consumers having a connected load of 1 MW and above with the power system, may procure at their option electricity through open access under bilateral arrangement from any generating company, trading licensee, or from any other source. In this situation, the consumers may enter into an agreement with any person for supply or purchase of electricity on such terms and conditions (including tariff) as may be agreed upon by them.
- Electricity tariff determination must be at a level in which costs can be recovered. In cases in which there are deficits, state governments must resolve them by the time the bill comes into effect.
- Smart grids, ancillary services, and decentralized distributed generation shall be added to the regulations for inter-state transmission tariffs by the CERC.

2.2.3 Function of Electricity Regulatory Commission

The Electricity Regulatory Commissions Act, 1998 (Appendix 2-73) is the governing law behind the establishment of the Electricity Regulatory Commissions, and their functions were stipulated by this law. However, in conjunction with the enactment of Electricity Act 2003, the functions of the Electricity Regulatory Commissions were contained in Electricity Act 2003.

There are Electricity Regulatory Commissions in both the Central Government and in state governments. Joint commissions can be established between two or more states, or between states and the Central Government. The CERC is under the jurisdiction of the MoP, and SERCs are under the jurisdiction of the Energy Department of state governments.

(1) CERC

The main functions of the CERC stipulated by Electricity Act 2003 are detailed below.

- a) To regulate the tariff of generating companies owned or controlled by the Central Government;
- b) To regulate the tariff of generating companies other than those owned or controlled by the

- Central Government, if such generating companies enter into or otherwise have a composite scheme for generation and sale of electricity in more than one State;
- c) To regulate the inter-State transmission of electricity;
 - d) To determine tariff for inter-State transmission of electricity;
 - e) To issue licenses to persons to function as transmission licensee and electricity trader with respect to their inter-State operations;
 - f) To adjudicate upon disputes involving generating companies or transmission licensee in regard to matters connected with clauses (a) to (d) above and to refer any dispute for arbitration;
 - g) To levy fees for the purposes of Electricity Act 2003;
 - h) To specify Grid Code having regard to Grid Standards;
 - i) To specify and enforce the standards with respect to quality, continuity and reliability of service by licensees;
 - j) To fix the trading margin in the inter-State trading of electricity, if considered, necessary.

In addition, the CERC also advises the MoP mainly on the below matters.

- k) Formulation of National electricity Policy and tariff policy;
- l) Promotion of competition, efficiency and economy in activities of the electricity industry;
- m) Promotion of investment in electricity industry.

(2) SERC

The main functions of the SERCs stipulated by Electricity Act 2003 are as detailed below.

- a) To determine the tariff for generation, supply, transmission and wheeling of electricity, wholesale, bulk or retail, as the case may be, within the State;
Provided that where open access has been permitted, the SERC shall determine only the wheeling charges and surcharge thereon, if any, for the said category of consumers;
- b) To regulate electricity purchase and procurement process of distribution licensees including the price;
- c) To facilitate intra-State transmission and wheeling of electricity;
- d) To issue licences to persons seeking to act as transmission licensees, distribution licensees and electricity traders with respect to their operations within the State;
- e) To promote co-generation and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee;
- f) To adjudicate upon the disputes between the licensees, and generating companies and to refer any dispute for arbitration;
- g) To levy fee for the purposes of Electricity Act 2003;
- h) To specify State Grid Code consistent with the Grid Code;

- i) To specify or enforce standards with respect to quality, continuity and reliability of service by licensees;
- j) To fix the trading margin in the intra-State trading of electricity, if considered, necessary.

In addition, the SERCs also advise the state governments mainly on the below matters.

- k) Promotion of competition, efficiency and economy in activities of the electricity industry;
- l) Promotion of investment in electricity industry;
- m) Reorganization and restructuring of electricity industry in the State.

State electricity regulatory commissions are esteemed to be independent institutions which acts in accordance with the principles of objectivity, transparency and equality. However, it is often criticized that the progress in filing of the tariff petitions by the electricity distribution utilities have been less than satisfactory, as proposed recovery in the revenue gap through a mix of tariff revision and subsidy support have not been treated smoothly by the state electricity regulatory commissions.

2.2.4 POWERS OF STATE GOVERNMENTS TO MAKE RULES

By specifying the authority of state governments, Electricity Act 2003 prevents state governments from freely formulating rules concerning electricity within states. Similarly, this act also limits the authority of the SERCs.

Examples of the items for which state governments are given authority under Electricity Act 2003 are provided below. These do not touch on the core of regulation of the electricity industry.

- ✓ The payment of fees for application for grant of license;
- ✓ The works of licensees affecting the property of other persons;
- ✓ The salary, allowances and other terms and conditions of service of the Chairperson and Members of the State Commission;
- ✓ The form and manner in which and the authority before whom oath of office;
- ✓ Any other matter required to be prescribed by the SERC.

2.2.5 Electricity Policy: National Electricity Policy

Based on Electricity Act 2003, in February, 2005, the MoP presented the National Electricity Policy (an MoP resolution) (Appendix 2-74). The main points of the National Electricity Policy are contained below.

(1) Aims and Objectives

The National Electricity Policy offered the below objectives and goals.

- Access to Electricity - Available for all households in next five years;
- Availability of Power - Demand to be fully met by 2012;
- Supply of Reliable and Quality Power of specified standards in an efficient manner and at reasonable rates;
- Per capita availability of electricity to be increased to over 1,000kWh by 2012;

- Minimum lifeline consumption of 1kWh/household/day as a merit good by year 2012;
- Financial Turnaround and Commercial Viability of Electricity Sector;
- Protection of consumers' interests.

(2) National Electricity Plan

The CEA shall prepare short-term and perspective plan. The National Electricity Plan would be for a short-term framework of five years while giving a 15 year perspective and would include:

Currently, the National Electricity Plan is being updated (as of July, 2016)¹⁷. Tariff Policy amended in 2016 (Appendix 2-75) includes many of items stipulated in National Electricity Plan.

- Short-term and long term demand forecast for different regions;
- Suggested areas/locations for capacity additions in generation and transmission keeping in view the economics of generation and transmission, losses in the system, load centre requirements, grid stability, security of supply, quality of power including voltage profile etc. and environmental considerations including rehabilitation and resettlement;
- Integration of such possible locations with transmission system and development of national grid including type of transmission systems and requirement of redundancies;
- Different technologies available for efficient generation, transmission and distribution;
- Fuel choices based on economy, energy security and environmental considerations.

(3) Issues addressed

The policy seeks to address the following issues:

- ✓ Rural Electrification
- ✓ Generation
- ✓ Transmission
- ✓ Distribution
- ✓ Recovery of Cost of services & Targetted Subsidies.
- ✓ Technology Development and Research and Development (R&D)
- ✓ Competition aimed at Consumer Benefits
- ✓ Financing Power Sector Programmes Including Private Sector Participation.
- ✓ Energy Conservation
- ✓ Environmental Issues
- ✓ Training and Human Resource Development
- ✓ Cogeneration and Non-Conventional Energy Sources
- ✓ Protection of Consumer interests and Quality Standards

¹⁷ It was updated and submitted as a Draft National Electricity Plan on December 2016. It has been collecting public comments during January 2017. The key contents of the 2016 Draft NEP is attached in the end of the chapter 2 as the ADDENDUM.

(4) Efforts toward Issues

1) Rural Electrification

Determined efforts should be made to ensure that the task of rural electrification for securing electricity access to all households and also ensuring that electricity reaches poor and marginal sections of the society at reasonable rates is completed within the next five years.

- ✓ Development of Rural Electrification Infrastructure
- ✓ Particular attention would be given in household electrification to dalit bastis, tribal areas and other weaker sections.
- ✓ Rural Electrification Corporation of India, a Government of India enterprise will be the nodal agency at Central Government level to implement the programme for achieving the goal.
- ✓ Government recognizes the need for providing necessary capital subsidy and soft long-term debt finances for investment in rural electrification as this would reduce the cost of supply in rural areas.
- ✓ Necessary institutional framework would need to be put in place
- ✓ The gigantic task of rural electrification requires appropriate cooperation among various agencies of the State Governments, Central Government and participation of the community.

2) Generation

- ✓ To provide availability of over 1,000kWh per capita electricity by year 2012 it had been estimated that need based capacity addition of more than 100GW would be required during the period.
- ✓ The Government of India has initiated several reform measures to create a favourable environment for addition of new generating capacity in the country.
- ✓ In order to fully meet both energy and peak demand by 2012, there is a need to create adequate reserve capacity margin, at least 5%.
- ✓ In creating new generation capacities, appropriate technology may be considered keeping in view the likely widening of the difference between peak demand and the base load.
- ✓ Hydro Generation:
 - Maximum emphasis would be laid on the full development of the feasible hydro potential in the country.
 - Harnessing hydro potential speedily will also facilitate economic development of States, particularly North-Eastern States, Sikkim, Uttarakhand, Himachal Pradesh and J&K, since a large proportion of our hydro power potential is located in these States.
 - Debt financing of longer tenure would need to be made available for hydro projects. Central Government is committed to policies that ensure financing of viable hydro projects.
 - State Governments need to review procedures for land acquisition, and other approvals/clearances for speedy implementation of hydroelectric projects.

- The Central Government will support the State Governments for expeditious development of their hydroelectric projects.
 - Proper implementation of National Policy on Rehabilitation and Resettlement (R&R) would be essential in this regard so as to ensure that the concerns of project-affected families are addressed adequately.
 - Adequate safeguards for environmental protection.
 - ✓ Non-conventional Energy Sources:
 - Efforts will be made to encourage private sector participation through suitable promotional measures.
- 3) Transmission
- ✓ The Central Transmission Utility (CTU) and State Transmission Utility (STU) have the key responsibility of network planning and development.
 - ✓ The Regulatory Commissions need to provide facilitative framework for non-discriminatory open access.
 - ✓ Private sector participation.
- 4) Distribution
- ✓ Adequate transition financing support for DISCOMs
 - ✓ Conducive business environment, for example, Multi-Year Tariff
 - ✓ Open access would be allowed, not later than five years from January 2004.
 - ✓ Segregation of technical and commercial losses through energy audits.
 - ✓ The concept of multiple licensees in the same area of supply through their independent distribution systems.
 - ✓ Electricity Act 2003 requires all consumers to be metered within two years.
 - ✓ To facilitate creation of network information and customer data base through IT technology.
 - ✓ High Voltage Distribution System is an effective method for reduction of technical losses, prevention of theft.
 - ✓ Electricity Act 2003 has provided for stringent measures against theft of electricity.
- 5) Recovery of Cost of Services & Targeted Subsidies
- ✓ Consumers below poverty line who consume below a specified level, say 30kWh per month, may receive special support, at least 50 % of the average cost of supply.
 - ✓ The existing cross-subsidies would need to be reduced progressively and gradually.
 - ✓ Necessary budget provision by State Government would be required to be made in advance so that the utility does not suffer financial problems that may affect its operations.

2.2.6 Electricity Policy: Tariff Policy

(1) Amendment of Tariff Policy

Based on Electricity Act 2003, the MoP publishes the Tariff Policy (an MoP resolution). The first Tariff Policy was published in January, 2006, and was amended in March, 2008, as well as in January and July, 2011. Most recently, the Tariff Policy was amended in January, 2016 (Appendix 2-75). The amendment in January, 2016 focused on 4Es (Electricity for all, Efficiency to ensure affordable tariffs, Environment for a sustainable future, Ease of doing business to attract investments and ensure financial viability), and carried out a large-scale amendment. The main points of the amendment are contained below¹⁸

- Electricity
 - ✓ 24X7 supply will be ensured to all consumers and State Governments and regulators will devise a power supply trajectory to achieve this.
 - ✓ Power to be provided to remote unconnected villages through micro grids with provision for purchase of power into the grid as and when the grid reaches there.
 - ✓ Affordable power for people near coal mines by enabling procurement of power from coal washery reject based plants.
- Efficiency
 - ✓ Reduce power cost to consumers through expansion of existing power plants.
 - ✓ Benefit from sale of un-requisitioned power to be shared allowing for reduction in overall power cost.
 - ✓ Transmission projects to be developed through competitive bidding process to ensure faster completion at lower cost.
 - ✓ Faster installation of Smart meters to enable “Time of Day” metering, reduce theft and allow net-metering.
 - ✓ Lower power cost by creating transmission capacity for accessing power from across India.
- Environment
 - ✓ **Renewable Power Obligation (RPO)**
In order to promote renewable energy and energy security, 8% of electricity consumption, excluding hydro power, shall be from solar energy by March 2022.
 - ✓ **Renewable Generation Obligation (RGO)**
New coal/lignite based thermal plants after specified date to also establish/procure/purchase renewable capacity.
 - ✓ Affordable renewable power through bundling of renewable power with power from plants whose PPAs have expired or completed their useful life.
 - ✓ **No inter-State transmission charges and losses to be levied for solar and wind power.**

¹⁸ MoP. (Appendix 2-76).

- ✓ Swachh Bharat Mission to get a big boost with procurement of 100% power produced from Waste-to-Energy plants.
- ✓ **To release clean drinking water for cities and reduce pollution of rivers like Ganga, thermal plants within 50 km of sewage treatment facilities to use treated sewage water.**
- ✓ **Promotion of Hydro projects through long term PPAs and exemption from competitive bidding till 15th August 2022. In other words, for Hydro, the competitive bidding obligation by distribution licensees is exempted until 2022, and ERCs' regulated tariff is allowed.**
- ✓
- ✓ Ancillary services to support grid operation for expansion of renewable energy.
- Ease of Doing Business
 - ✓ Generate employment in coal rich Eastern states like Odisha, West Bengal, Jharkhand, Chhattisgarh etc. by encouraging investments. States allowed to setup plants, with up to 35% of power procured by DISCOMs on regulated tariff.
 - ✓ Remove market uncertainty by allowing pass through for impact of any change in domestic duties, levies, cess and taxes in competitive bid projects.
 - ✓ Clarity on tariff setting authority for multi-State sales. CERC to determine tariff for composite scheme where more than 10% power sold outside State.

(2) Overview of Tariff Policy 2016

The Tariff Policy contains concrete methods for setting electricity tariffs. The main points are contained below. With regard to generation, primarily the items related to hydroelectric power and renewable energy have been extracted.

1) General Approach to Tariff

- Detailed guidelines for tariff based bidding process for procurement of electricity by distribution licensees, which MoP has already issued.
- All future requirement of power should continue to be procured competitively by distribution licensees except in cases of expansion of existing projects or where there is a company owned or controlled by the State Government as an identified developer and where regulators will need to resort to tariff determination based on norms provided that expansion of generating capacity by private developers for this purpose would be restricted to one time addition of not more than 100% of the existing capacity.
- Provided further that the Electricity Regulatory Commission shall ensure that in case of expansion of such projects, the benefit of sharing of infrastructure of existing project and efficiency of new technology is passed on to consumers through tariff.
- Provided also that the State Government can notify a policy to encourage investment in the State by allowing setting up of generating plants, including from renewable energy sources out of which a maximum of 35% of the installed capacity can be procured by the Distribution

Licensees of that State for which the tariff may be determined under Section 62 of the Electricity Act 2003.

- The tariff of all new generation and transmission projects of company owned or controlled by the Central Government shall continue to be determined on the basis of competitive bidding as per the Tariff Policy notified on 6th January, 2006.
- The developer of a hydroelectric project, including Pumped Storage Plant (PSP), would have the option of getting the tariff determined by the Electricity Regulatory Commission for the power to be sold through long term PPAs on the basis of performance based cost of service regulations if the following conditions are fulfilled:
 - ✓ The Electricity Regulatory Commission is satisfied that the project site has been allotted to the developer by the concerned State Government after following a transparent two stage process. The first stage should be for prequalification on the basis of criteria of financial strength, past experience of developing infrastructure projects of similar size, past track record of developing projects on time and within estimated costs, turnover and ability to meet performance guarantee etc. In the second stage, bids are to be called on the basis of only one single quantifiable parameter, such as, additional free power in excess of percentage of free power, as notified by MoP, equity participation offered to the State Government, or any other parameter to be notified by MoP from time to time.
 - ✓ Concurrence of CEA (if required under Section 8 of the Act), financial closure, award of work and long term PPA (of the duration of 35 years or more) of the capacity with distribution licensees are completed by 15th August 2022.
 - ✓ Long term PPA is firmed up for 60% or more of the total saleable design energy, balance being allowed for merchant sale. Provided that distribution licensees can extend the duration of long term PPA beyond 35 years for a further period of 15 years at the existing terms and conditions subject to the approval of Electricity Regulatory Commission. Provided further that nothing contained in this clause shall apply to Pumped Storage Plants (PSP).
 - ✓ The time period for commissioning of all the units of the project shall be fixed at four years from the date of approval of the commissioning schedule by the Electricity Regulatory Commission. However, the Electricity Regulatory Commission may, after recording reasons in writing, fix longer time period for hydro electric projects (reservoir as well as run-of- river projects) of more than 100MW capacity. Agreed timelines to achieve the fixed commissioning schedule alongwith penalty for delay shall be decided by the Electricity Regulatory Commission in consultation with the CEA. The Electricity Regulatory Commission shall allow pass through the Interest During Construction (IDC) and Financing Cost (FC) only upto the period of delay not attributable to the developer, as approved by the CEA.
 - ✓ Award of contracts for supply of equipment and construction of the project, either through a turnkey or through well defined packages, are done on the basis of international competitive bidding.

- The developers of hydro electric projects of more than 100MW design capacity for which sites have been awarded earlier by following a transparent process and on the basis of pre-determined set of criteria would have the option of getting the tariff determined by the Electricity Regulatory Commission for the power to be sold through long term PPA on the basis of cost plus.
- In case of hydro electric project, the Electricity Regulatory Commission shall determine tariff ensuring the following:
 - ✓ Any expenditure incurred by the project developer for getting project site allotted would neither be included in the project cost, nor any such expenditure shall be passed through in tariff.
 - ✓ The project cost shall include the cost of the approved R&R plan of the Project which shall be in conformity with the following:
 - (a) the National Rehabilitation & Resettlement Policy currently in force;
 - (b) the R&R package as enclosed at appendix.
 - ✓ Annual fixed charges shall be taken pro-rata to the saleable design energy tied up on the basis of long term PPAs with respect to total saleable design energy. The total saleable design energy shall be arrived at by deducting the following from the design energy at the bus bar:
 - Free power for the host State and the riparian State and percentage for contribution towards Local Area Development Fund as constituted by the State Government.
 - Energy corresponding to 100kWh to be provided free of cost every month to every Project Affected Family to be offered through the concerned distribution licensee in the designated resettlement area/projects area for a period of ten years from the date of commissioning.
- The Electricity Regulatory Commission shall provide for suitable regulatory framework for incentivizing the developers of Hydro Electric Projects (HEPs) for using long-term financial instruments in order to reduce the tariff burden in the initial years.
- The real benefits of competition would be available only with the emergence of appropriate market conditions. Shortages of power supply will need to be overcome. Multiple players will enhance the quality of service through competition. All efforts will need to be made to bring power industry to this situation as early as possible.
- Central/State Government as well as the Electricity Regulatory Commission while implementing such plans shall ensure viability of the generation, transmission and distribution in terms of recovery of all prudent costs.
- Tariff policy lays down the following framework for performance based cost of service regulation in respect of aspects common to generation, transmission as well as distribution.
 - ✓ Return on Investment
CERC would notify, from time to time, the rate of return on equity.
 - ✓ Equity Norms
Debt: Equity ratio of 70:30

- ✓ Depreciation
CERC may notify the rates of depreciation.
 - ✓ Cost of Debt
Structuring of debt with a view to reducing the tariff should be encouraged.
 - ✓ Cost of Management of Foreign Exchange Risk
Foreign exchange variation risk shall not be a pass through except for appropriate costs of hedging and swapping.
 - ✓ Operating Norms
CERC would, in consultation with the CEA, notify operating norms from time.
 - ✓ Renovation and Modernization
Appropriate capital costs would need to be assessed by the Electricity Regulatory Commission.
 - ✓ Multi Year Tariff (MYT)
Based on Electricity Act 2003, Electricity Regulatory Commission would determine MYT.
 - ✓ Benefits under Clean Development Mechanism (CDM)
Benefits under CDM shall be into consideration.
 - ✓ Composite Scheme
CERC shall regulate the tariff of generating company, if such generating company enters into or otherwise have a composite scheme for generation and sale of electricity, at least 10% of the capacity, in more than one State.
 - The Electricity Regulatory Commissions shall introduce open access for consumers with 1MW and above.
- 2) Generation
- Power procurement for future requirements should be through a transparent competitive bidding mechanism using the guidelines issued by MoP from time to time. These guidelines provide for procurement of electricity separately for base load requirements and for peak load requirements.
 - The Electricity Regulatory Commission shall introduce differential rates of fixed charges for peak and off peak hours.
 - PPA should ensure adequate and bankable payment security arrangements to the Generating companies.
 - After the award of bids, if there is any change in domestic duties, levies, cess and taxes imposed by Central/State Government leading to corresponding changes in the cost, the same may be treated as “Change in Law.”
 - Renewable Power Generation
 - ✓ The Electricity Regulatory Commission shall fix a minimum percentage of the total consumption of electricity in the area of a distribution licensee for purchase of energy from renewable energy sources, taking into account availability of such resources and its

impact on retail tariffs. Cost of purchase of renewable energy shall be taken into account while determining tariff by SERCs. Long term growth trajectory of Renewable Purchase Obligations (RPOs) will be prescribed by the Ministry of Power in consultation with MNRE.

- SERCs shall also reserve a minimum percentage for purchase of solar energy from the date of notification of this policy which shall be such that it reaches 8% of total consumption of energy, excluding Hydro Power, by March 2022 or as notified by MoP from time to time.
 - Distribution Licensee(s) shall compulsorily procure 100% power produced from all the Waste-to-Energy plants in the State.
 - The renewable energy based generation companies can sell the electricity to local distribution licensee at the rates for conventional power and can recover the balance cost by selling Renewable Energy Certificates (RECs) to other distribution companies and obligated entities enabling the latter to meet their renewable power purchase obligations. The REC mechanism should also have a solar specific REC.
 - The Electricity Regulatory Commission may also provide for a suitable regulatory framework for encouraging such other emerging renewable energy technologies by prescribing separate technology based REC multiplier.
- ✓ **States shall endeavor to procure power from renewable energy sources through competitive bidding to keep the tariff low, except from the waste to energy plants. Procurement of power by Distribution Licensee from renewable energy sources from projects above the notified capacity, shall be done through competitive bidding process. The Electricity Regulatory Commission shall take into account the solar radiation and wind intensity which may differ from area to area to ensure that the benefits are passed on to the consumers.**¹⁹
- ✓ CERC should lay down guidelines for pricing intermittent power, especially from renewable energy sources, where such procurement is not through competitive bidding. The tariff stipulated by CERC shall act as a ceiling for that category.
 - ✓ In order to incentivize the Distribution Companies to procure power from renewable sources of energy, MoP may notify, from time to time, an appropriate bid-based tariff framework for renewable energy, allowing the tariff to be increased progressively in a back-loaded or any other manner in the public interest during the period of PPA, over the life cycle of such a generating plant.
 - ✓ Any generating company proposing to establish a coal/lignite based thermal generating station after a specified date shall be required to establish such renewable energy generating capacity or procure and supply renewable energy equivalent to such capacity, as may be prescribed by MoP from time to time. In case an obligated entity procures this renewable power, then the SERCs will consider the obligated entity to have met the

¹⁹ The preferential tariff regime for RE power appears to be on its way out. (<http://reconnectenergy.com/blog/2016/01/analysis-of-amendments-in-national-tariff-policy/>)

Renewable Purchase Obligation (RPO) to the extent of power bought from such renewable energy generating stations.

- ✓ In order to further encourage renewable sources of energy, no inter-State transmission charges and losses may be levied till such period as may be notified by MoP on transmission of the electricity generated from solar and wind sources of energy through the inter-state transmission system for sale.
- ✓ The Electricity Regulatory Commission may provide regulatory framework to facilitate generation and sale of electricity from renewable energy sources particularly from roof-top solar system. The Central/State Government may also provide complementary policy support for this purpose.

3) Transmission

● Ancillary Services

- ✓ CERC may introduce the norms and framework for ancillary services, including the method of sharing the charges, necessary to support the power system or grid operation for maintaining power quality, reliability and security of the grid.
- ✓ CERC shall also consult the concerned Government Agencies while specifying the norms for ancillary services.
- ✓ SERCs shall also adopt the norms and framework for ancillary services as specified by CERC.

In August, 2015, the CERC presented "Regulation on Ancillary Services Operations (Appendix 2-77)." The main points are shown below.

- Objective: The objective of these regulations is to restore the frequency at desired level and to relieve the congestion in the transmission network.
- Scope: These regulations shall be applicable to the Regional Entities involved in the transactions facilitated through open access in inter-State transmission of electricity.
- Eligibility: All Generating Stations that are regional entities and whose tariff is determined or adopted by the Electricity Regulatory Commission for their full capacity shall provide Reserves Regulation Ancillary Services (RRAS).
- Time-block: 15 minutes
- Responsibility of Ancillary Services: National Load Despatch Centre (NLDC)/ Regional Load Despatch Centres (RLDC)
- Charges: The RRAS Provider shall on monthly basis submit details of fixed charges and variable charges to SERC. SERC shall intimate NLDC/RLDC on monthly basis the details of fixed charges, variable charges applicable for the RRAS Providers for merit order dispatch.
- Energy Accounting: Energy Accounting shall be done by SERC on weekly basis along with Deviation Settlement Account. SERC shall issue an Ancillary Services Statement along with the Deviation Settlement Mechanism Account.
- Settlement: The settlement shall be done by NLDC/RLDC. Deficit, if any, in the Regional Deviation Pool Account Fund maintained by an RLDC due to despatch of Ancillary Services,

shall be made up by Regional Deviation Pool Account Fund maintained by other RLDCs.

- Detailed Procedure: NLDC/RLDC shall, after obtaining prior approval of CERC, issue the Detailed Procedure within a period of 3 months of notification of these regulations.

4) Distribution

- Loss making utilities need to be transformed into profitable ventures.
- The Electricity Regulatory Commission should mandate Distribution Licensee to undertake load forecasting every year and to publish and submit to the Commission their short, medium and long-term power procurement plans to meet the load.
- SERCs will devise a specific trajectory so that 24 hours supply of adequate and uninterrupted power can be ensured to all categories of consumers by 2021-22 or earlier.
- Framework for revenue requirements and costs
 - ✓ Reduction of Aggregate Technical & Commercial (AT&C) losses
 - ✓ Metering shall be completed.
 - ✓ Pass through of past losses or profits should be allowed to the extent caused by uncontrollable factors.

- Tariff design

The tariff progressively reflects the efficient and prudent cost of supply of electricity.

- Smart Meter

The Electricity Regulatory Commission shall mandate smart meters for:

- Consumers with monthly consumption of 500kWh and more at the earliest but not later than 31st December 2017;
- Consumers with monthly consumption above 200kWh by 31st December 2019.
- **Cross-subsidy surcharge and additional surcharge for open access**²⁰
 - ✓ A consumer who is permitted open access will have to make payment to the generator, the transmission licensee whose transmission systems are used, distribution utility for the wheeling charges and, in addition, the cross subsidy surcharge.
 - ✓ SERCs may calculate the cost of supply of electricity by the distribution licensee to consumers of the applicable class as aggregate of (a) per unit weighted average cost of power purchase including meeting the Renewable Purchase Obligation; (b) transmission and distribution losses applicable to the relevant voltage level and commercial losses allowed by the SERC; (c) transmission, distribution and wheeling charges up to the relevant voltage level; and (d) per unit cost of carrying regulatory assets, if applicable.

5) Trading Margin

Electricity Act 2003 provides that the Electricity Regulatory Commission may fix the trading margin, if considered necessary. Though there is a need to promote trading in electricity for making the markets competitive, the Electricity Regulatory Commission should monitor the

²⁰ This was analyzed to make calculation of cross-subsidy methodology to be less arbitrary. (<http://reconnectenergy.com/blog/2016/01/analysis-of-amendments-in-national-tariff-policy/>)

trading transactions continuously and ensure that the electricity traders do not indulge in profiteering in situation of power shortages. Fixing of trading margin should be resorted to for achieving this objective.

(3) Current State of Electricity Tariffs

This section covers the electricity tariffs of DISCOMs. As SERCs determine the electricity tariffs for each DISCOM, there are as many electricity tariff tables as there are DISCOMs. By category, the minimum and maximum electricity tariffs are shown below.

Table 2.2.6-1 Minimum and Maximum of Electricity Tariff in India

Unit: INR/ kWh

Domestic

No.	Load/consumption	Max.	State/Utility	Min.	State/Utility
1	1kW (100kWh/Month)	5.83	Rajasthan	1.20	Puduchery
2	2kW (200kWh/Month)	6.63	Punjab	1.35	Puduchery
3	4kW (400kWh/Month)	7.55	Tripura	1.93	Dadra & Nagar Haveli and Daman & Diu
4	6kW (600kWh/Month)	9.01	Mahatashtra - Mumbai - (B.E.S.T.)	2.13	Dadra & Nagar Haveli and Daman & Diu
5	8kW (800kWh/Month)	10.07	Mahatashtra - Mumbai - (B.E.S.T.)	2.24	Dadra & Nagar Haveli and Daman & Diu
6	10kW (1000kWh/Month)	10.71	Mahatashtra - Mumbai - (B.E.S.T.)	2.30	Dadra & Nagar Haveli and Daman & Diu

Commercial

No.	Load/consumption	Max.	State/Utility	Min.	State/Utility
7	2kW (300kWh/Month)	11.65	Mahatashtra - Mumbai - (B.E.S.T.)	2.00	Jharkhand (Rural Areas)
8	5kW (750kWh/Month)	12.34	Mahatashtra - Mumbai - (B.E.S.T.)	3.08	Uttar Pradesh (Rural Areas)
9	10kW (1500kWh/Month)	13.42	Mahatashtra - Mumbai - (B.E.S.T.)	3.08	Uttar Pradesh (Rural Areas)
10	20kW (3000kWh/Month)	13.96	Mahatashtra - Mumbai - (B.E.S.T.)	3.08	Uttar Pradesh (Rural Areas)
11	30kW (4500kWh/Month)	15.36	Mahatashtra - Mumbai - (B.E.S.T.)	3.08	Uttar Pradesh (Rural Areas)
12	40kW (6000kWh/Month)	15.36	Mahatashtra - Mumbai - (B.E.S.T.)	3.08	Uttar Pradesh (Rural Areas)
13	50kW (7500kWh/Month)	15.36	Mahatashtra - Mumbai - (B.E.S.T.)	3.08	Uttar Pradesh (Rural Areas)

Agriculture

No.	Load/consumption	Max.	State/Utility	Min.	State/Utility
14	2HP (400kWh/Month)	6.59	West Bengal - DPSC Ltd. (1700 hrs to 2300 hrs)	0	Karnataka & Tamil Nadu
15	3HP (600kWh/Month)	6.59	West Bengal - DPSC Ltd. (1700 hrs to 2300 hrs)	0	Karnataka & Tamil Nadu
16	5HP (1000kWh/Month)	6.59	West Bengal - DPSC Ltd. (1700 hrs to 2300 hrs)	0	Karnataka & Tamil Nadu
17	10HP (2000kWh/Month)	6.59	West Bengal - DPSC Ltd. (1700 hrs to 2300 hrs)	0	Karnataka & Tamil Nadu

Small Industries

No.	Load/consumption	Max.	State/Utility	Min.	State/Utility
18	5kW (750kWh/Month)	10.3	Mahatashtra - Mumbai - (B.E.S.T.)	2.97	Sikkim (Rural)
19	10kW (1500kWh/Month)	10.99	Mahatashtra - Mumbai - (B.E.S.T.)	3.30	Goa
20	15kW (22500kWh/Month)	11.22	Mahatashtra - Mumbai - (B.E.S.T.)	3.30	Goa

Medium Industries

No.	Load/consumption	Max.	State/Utility	Min.	State/Utility
21	50kW (7500kWh/Month)	12.58	Mahatashtra - Mumbai - (B.E.S.T.)	3.72	Dama & Diu
22	100kW (15000kWh/Month)	12.58	Mahatashtra - Mumbai - (B.E.S.T.)	3.90	Goa

Large Industries (at 11kv)

No.	Load/consumption	Max.	State/Utility	Min.	State/Utility
23	250kW 40%LF (73000kWh/Month)	11.51	Mahatashtra - Mumbai - (B.E.S.T.)	3.75	Arunachal Pradesh
24	250kW 60%LF (109500kWh/Month)	11.24	Mahatashtra - Mumbai - (B.E.S.T.)	3.75	Arunachal Pradesh
25	500kW 40%LF (146000kWh/Month)	11.51	Mahatashtra - Mumbai - (B.E.S.T.)	3.75	Arunachal Pradesh
26	500kW 60%LF (219000kWh/Month)	11.24	Mahatashtra - Mumbai - (B.E.S.T.)	3.75	Arunachal Pradesh
27	1000kW 40%LF (292000kWh/Month)	11.51	Mahatashtra - Mumbai - (B.E.S.T.)	3.75	Arunachal Pradesh
28	1000kW 60%LF (438000kWh/Month)	11.24	Mahatashtra - Mumbai - (B.E.S.T.)	3.75	Arunachal Pradesh
29	5000kW 40%LF (1460000kWh/Month)	11.51	Mahatashtra - Mumbai - (B.E.S.T.)	3.75	Arunachal Pradesh
30	5000kW 60%LF (2190000kWh/Month)	11.24	Mahatashtra - Mumbai - (B.E.S.T.)	3.75	Arunachal Pradesh
31	10000kW 40%LF (2920000kWh/Month)	11.51	Mahatashtra - Mumbai - (B.E.S.T.)	3.75	Arunachal Pradesh
32	10000kW 60%LF (4380000kWh/Month)	11.24	Mahatashtra - Mumbai - (B.E.S.T.)	3.75	Arunachal Pradesh
33	20000kW 40%LF (5840000kWh/Month)	11.51	Mahatashtra - Mumbai - (B.E.S.T.)	3.75	Arunachal Pradesh
34	20000kW 60%LF (8760000kWh/Month)	11.24	Mahatashtra - Mumbai - (B.E.S.T.)	3.75	Arunachal Pradesh

Large Industries (at 33kv)

No.	Load/consumption	Max.	State/Utility	Min.	State/Utility
35	5000kW 40%LF (1460000kWh/Month)	9.18	West Bengal - DPSC Ltd. (1700 hrs to 2300 hrs)	3.40	Arunachal Pradesh
36	5000kW 60%LF (2190000kWh/Month)	8.96	Delhi - NDMC	3.40	Arunachal Pradesh
37	10000kW 40%LF (2920000kWh/Month)	9.18	West Bengal - DPSC Ltd. (1700 hrs to 2300 hrs)	3.40	Arunachal Pradesh
38	10000kW 60%LF (4380000kWh/Month)	8.96	Delhi - NDMC	3.40	Arunachal Pradesh
39	20000kW 40%LF (5840000kWh/Month)	9.18	West Bengal - DPSC Ltd. (1700 hrs to 2300 hrs)	3.40	Arunachal Pradesh
40	20000kW 60%LF (8760000kWh/Month)	8.96	Delhi - NDMC	3.40	Arunachal Pradesh
41	50000kW 40%LF (14600000kWh/Month)	9.18	West Bengal - DPSC Ltd. (1700 hrs to 2300 hrs)	3.40	Arunachal Pradesh
42	50000kW 60%LF (21900000kWh/Month)	8.96	Delhi - NDMC	3.40	Arunachal Pradesh

Power Intensive Industries

No.	Load/consumption	Max.	State/Utility	Min.	State/Utility
43	50000kW 60%LF (21900000kWh/Month)	7.48	Punjab	3.25	Arunachal Pradesh
44	50000kW 80%LF (29200000kWh/Month)	7.34	Punjab	3.25	Arunachal Pradesh

Railway Traction

No.	Load/consumption	Max.	State/Utility	Min.	State/Utility
45	12500kW (2500000kWh/Month)	9.33	Punjab (at 132kV)	4.81	West Bengal - D.V.C. (at 12kV)

source: Electricity Tariff & Duty and Average rates of electricity supply in India, March 2015, CEA(Appendix 2-62)

States have different and complex tariff structure with various categories. Central government plans to make electricity billing more efficient and transparent by reducing the number of categories of consumers, which should improve tariff collection and improve the health of distribution companies.²¹

(4) Electricity Tariff Revision Trends

There is a tendency for the electricity tariff revisions of DISCOMs to be sluggish. Only 20 of 29 states have applied for 2017 tariff revisions. Tariff hikes allowed in most states have been modest, ranging

²¹ The Economic Times, Oct. 27, 2017

http://articles.economictimes.indiatimes.com/2016-10-27/news/55087581_1_government-plans-to-rationalise-power-tariffs

between, 0.6% and 8.8%.²²

Table 2.2.6-2 Higher than National Average Tariff Hikes

State	FY2011	FY2012	FY2013	FY2014	FY2015	Average Hike
Kerala	0%	30%	8%	24%	3%	16%
Delhi	22%	22%	5%	8%	0%	14%
Nagaland	34%	12%	7%	0%	5%	14%
Andhra Pradesh	8%	18%	23%	0%	5%	13%
Tamil Nadu	0%	37%	0%	15%	0%	12%
Chhattisgarh	0%	18%	0%	15%	14%	11%
Tripura	0%	17%	31%	0%	0%	11%
Haryana	4%	19%	13%	0%	8%	10%
Meghalaya	0%	13%	7%	15%	8%	10%
Rajasthan	9%	8%	9%	16%	0%	10%
J&K	15%	19%	9%	0%	0%	10%
Bihar	19%	12%	7%	0%	3%	9%
Uttar Pradesh	0%	18%	5%	11%	5%	9%
Odisha	20%	12%	2%	0%	5%	9%
Goa	0%	12%	0%	8%	14%	8%

source: Towards UjwalBharat UDAY: The Story of Reform, November 2015, MoP, MoC, MNRE (Appendix 2-66)

(5) CERC Tariff Regulation Trends

In February, 2014, the CERC stipulated the New Tariff Regulations for the five-year period from April, 2014 to March, 2019 (Terms and Conditions of Tariff) Regulations, 2014, 21st February, 2014²³). While there is a possibility that these regulations will lead to tariff reductions for consumers, as items such as the introduction of strict operational standards are included, the amended content is strict toward generation businesses. The main amendments are shown below.

1) Generation Incentives

- ✓ The incentive calculation method for thermal power stations shall change from PAF (Plant Availability Factor) to PLF (Plant Load Factor). The incentive shall not change from 50 paise/kWh.
- ✓ The return on equity (ROE) shall remain at 15.5%. Parties such as generation businesses had been requesting an ROE higher than the current figure.
- ✓ Power stations and transmission networks that do not implement competitive bidding shall not be allowed.

2) Abolition of Favorable Treatment Concerning the Tax System

- ✓ Tax arbitrage shall be abolished.

²² Economic Times, Sep. 14, 2016.

²³ <http://cercind.gov.in/2014/regulation/reg21.pdf>

2.2.7 Electricity Policy: Land Acquisition

(1) Past Laws Concerning Indian Land Acquisition

The British government in India enacted the first land acquisition legislation. After that, land acquisition legislation was enacted in Bombay (currently Mumbai) in 1839, and in Madras in 1852. In 1857, a land acquisition law that applied to the whole of British-ruled India was enacted, and in 1870, a new land acquisition law was enacted. In 1894 (Appendix 2-79), the land acquisition law of 1870 was abolished, and the Land Acquisition Act was enacted.²⁴ While Land Acquisition Act 1894 was amended many times after that, even after Indian independence, the act formed the basis for land acquisition.

1) Land Acquisition Act 2013

The issue of land acquisition was an important issue for the Indian government. In particular, it became necessary to create a law that addressed three major points. First, in Land Acquisition Act 1894, fair compensation was not stipulated in cases in which land was acquired for public purpose. In addition, it was necessary to integrate rehabilitation and resettlement as well.

Accordingly, new land acquisition legislation was discussed from 2007, and Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (Land Acquisition Act 2013) (Appendix 2-80) was enacted in 2013, during the period of the previous administration.

The main points of Land Acquisition Act 2013 are contained below.

a) Public Purpose

In this act, central/state government and public sector undertakings apply to cases in which land acquisition is carried out for public purpose. The main instances of public purpose are shown below.

- National Security, as with Military Affairs, Etc.
- Infrastructure Projects
 - All activities or items listed in the notification of Department Economic Affairs, excluding private hospitals, private educational institutions and private hotels;
 - Projects involving agriculture and fishery sector set up or owned by Government or farmer's cooperatives;
 - Project for industrial corridors or mining activities national investment and manufacturing zones, as designated in the National Manufacturing Policy;
 - Project for water harvesting and water conservation structures, sanitation;
 - Project for Government administrated, Government aided educational and research schemes or institutions;

²⁴ Report on the law of acquisition and requisitioning of land, September 1958, Ministry of Law (Appendix 2-78)

- Project for sport, health care, tourism, transportation or space programme;
 - Any infrastructure facility as may be notified in this regard by the Central Government and after tabling of such notification in Parliament.
- b) Preliminary Investigation for Determination of Social Impact and Public Purpose
- Whenever Government intends to acquire land for a public purpose, it shall consult the concerned Panchayat, Municipality at village level or ward level in the affected area and carry out a Social Impact Assessment study in consultation with them.
 - Government shall ensure the completion of the Social Impact Assessment study within a period of six months from the date of its commencement.
 - Government shall ensure that the Social Impact Assessment report is evaluated by an independent multi-disciplinary Expert Group.
- c) Special Provision to Safeguard Food Security
- In order to safeguard Food Security, no irrigated multi-cropped land shall be acquired.
- d) Compensation
- Collectors determine the market value of the land they will acquire based on the standards stipulated in Land Acquisition Act 2013, and calculate the total compensation value.
 - For the calculation of land's compensation value, the market price of the land is multiplied by the following factors.
 - Rural areas: One to two
 - Urban areas: One
 - For the calculation of solatium, 100% of the land's market price is multiplied by the following factors.
 - Rural areas: One to two
 - Urban areas: One
 - Accordingly, in rural areas, the compensation value can reach a maximum of four times the market value of the land. In addition, the market value of items such as buildings and trees that are attached to the land are also targets for compensation. Further, in addition to the compensation, broad rights to rehabilitation and resettlement are granted to people who lose ownership of their land or livestock.
 - No income tax shall be levied except under section 64, Land Acquisition Act 2013.
 - Where a State law or policy framed by the Government of a State, the State provides for a higher compensation than calculated under, and the State offers more beneficial rehabilitation and resettlement provisions than the Act.

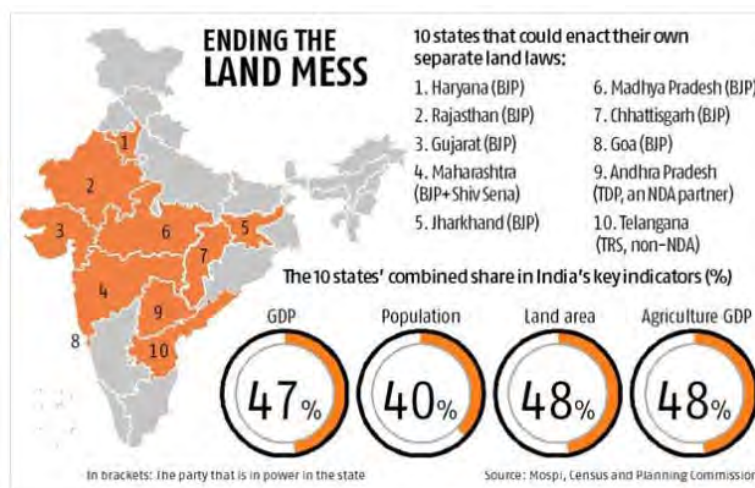
2) Movement of Land Acquisition Act 2013 Amendments

With regard to preparation of the infrastructure indispensable to the development of the Indian economy, the inability to acquire necessary land has been pointed out as one of the main barriers.

Under the current Land Acquisition Act, due to reasons such as the relatively high level of the considerations and compensatory fees paid to the farmers who own the land when companies acquire plant buildings or plots, as well as the obligation to perform social impact evaluations, actual acquisition has barely moved forward. The current Land Acquisition Act is not functioning as Land Acquisition Act 2013 requires high percentage of agreement and social impact evaluations.

While the Modi administration has submitted a Land Acquisition Act amendment bill, which includes exemption that not require high percentage of agreement and social impact evaluations, to the Parliament of India, an opposing party, which comprises the majority in the Rajya Sabha, is opposed, and debate on the bill has been rejected. In this context, through a presidential decree, the Modi administration has taken provisional measures to give effectiveness to the Land Acquisition Act amendment bill, but in August, 2015, Prime Minister Modi declared that he would not amend the ordinance in order to avoid turning a policy unpopular with farmers into a point of contention before Legislative Assembly elections.

While efforts toward reform are at a standstill in the Parliament of India, the Modi administration is supporting reform at the state level. In India, which is a federation, state governments are granted great authority, and they are able to enact state laws that independently revise nationally established legislation. Land is a state subject, which means the state law supersedes any central law on the same subject. This strategy can avoid resistance from opposition parties unlike Rajya Sabha although state level. Centered on states with governors belonging to the ruling party, around 10 states have indicated the desire to perform independent legislative reform of the Land Acquisition Act, and in April, 2016, the state of Rajasthan became the first state to enact an independent state land acquisition law.



source: Business Standard, 16 July 2015²⁵ (Appendix 2-81)

Figure 2.2.7-1 Current Status of State Land Acquisition Law Establishment

²⁵ http://www.business-standard.com/article/economy-policy/bjp-state-govts-suggest-state-specific-land-acquisition-laws-115071501211_1.html

2.2.8 ELECTRICITY POLICY: SHORT-TERM POWER MARKET

Short-term transactions of electricity refers to the contracts less than one year for the following trades:

- Electricity traded under bilateral transactions through Inter-State Trading Licensees (only inter-state trades),
- Electricity traded directly by the Distribution Licensees,
- Electricity traded through Power Exchanges
- Electricity transacted through Deviation Settlement Mechanism(DSM²⁶)

Inter-state trading licensees (traders) have been conducting electricity transactions since 2004, and as of March, 2015, there are 47 inter-state trading licensees. In India, two Power Exchanges have been conducting business since 2008.

(1) Scope of the Short-Term Power Market

The below table shows the changes in the short-term power market from FY 2009 to FY 2015. The proportion of India's total generated amount occupied by the short-term power market shifts around 10%.

Table 2.2.8-1 Total Volume of Short-term Transactions of Electricity with respect to Total Electricity Generation

Year	Total Volume of Short-term Transaction of Electricity (TWh)	Total Electricity Generation (TWh)	Share
FY2009	65.90	764.03	9%
FY2010	81.56	809.45	10%
FY2011	94.51	874.17	11%
FY2012	98.94	907.49	11%
FY2013	104.64	962.90	11%
FY2014	98.99	1,045.09	9%
FY2015	115.23	1,107.82	10%

source: Report on Short-term Power Market in India: 2015-16, CERC (Appendix 2-83)

(2) Electricity Transacted through Traders and Power Exchanges

The journey up to the establishment of the Power Exchanges is detailed below.

The establishment of Power Markets was stipulated in Electricity Act 2003 and the National Electricity Policy.

In May, 2004, open access was introduced in inter-state transmission.

In July, 2006, the CERC presented a staff paper regarding Power Exchanges.

In December, 2006, the CERC held a public hearing.

In February, 2007, the CERC presented guidelines for setting up Power Exchanges.

In August, 2007, the establishment of the first Power Exchange was approved.

²⁶ Although DSM is not a market mechanism, electricity transacted under DSM is often considered a part of short-term transaction.

In July, 2008, operations began for Indian Energy Exchange Limited (IEX), the first Power Exchange. In October, 2008, operations began for Power Exchange India Limited (PXIL), the second Power Exchange.

IEX is headquartered in Delhi, and is operated by Financial Technologies (India) (FTI), an Indian securities transaction and electronic transaction developer. In addition to the day-ahead market and the term-ahead market, it also handles Renewable Energy Certificates and Energy Saving Certificates. PXIL is headquartered in Mumbai, and its shareholders are the National Stock Exchange of India (NSEI) and the National Commodity & Derivatives Exchange (NCDEX), two of India's major transaction locations. In terms of its products, it handles the day-ahead market and the term-ahead market. In addition to these, IEX has Renewable Energy Certificates and Energy Saving Certificates, and PXIL has weekly products, intra-day products, and any-day products.

The volume of electricity transacted through traders and Power Exchanges is shown in the below table. The share of the volume of electricity transacted through traders and Power Exchanges within the total volume of the short-term transaction of electricity increased from 51% in FY 2009 to 61% in FY 2015.

Looking at the shares of the Power Exchanges, comparing IEX to PXIL, IEX has a much higher share, reaching 98% in FY 2015. The transacted price through IEX and PXIL has been decreasing in recent years steadily.

Table 2.2.8-2 Volume of Electricity Transacted through Traders and Power Exchanges

Year	Electricity Transacted through Traders (TWh)	Electricity Transacted through IEX (TWh)		Electricity Transacted through PXIL (TWh)		Electricity Transacted through IEX and PXIL (TWh)	Total (TWh)
		Day Ahead	Term Ahead	Day Ahead	Term Ahead		
FY2009	26.72	6.17	0.095	0.92	0.003	7.19	33.91
FY2010	27.70	11.80	0.91	1.74	1.07	15.52	43.22
FY2011	35.84	13.79	0.62	1.03	0.11	15.54	51.38
FY2012	26.12	22.35	0.48	0.68	0.04	23.54	59.66
FY2013	35.11	28.92	0.34	1.11	0.30	30.67	65.78
FY2014	34.56	28.12	0.22	0.34	0.72	29.40	63.96
FY2015	35.43	33.96	0.33	0.14	0.58	35.01	70.43

source: Report on Short-term Power Market in India: 2015-16, CERC (Appendix 2-83)

The price of electricity transacted through traders and Power Exchanges is shown in the below table. The prices each year are in a decreasing trend.

Table 2.2.8-3 Price of Electricity Transacted through Traders and Power Exchanges

Year	Price of Electricity transacted through Traders (Rupee/kWh)	Price of Electricity transacted through Power Exchanges (DAM+TAM) (Rupee/kWh)
FY2009	5.26	4.96
FY2010	4.79	3.47
FY2011	4.18	3.57
FY2012	4.33	3.67
FY2013	4.29	2.90
FY2014	4.28	3.50
FY2015	4.11	2.72

source: Report on Short-term Power Market in India: 2015-16, CERC (Appendix 2-83)

(3) Electricity Transacted Directly Between DISCOMs

The electricity transacted directly between DISCOMs is shown in the below table. The share of the volume of electricity transacted directly between DISCOMs within the total volume of the short-term transaction of electricity is in an increasing trend, and reached 21% in FY 2015. The transaction price between DISCOMs are unknown.

Table 2.2.8-4 Electricity Transacted Directly Between DISCOMs

Year	Volume of Electricity Transacted Directly between DISCOMs (TWh)	Total Volume of Short term (TWh)	Share
FY2009	6.19	65.90	9%
FY2010	10.25	81.56	13%
FY2011	15.37	94.51	16%
FY2012	14.52	98.94	15%
FY2013	17.38	104.64	15%
FY2014	15.58	98.99	16%
FY2015	24.04	115.23	21%

source: Report on Short-term Power Market in India: 2015-16, CERC (Appendix 2-83)

(4) Electricity Transacted through DSM

In India, in order to draw out more electricity than the amount of electricity applied to power grids, the frequency is lower than the standard 50Hz, and the loss of power grid safety has become an issue. In order to maintain grid discipline and grid security through commercial mechanisms, the Deviation Settlement Mechanism (DSM) was created (Deviation Settlement Mechanism and related matters) Regulations, 2014, January, 2014) (Appendix 2-133).

On commencement of this Deviation Settlement Mechanism Regulations, UI regulation was repealed, and any reference to the CERC (Unscheduled Interchange charges and related matters) Regulations, 2009 shall deemed to be replaced.

In the context of differences between UI and DSM, refer to “(5) Deviation Settlement Mechanism (DSM), 2.4.6 PSP relevant CERC Regulations.”

The volume and price of electricity transacted through the DSM is shown in the below table. The volume is in a decreasing trend. It is postulated that the background for this is that India's electricity deficit is in a trend toward easing up, and the excessive withdrawal of electricity from power grids is lessening. Transacted prices are decreasing trend, the price in FY2015 was below INR 2/ kWh.

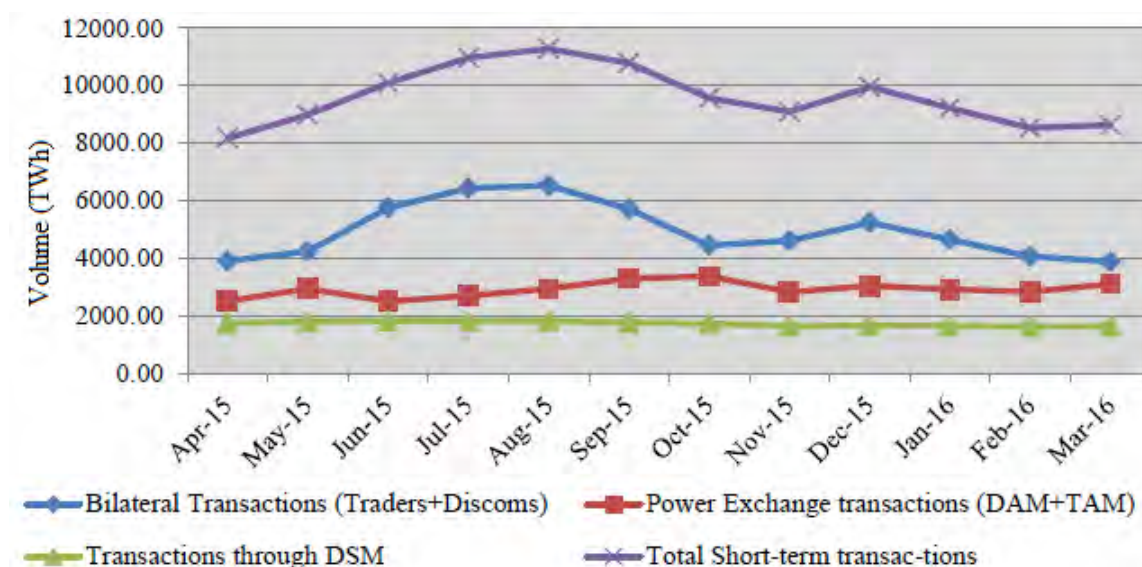
Table 2.2.8-5 Volume and Price of Electricity transacted through DSM

Year	Volume of Electricity Transacted through DSM (TWh)	Total Volume of Short term (TWh)	Share	Price of Electricity Transacted through DSM (Rupee/kWh)
FY2009	25.81	65.90	39%	4.62
FY2010	28.08	81.56	34%	3.91
FY2011	27.76	94.51	29%	4.09
FY2012	24.76	98.94	25%	3.86
FY2013	21.47	104.64	21%	2.05
FY2014	19.45	98.99	20%	2.26
FY2015	20.75	115.23	18%	1.93

source: Report on Short-term Power Market in India: 2015-16, CERC (Appendix 2-83)

(5) Trend of monthly short-term Electricity transaction

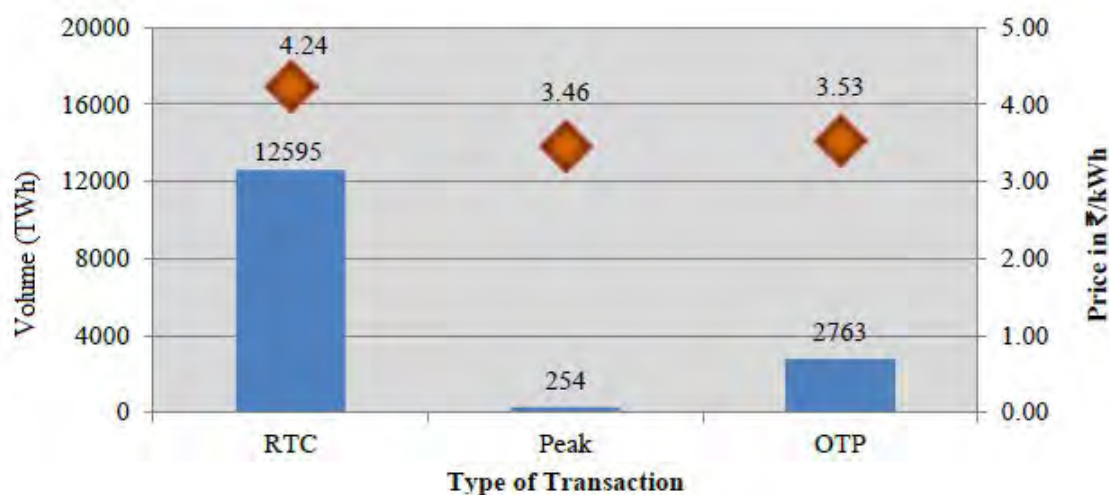
The volume of short-term transactions of electricity in FY2015 is shown below. It is observed from the figure that there is a cyclical trend in the monthly volume of short-term transactions of electricity. A similar trend is also observed in the volume of bilateral transactions. It is also observed from the figure that the volume of all other segments of the short-term transactions of electricity reflect irregular trend.



source: Report on Short-term Power Market in India: 2015-16, CERC (Appendix 2-83)

Figure 2.2.8-1 Volume of Short-term Transactions of Electricity, 2015-16

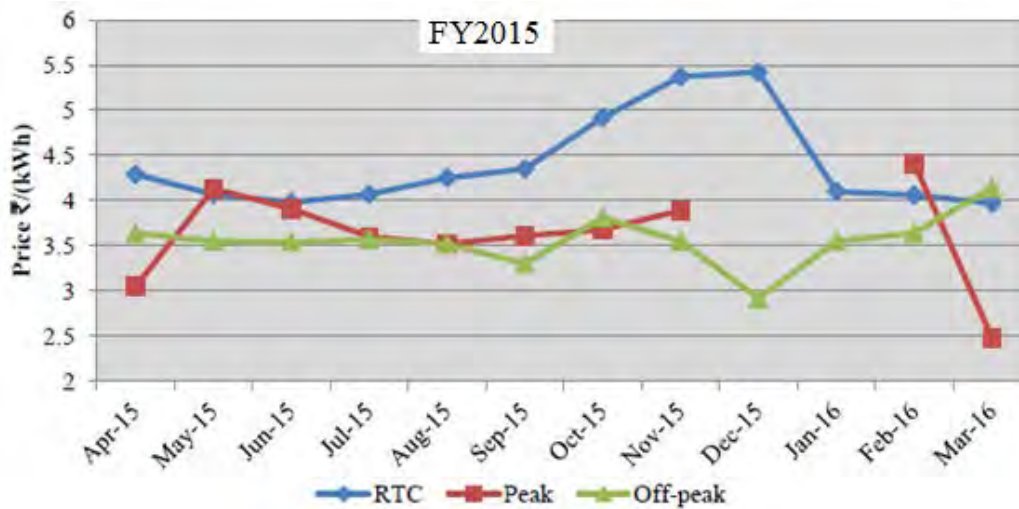
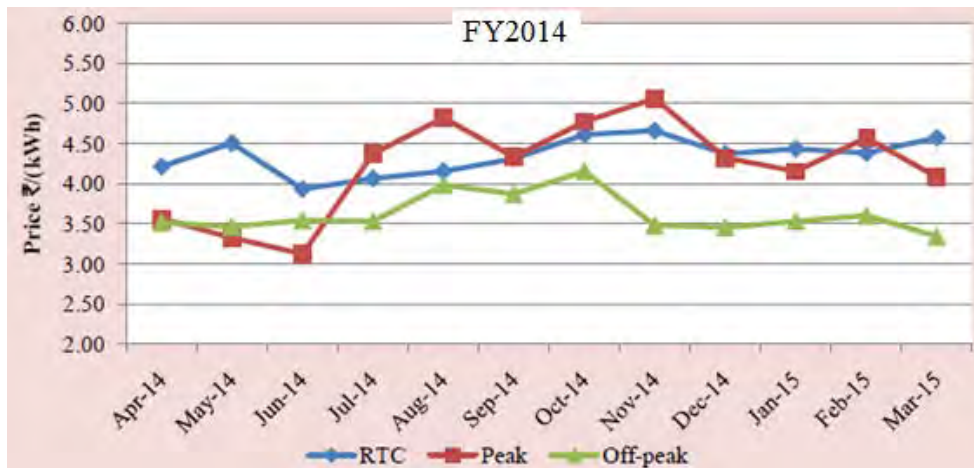
Transaction period wise the volume and price of electricity transacted through traders in FY2015 is shown below. Peak period and OTP (other than RTC & Peak period). Of the total volume, 80.68% was transacted during RTC (Round the Clock) followed by 17.70% during OTP (other than RTC & Peak period), and 1.62% during peak period. It can be observed from the figure that there is hardly any volume transacted during peak period. It can also be observed that the weighted average price during RTC is high (INR 4.24/kWh), when compared with the price during Peak period (INR 3.46/kWh) and OTP (INR 3.53/kWh).



source: Report on Short-term Power Market in India: 2015-16, CERC (Appendix 2-83)

Figure 2.2.8-2 Volume and Price of Electricity Transacted through Traders during RTC, Peak and OTP, 2015-16

Transaction period wise the price of electricity transacted through traders in FY2014 and FY2015. Months that peak period price was higher than RTC price were more frequent than months that RTC price was higher than peak period price. In Contrast, Months that RTC price was higher than peak period price were more frequent than months that peak period price was higher than RTC price. Most of transacted volume were transacted in RTC, there was almost no transacted volume in peak period in FY 2015.

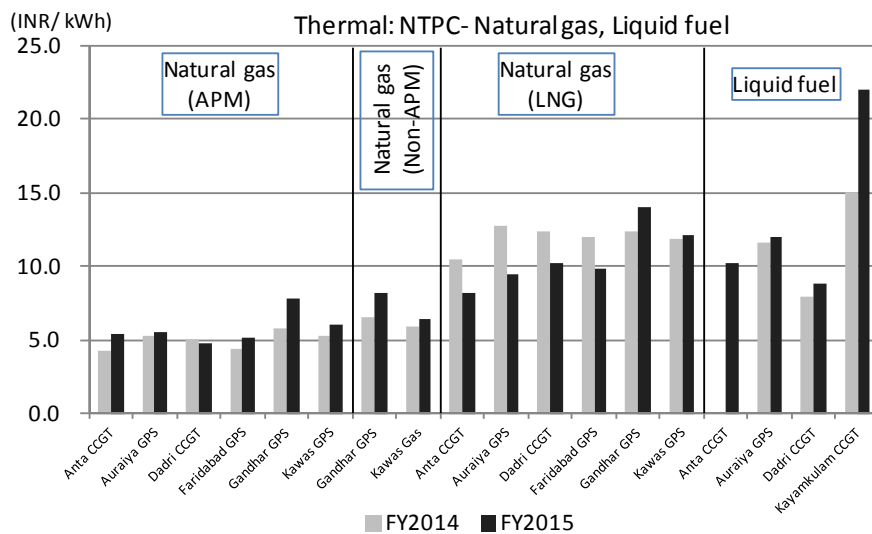
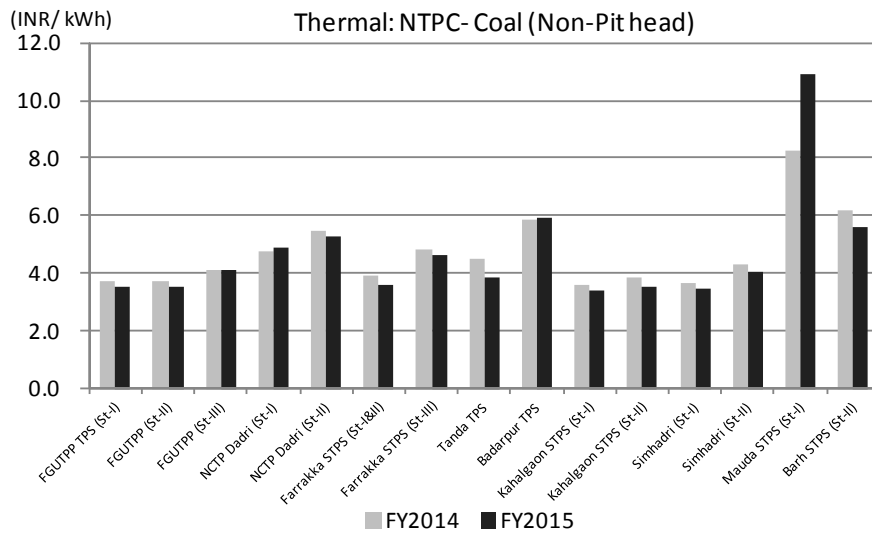
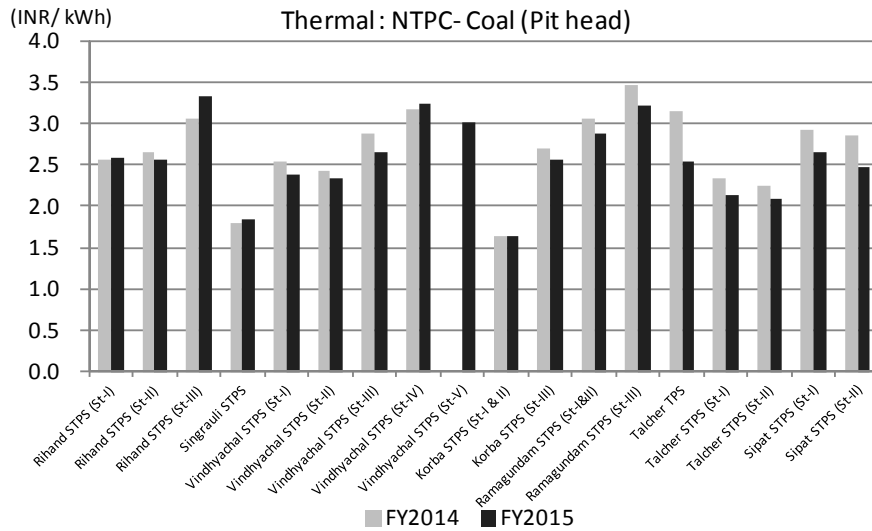


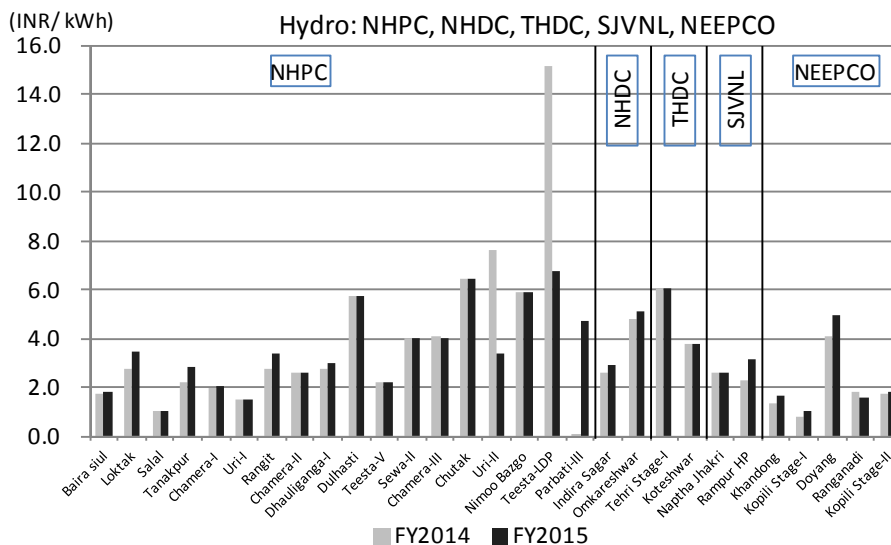
source: Report on Short-term Power Market in India: 2014-15, 2015-16, CERC (Appendix 2-82~83)

Figure 2.2.8-3 Price of Electricity Transacted through Traders during Round the Clock, Peak and Off Peak periods

Generation unit of Central Generation Company wise long-term electricity price is shown below. Generation capacity weighted average price is shown below. Long-term electricity price plays most of the electricity purchase, and it binds the trading prices of short term market.

Looking at fuel wise price, the CPP (Pit head) was the cheapest, next to CPP (Non-Pit head) within thermal plants. GPP was higher than CPP, gasified natural gas from imported LNG was highest within GPP. NEEPO in North-Eastern region shows cheapest price with below INR 2/ kWh. THDC in Uttarakhand shows highest price with over INR 5/ kWh.





source: Report on Short-term Power Market in India: 2014-15, 2015-16, CERC (Appendix 2-82~83)

Figure 2.2.8-4 Long Term Price of Power Plants

Table 2.2.8-6 Long-Term Price (Central, generation capacity weighted average)

Unit: INR/ kWh

Fuel	FY2014	FY2015
Thermal: NTPC- Coal (Pit head)	2.5	2.4
Thermal: NTPC- Coal (Non-Pit head)	4.8	4.8
Thermal: NTPC- Natural gas (APM)	5.1	5.8
Thermal: NTPC- Natural gas (Non-APM)	6.2	7.3
Thermal: NTPC- Natural gas (LNG)	12.0	10.8
Thermal: NTPC- Liquid fuel (Naphtha/ HSD)	8.6	12.1
Hydro: NHPC	2.9	3.0
Hydro: NHDC	3.3	3.7
Hydro: THDC	5.4	5.4
Hydro: SJVNL	2.5	2.7
Hydro: NEEPO	1.7	1.8

source: Report on Short-term Power Market in India: 2014-15, 2015-16, CERC (Appendix 2-82~83)

2.3 CURRENT SITUATION AND CHALLENGES OF ELECTRICITY SECTOR IN INDIA

2.3.1 Electricity Deficit

For many years, India has experienced frequent power outages due to a supply capacity deficit, and this has become a major factor impeding economic development. The Modi administration has adopted "24 x 7 Power For All" as one of its main public promises, and is working to achieve a major improvement in supply capacity through introduction of renewable energy (primarily solar energy), new expansion of thermal power plants, and other efforts. As a result, the deficit in India's electricity supply position is improving.

The following table shows the anticipated power supply position for FY2016, prepared by CEA. For India as a whole, both energy and peak demand are forecast to switch to a surplus for the first time in FY2016. In terms of regions, there is expected to be a deficit in energy in the Northern region, Eastern region and North-Eastern region, and in terms of peak demand, there is expected to be a deficit in the Northern region, Southern region and North-Eastern region. Each state government has formulated a "24 x 7 Power for All" programme in cooperation with the Central Government, and the plan is to realise "24 x 7 Power for All" by 2019.

Table 2.3.1-1 Anticipated Power Supply Position for FY2016

Region	Energy				Peak demand			
	Requirement (GWh)	Availability (GWh)	Surplus/ Deficit (GWh)	(%)	Demand (MW)	Met (MW)	Surplus/ Deficit (MW)	(%)
Northern	357,459	351,009	-6,450	-1.8	55,800	54,900	-900	-1.6
Western	379,087	405,370	26,283	6.9	51,436	56,715	5,279	10.3
Southern	310,564	320,944	10,381	3.3	44,604	40,145	-4,459	-10.0
Eastern	151,336	135,713	-15,622	-10.3	21,387	22,440	1,053	4.9
North-Eastern	16,197	14,858	-1,339	-8.3	2,801	2,695	-106	-3.8
All India	1,214,642	1,227,895	13,252	1.1	165,253	169,503	4,250	2.6

source: LOAD GENERATION BALANCE REPORT 2016-17, May 2016, CEA (Appendix 2-84)

(1) Measures to handle power deficits at peak times

The deficit issue of Discoms company hinders new entrants in the power generation sector. In addition to AT & C losses such as electricity theft, unbillings, uncollected billings, the issue of electricity tariff is included in the deficit of Discoms. Electricity tariffs vary greatly depending on the customer's sector. In the domestic sector and agriculture sector, rates are kept low as a matter of government policy, while rates in the industry sector are set high generally. This method of determining prices is also a factor that Discoms cannot collect part of the cost. Part of the deficit is subsidized by the state government, but the cumulative deficits of Discoms are growing. As the problem of deficits at Discoms hinders new entry into the power generation sector, former Central Government (UPA) adopted financial restructuring programmes in 2003 and 2012. But there was almost no progress in reducing state Discoms' debt and the total debt of state Discoms reached over

INR 4 trillion.²⁷ It was observed that the increase of electricity tariff was failed, which was the condition of the programmes. This may be the main reason of the failure. Some media report suggested that the increase of electricity tariff was the matter of State Government rather than an independent regulator but State Government made no ensure to increase electricity tariff . In November 2015, the current Central Government adopted Ujwal DISCOM Assurance Yojana (UDAY), a new scheme for securitizing and trading debt, and moves to adopt it in each state have come into full swing.

Regarding internal cross-subsidies for electricity tariffs, a framework for reducing and abolishing the system was indicated in the Electricity Act 2003, and with the coming of the Modi administration, there has also been guidance by the Central Government, and in recent years there have been moves to start tariff revision in each state.

In India, load despatch centres have the obligation of maintaining grid stability. In India's Grid Code, load rejection is permitted as the primary means of maintaining grid quality. Therefore, most load despatch centres choose load rejection over securing costly supply. In India, all generation companies are obligated to maintain a 5 % spinning reserve for ancillary services, but since there is a deficit of power supply at peak demand, the situation is such that all operable power plants are in full operation, and the rules are not being adhered to. However, this peak demand deficit and energy deficit are expected to improved greatly in the next 2-3 years, and after that improvement it is likely that the spinning reserve obligation will be mandated more strictly, and there will be a heightened degree of attention to ancillary services. This should be carefully monitored.

(2) Transition from quantity to quality

In India, the power supply capacity deficit which has previously been an issue is expected to be resolved in the near future due to new expansion of thermal power capacities, adoption of renewable energy, and other efforts. Going forward, a major issue will be coping with variable renewable energy such as solar PV, which is expected to be introduced on a large scale in the next stage. That is, a phenomenon has been pointed out whereby large-scale adoption of solar PV results in power generation exceeding power consumption during the day, and when solar PV generation stops in the evening, there is a sudden increase in power demand. This phenomenon is called the Duck Curve, and has begun to be raised as an issue in California, United States, where large-scale adoption of renewable energy is progressing. In India too, there is a similar shift between peak solar output and peak demand in the evening, and thus at companies such as POSOCO, response to the "Duck Curve Phenomenon" has been highlighted, and the importance of pumped storage power (PSP) as a countermeasure is starting to be recognized due to its ability to store electricity and cope with sudden increases in output.

²⁷ Moneycontrol, 6th November 2015

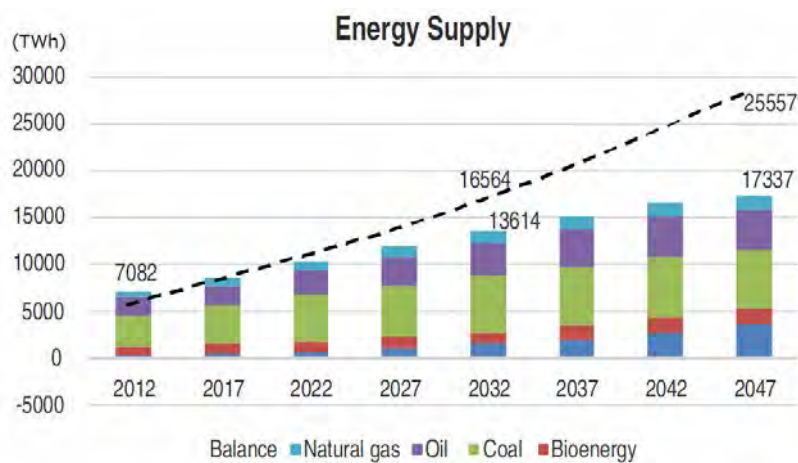
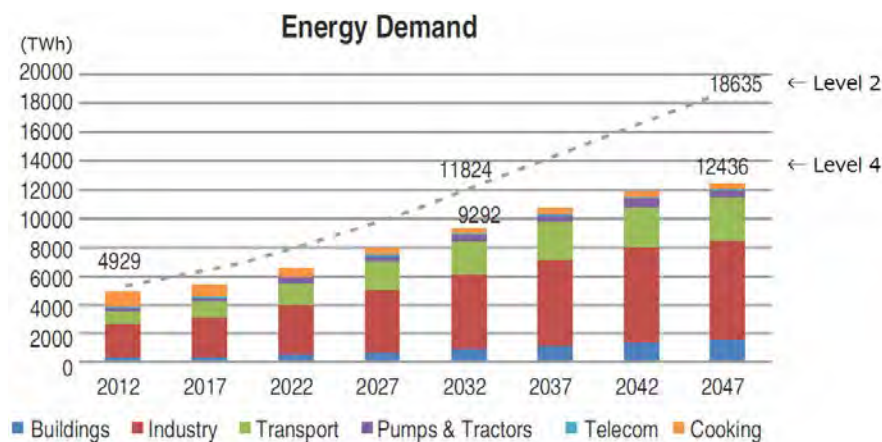
http://www.moneycontrol.com/news/economy/cabinet-clears-financial-restructuring-pkg-for-discoms_4008241.html

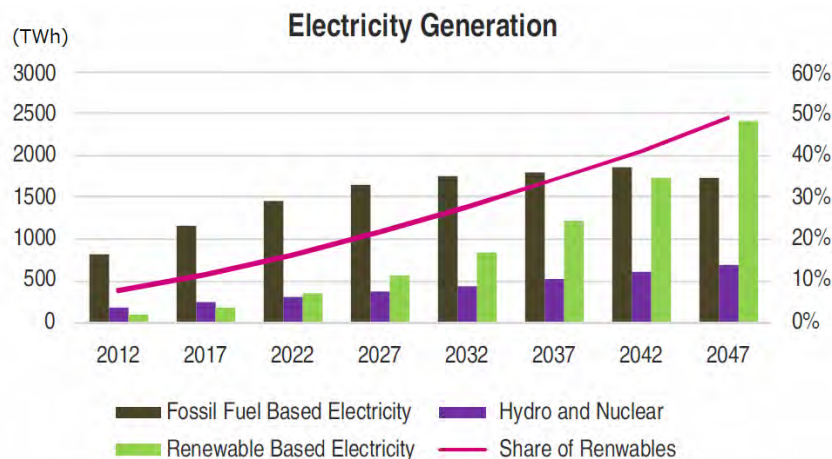
2.3.2 Key Issues and Government Response

(1) Energy Demand Outlook

Regarding long-term electricity demand outlook going forward, the MoP is compiling the 19th Electric Power Survey, and it is expected to be released soon.

In addition, in its India Energy Security Scenario 2047 released in August 2015, the National Institution for Transforming India Aayog (NITI Aayog) has compiled forecasts of energy supply and demand in each sector until the year 2047. The scenario presents four levels, from Least Effort (Level 1) to Heroic Effort (Level 4), to serve as a guide going forward for relevant ministries, agencies and institutions in deploying policy.





source: India Energy Security Scenarios 2047, NITI Aayog, August 2015 (Appendix 2-86)

Figure 2.3.2-1 Outlook of Energy Demand, Energy Supply and Electricity Generation

Definition of the levels in Energy Security Scenarios 2047²⁸

Level 1- the 'Least Effort' scenario: This assumes that little or no effort is being made in terms of interventions on the demand and the supply side.

Level 2- the 'Determined Effort' scenario: This describes the level of effort which is deemed most achievable by the implementation of current policies and programmes of the government.

Level 3- the 'Aggressive Effort' scenario: This describes the level of effort needing significant change which is hard but deliverable.

Level 4- the 'Heroic Effort' scenario: This considers extremely aggressive and ambitious changes that push towards the physical and technical limits of what can be achieved.

(2) Power Generation Plan in the 12th Five Year Plan

The Integrated Energy Policy announced in August 2006 calls for India-wide generation capacity to be increased by about 5 times, from 160 GW to 800 GW, by 2032.

The following table shows generation capacity in India at the end of March 2016. Total generation capacity is 289.1 GW, and broken down by fuel, coal accounts for the largest share of 185.2 GW (about 62% of the total), followed by hydro at 42.8 GW (14% of the total) and renewable energy at 38.8 GW (13%).

²⁸ India Energy Security Scenario 2047 Handbook <http://www.indiaenergy.gov.in/iess/docs/Hand%20Book.pdf>

Table 2.3.2-1 All India Installed Capacity by Region as of 31th March 2016

Unit: MW

Region	Thermal				Nuclear	Hydro	RES	Total
	Coal	Gas	Diesel	Total				
Northern	45,645	5,331	0	50,976	1,620	18,247	8,167	79,009
Western	72,153	10,815	0	82,968	1,840	7,448	13,698	105,954
Southern	36,443	6,474	917	43,834	2,320	11,558	16,213	73,925
Eastern	30,623	190	0	30,813	0	4,289	470	35,572
North-East	310	1,698	36	2,044	0	1,242	263	3,549
Islands	0	0	40	40	0	0	11	51
All India	185,173	24,509	994	210,675	5,780	42,783	38,822	298,060

note: RES=Non-conventional Renewable Energy
source: CEA (Appendix 2-19)

The following table shows progress, as of the end of March 2016, toward the capacity addition target in the 12th Five Year Plan (April 2012 - March 2017). For the target of 88GW, capacity addition at the end of March 2016, before the final year of the plan, was 85GW, for an achievement rate of 96 %.

Table 2.3.2-2 Capacity Addition Targets and Achievements in the 12th Plan**Targets (MW)**

Type/Sector	Central	State	Private	Total
Thermal	14,878	13,922	43,540	72,340
Hydro	6,004	1,608	3,285	10,897
Nuclear	5,300	0	0	5,300
Total	26,182	15,530	46,825	88,537

Achievements (MW)

Type/Sector	Central	State	Private	Total
Thermal	12,638	18,579	48,963	80,180
Hydro	2,504	712	595	3,811
Nuclear	1,000	0	0	1,000
Total	16,142	19,291	49,558	84,991
Achievement	61.7%	124.2%	105.8%	96.0%

source: CEA (Appendix 2-19)

(3) Future Power Generation Plan

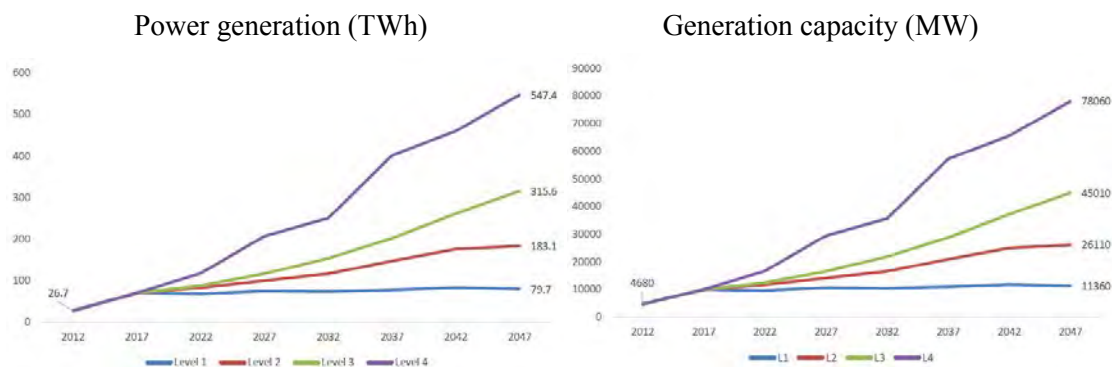
NITI Aayog is currently formulating a power development plan for the 13th Five Year Plan which will start in April 2017 (April 2017 - March 2022). This section indicates development policy for each fuel, as described primarily in Energy Security Scenarios 2047.

1) Nuclear power plants

In India, 21 nuclear power plants are currently operating, with a generation capacity of 5.8GW. The policy in the plan calls for generation capacity to be raised by at least 10 times by

constructing about 40 new nuclear power plants by 2032. In India, domestic production of nuclear power plants has previously been achieved, but the market has been opened to foreign countries, and plans call for Russia to construct 12 plants, EDF (France) 6 plants, and Westinghouse (US) 6 plants.

In Energy Security Scenarios 2047, nuclear power generation and nuclear power generation capacity are projected as follows by level.



source: India Energy Security Scenario 2047

Figure 2.3.2-2 Nuclear power generation and generation capacity (Appendix 2-89)

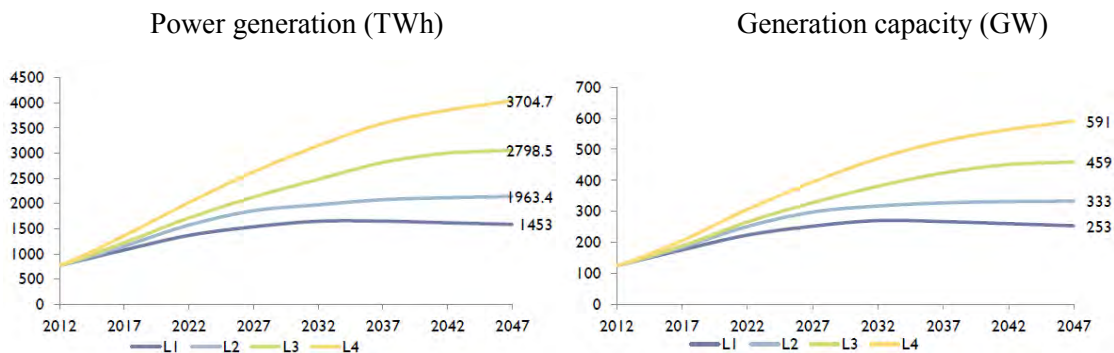
2) Thermal power plants

a) Coal-fired power plants

Since India has plentiful domestic coal resources, the country is promoting the large-scale coal-fired power project 'Ultra Mega Power Projects (UMPPs)'. This is a project for constructing power plants with a generation capacity of 4 GW on single sites. In May 2016, Power Minister Piyush Goyal said that bidding for UMPPs will be carried out at 3 locations (Cheyyur in Tamil Nadu, Sundargarh (Bedabahal) in Odisha and Banka in Bihar) in FY2017. However, Power Minister also mentioned it was in no rush to UMPP given the present supply-demand projection for power in the country. The availability of surplus power capacity in the absence of strong demand from Discoms and the low spot market prices (as low as INR 2/kWh) has not attracted much investors interests. The Government of India plans to eliminate thermal coal imports by increasing domestic coal production. The MOC plan of full self sufficient domestic coal supply has made the imported coal UMPP projects less prioritized.

However, It is no choice that thermal power continues to lead the power sector in India. Under the circumstances, many of the UMPP projects have been put on hold, yet the government firm revised policy if any on UMPPs has not yet released.

In Energy Security Scenarios 2047, coal-fired power generation and coal-fired power generation capacity are projected as follows by level.



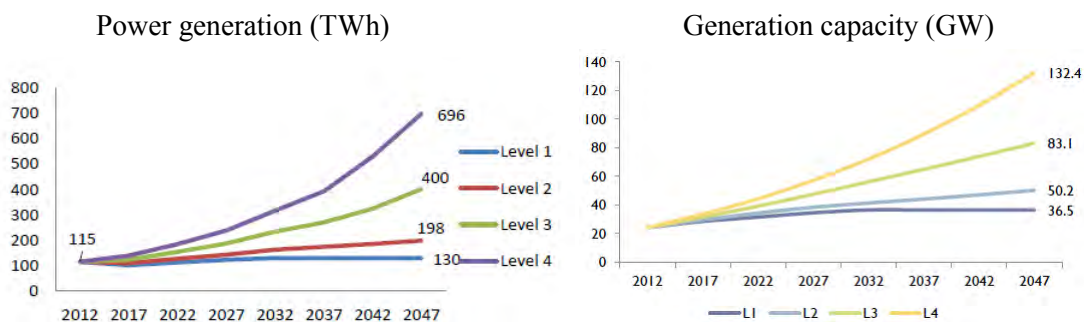
source: India Energy Security Scenario 2047 (Appendix 2-90)

Figure 2.3.2-3 Coal-fired power generation and generation capacity

b) Gas-fired power plants

From the standpoint of energy efficiency and the environment, India wants to increase consumption of natural gas, but at present the country relies on imports for about 70% of natural gas demand. To increase the supply of natural gas, exploration for gas fields is currently being carried out inside India. Also, the TAPI gas pipeline linking Turkmenistan-Afghanistan-Pakistan-India (TAPI) is being constructed in order to import natural gas from Turkmenistan. Construction of the TAPI gas pipeline started in December 2015, and is scheduled to be completed in 2018. Through the TAPI gas pipeline India plans to import 38 Mcf/d of natural gas, and the policy calls for some of this imported natural gas to be used in gas-fired power generation. In India, gas-fired power generation currently accounts for only a small share, but in the future this is expected to increase.

In Energy Security Scenarios 2047, gas-fired power generation and gas-fired power generation capacity are projected as follows by level.



source: India Energy Security Scenario 2047 (Appendix 2-90)

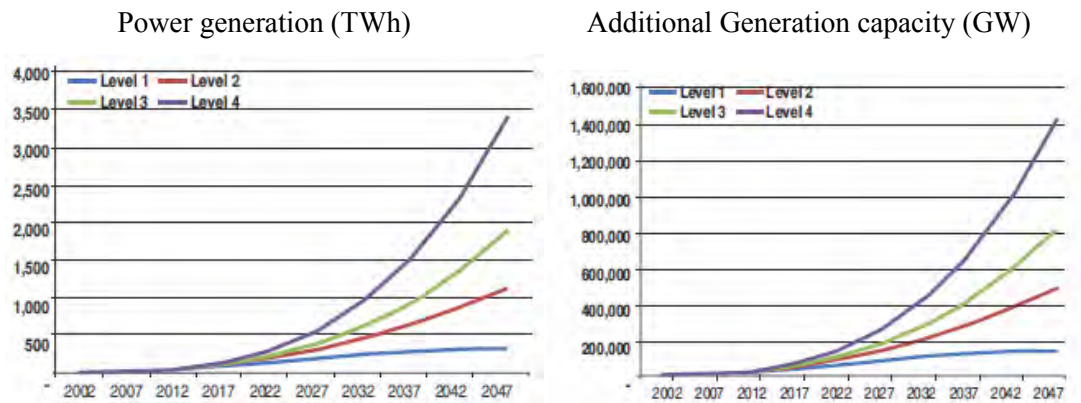
Figure 2.3.2-4 Gas-fired power generation and generation capacity

c) Non-conventional Renewable power generation

As a measure to develop new power sources and address global warming, the policy calls for renewable energy to be greatly expanded to 175GW by 2022. This breaks down into 100GW of

solar energy (of which 40GW is rooftop solar), 60GW of wind, 5GW of small-hydro, and 10GW of biomass. In order to promote the renewable energy, the Central Government announced a new tariff policy in January 2016, and is hammering out various measures to promote renewable energy. In addition, some states are independently establishing their own policies for promotion of renewable energy.

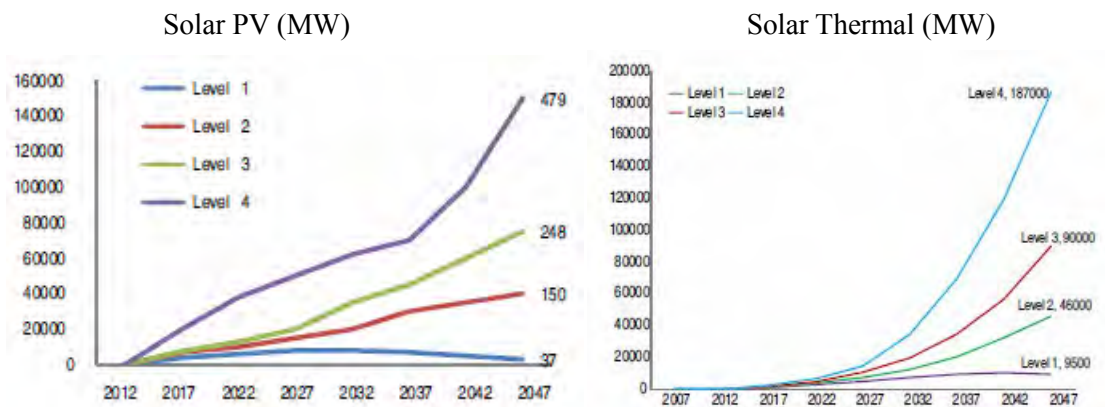
In Energy Security Scenarios 2047, non-conventional renewable power generation and additional non-conventional renewable power generation capacity are projected as follows by level.



source: India Energy Security Scenario 2047 (Appendix 2-91)

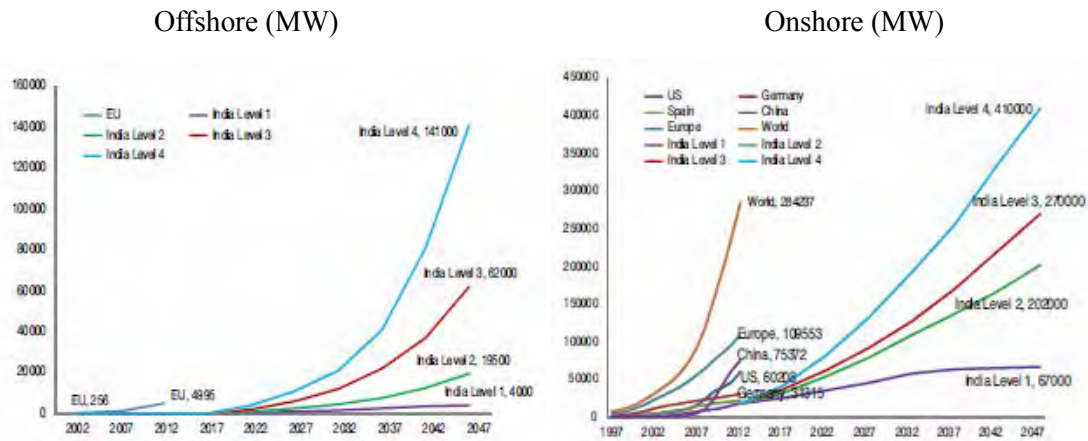
Figure 2.3.2-5 Non-conventional Renewable power generation and generation capacity

In Energy Security Scenarios 2047, additional power generation capacity for solar energy and wind are projected as follows by level.



source: India Energy Security Scenario 2047 (Appendix 2-91)

Figure 2.3.2-6 Additional Solar energy power generation capacity



source: India Energy Security Scenario 2047 (Appendix 2-91)

Figure 2.3.2-7 Additional Wind power generation capacity

3) Large Hydro

MoP introduced the National Policy on Hydropower Development in 1998. Through various measures, Central Government aims to realise 100% hydropower potential by FY2025. To this effect, the CEA has undertaken feasibility and ranking studies in order to determine the feasible completion of large and small hydro projects that are under development, in the 12th and 13th Five Year Plan.

The following figure shows large hydro potential in India, and the table below shows probable installed capacity by river basin. According to CEA, India has nearly 150GW of economically exploitable large hydro potential. This is available mainly in the Brahmaputra, Indus and Ganga river basins.



source: India Energy Security Scenario 2047 (Appendix 2-92)

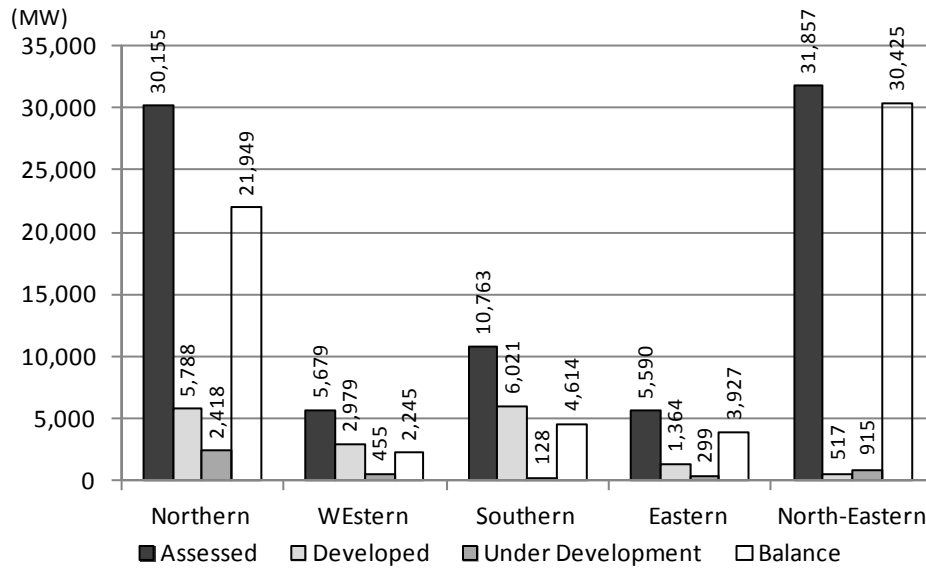
Figure 2.3.2-8 Basin-wise Large Hydro potential in India

Table 2.3.2-3 Basin-wise Large Hydro potential in India

River Basin	Probable installed capacity (MW)
Indus	33,832
Ganga	20,711
Central Indian rivers	4,152
West flowing (southern)	9,430
East flowing (southern)	14,511
Brahmaputra	66,065
Total	149,000

source: India Energy Security Scenario 2047 (Appendix 2-92)

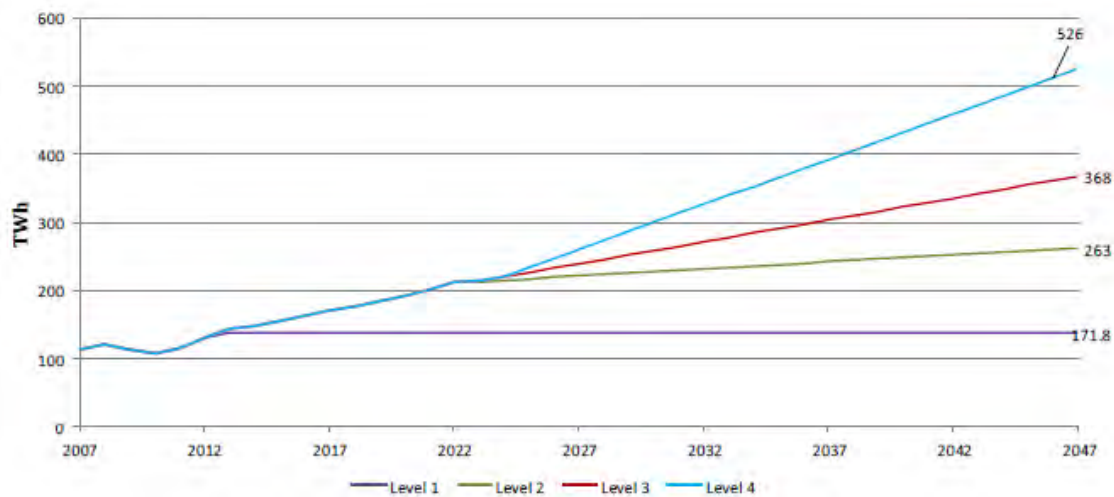
The following graph shows the status of hydro potential development. Of the estimated potential, around 42GW MW is currently installed. Large hydro projects, however, are accompanied by significant ecological impacts and resettlement of local population and livelihoods, which limits its viability to account for a major share of the electricity generation mix in the long run.



source: India Energy Security Scenario 2047 (Appendix 2-92)

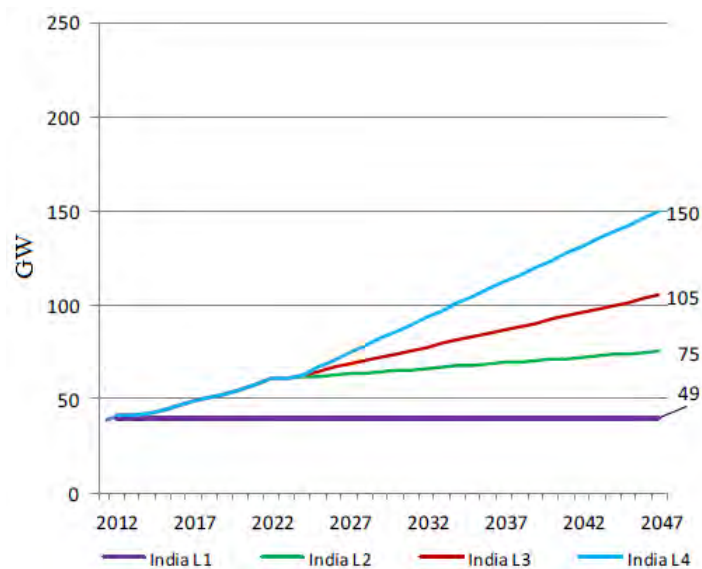
Figure 2.3.2-9 Status of Hydro Potential Development in India

In Energy Security Scenarios 2047, large hydro power generation and large hydro power generation capacity are projected as follows by level.



source: India Energy Security Scenario 2047 (Appendix 2-92)

Figure 2.3.2-10 Large Hydro power generation



source: India Energy Security Scenario 2047 (Appendix 2-92)

Figure 2.3.2-11 Large Hydro power generation capacity

4) Pumped Storage Plants (PSP)

At present, 9 PSPs, total capacity 4.8GW, are installed in the country. Of these, 5 are operating in the pumping mode with an installed capacity of 2.6GW.

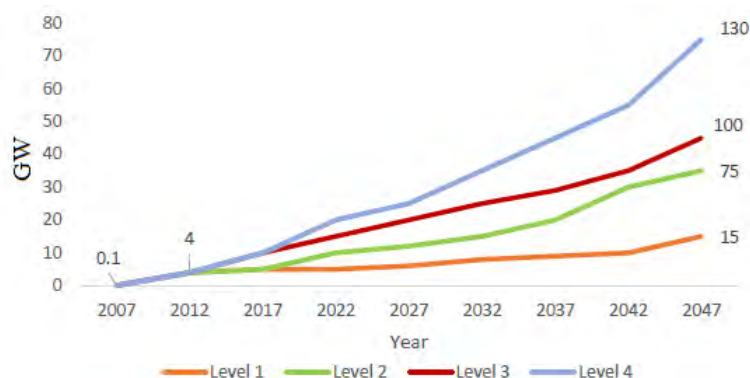
The following table shows PSP potential by region. About 96,500 MW is estimated to be potentially available from pumped hydro schemes, across 56 sites. Individual capacities vary from 600 MW to 2,800 MW.

Table 2.3.2-4 Region-wise PSP potential

Region	Probable installed capacity (MW)
Northern	13,065
Western	39,684
Southern	17,750
Eastern	9,125
North-Eastern	16,900
Total	96,524

source: India Energy Security Scenario 2047 (from reassessment studies by CEA, 1987) (Appendix 2-92)

In India Energy Security Scenario 2047, PSP is treated not as the Hydro category but as the Electrical Energy Storage (EES) category. In Energy Security Scenarios 2047, EES capacity is projected as follows by level. In addition to PSP, EES includes compressed air energy storage (CAES), flywheels, batteries and fuel cells.



source: India Energy Security Scenario 2047 (Appendix 2-93)

Figure 2.3.2-12 Electrical Energy Storage Capacity

(4) Transmission

1) Current Situation

The following table shows transmission lines for each voltage and sector at the end of March 2016.

Table 2.3.2-5 Executive summary of Target and Achievement of Transmission Lines during 2015-16

(All figures in circuit kms.)

Programme / Achievement	HVDC		765 kV				400 kV						220 kV						Total Central, State & JV/ Private Sector									
	± 800 kV						± 500 kV		Central Sector			State/ Private Sector			Central Sector			State/ Private Sector			Central Sector		State/ Private Sector		Grand Total			
	Central Sector	State Sector	Total	Central Sector	JV/Private Sector	Total	PC/CIL	DVC	Total CS	State Sector	JV/Private Sector	Total	PC/CIL	DVC	Total CS	State Sector	JV/Private Sector	Total	PC/CIL	DVC	Total CS	State Sector	JV/Private Sector					
Programme 2015-16	0	0	0	0	0	0	4204	0	1257	5461	3943	0	3943	3759	1466	9168	0	867	867	8216	0	9083	8147	867	9014	11975	2723	23712
Mar 2016																												
Programme	0	0	0	0	0	0	0	0	0	0	0	0	239	310	549	0	0	0	461	0	461	0	0	0	700	310	1010	
Achievement	0	0	0	0	0	0	172	0	0	172	1110	0	1110	12	0	1122	36	0	36	1063	0	1099	1318	0	1318	1075	0	2393
Upto Mar, 2016																												
Programme	0	0	0	0	0	0	4204	0	1257	5461	3943	0	3943	3759	1466	9168	0	867	867	8216	0	9083	8147	867	9014	11975	2723	23712
Achievement	3506	0	3506	0	0	0	4324	0	1277	5601	6009	0	6009	4047	1125	11181	187	212	399	7427	0	7826	14026	212	14238	11474	2402	28114

Note: 400 kV D/C Ib - Meramundali (Loc No. 122/0 to Meramundali) -418 Ckm has been readjusted (Shifted) from 220 kV to 400 kV voltage level in January 2016.

source: Monthly Transmission Report, CEA (Appendix 2-54)

In India, the system after independence was such that power supply was completed within states, but in the 1960s, the power grid began to be managed in regional units.

Initially, State grids were inter-connected to form regional grid and India was demarcated into 5 regions namely Northern, Eastern, Western, North Eastern and Southern region.

In October 1991 North Eastern and Eastern grids were connected.

In March 2003 Western Region and Eastern Region - North Eastern Region were interconnected.

August 2006 Northern and Eastern grids were interconnected thereby 4 regional grids Northern, Eastern, Western and North Eastern grids are synchronously connected forming central grid operating at one frequency.

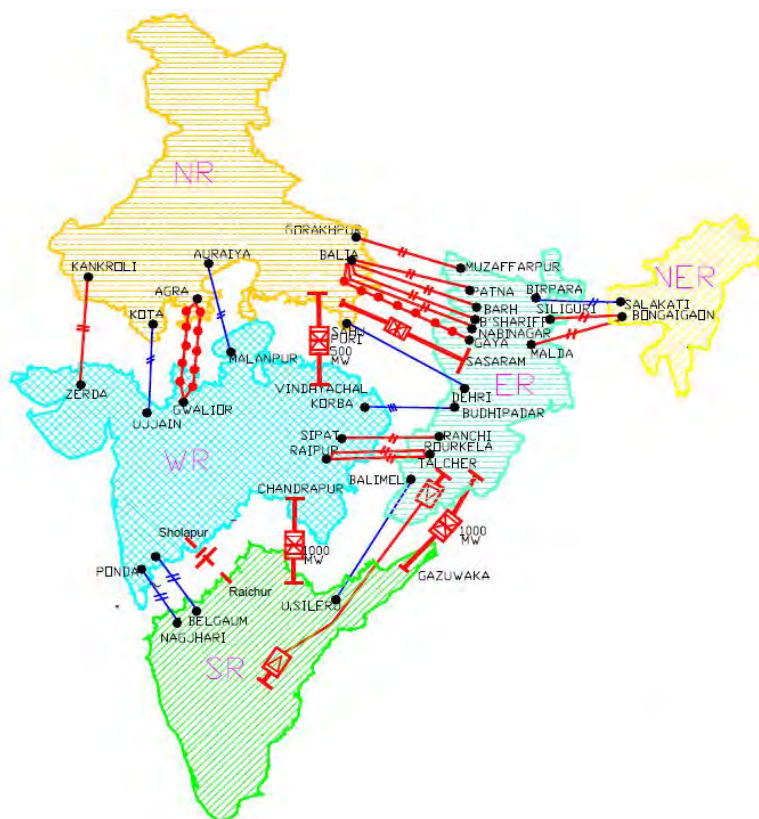
On 31st December 2013, Southern Region was connected to Central Grid in Synchronous mode.

The following table shows Inter Regional Transmission Capacity. As of July 2016, it is 59,550MW. Projected capacity for the end of the 12th Five Year Plan is 68,050MW.

Table 2.3.2-6 Inter Regional Transmission Capacity

Break-up	Capacity as of July 2016 (MW)	Expected at the end of 12th Plan (MW)
Eastern- Northern	17,930	17,930
Eastern- Western	12,790	12,790
Eastern- Southern	3,630	3,630
Eastern- North Eastern	2,860	2,860
Sub Total	37,210	37,210
Western- Northern	12,920	16,920
Western- Southern	7,920	7,920
Sub Total	20,840	24,840
Northern- North Eastern	1,500	6,000
132kV (Inter Regional)	600	0
Grand Total	59,550	68,050

source: MoP (access: 30th August 2016) ²⁹



source: Transmission Infrastructure requirement & Grid Integration aspects, January 2014, PGCIL (Appendix 2-94)

Figure 2.3.2-13 Inter-Regional Transmission Lines

²⁹ <http://powermin.nic.in/en/content/inter-regional-transmission-capacity>

2) Future Plans

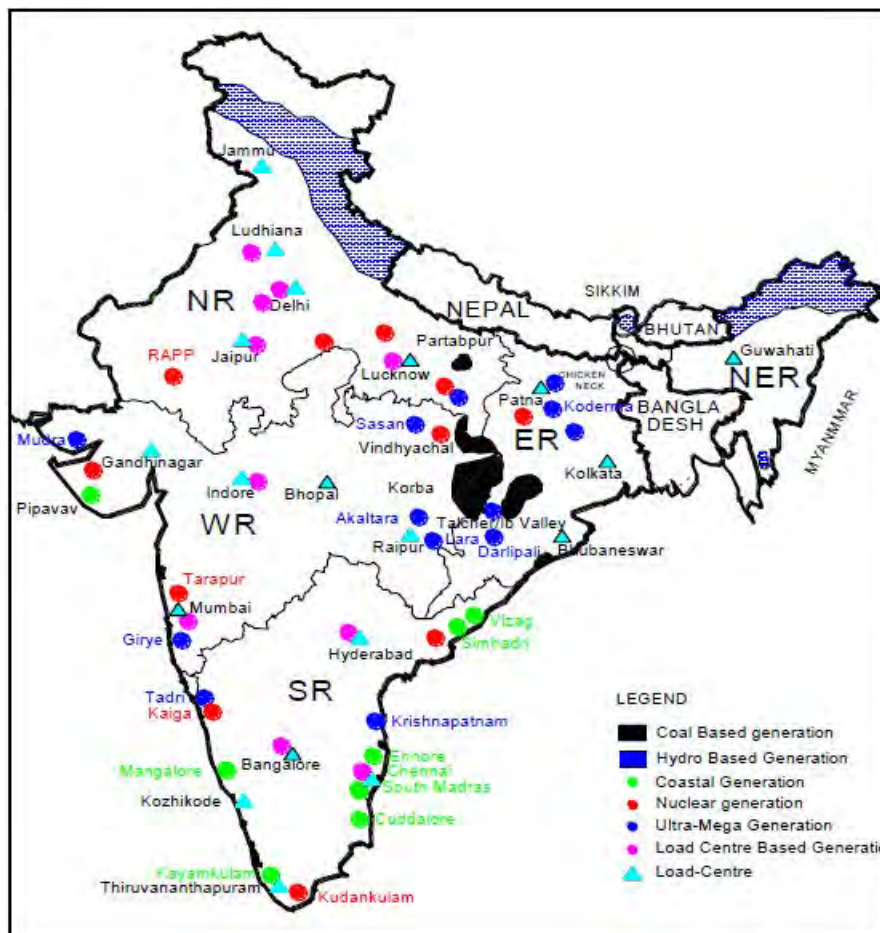
The following figure shows demand centers and energy resources in India.

Coal resources are primarily located in central India and there are plans for new coal-fired, in addition to existing coal-fired plants, in Chhattisgarh, Orissa, Jharkhand, and Madhya Pradesh.

Hydro resources are primarily located in the North Eastern and Northern Himalayan regions.

Also, in the coastal regions there are existing power plants using imported coal and gasified natural gas from imported LNG, as well as plans for new power plants.

Because the energy resources and demand centers are located in different places, transmission lines must be improved to meet the needs of demand centers.



source: Transmission Infrastructure requirement & Grid Integration aspects, January 2014, PGCIL (Appendix 2-94)

Figure 2.3.2-14 Demand Center and Energy Resources in India

According to the Power Grid Corporation, there are the following transmission line expansion projects.³⁰

³⁰ Transmission Infrastructure requirement & Grid Integration aspects, PGCIL (Appendix 2-94)

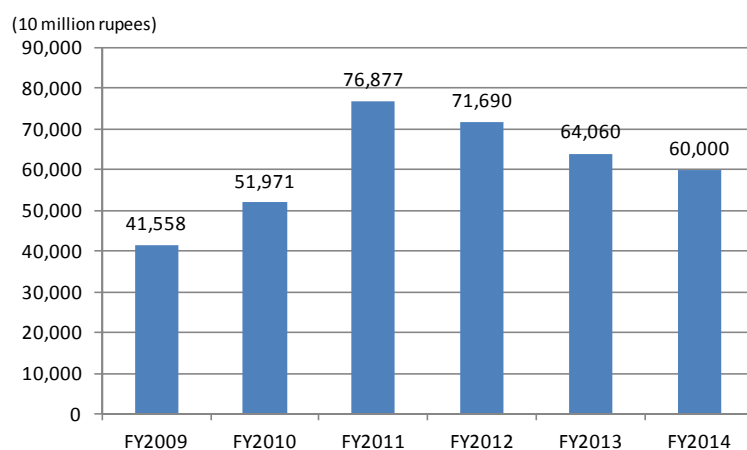
- Expansion Programme for next 5-6 years
 - Transmission Line : 109,440 ckm
 - 765 kV – 27,000 ckm
 - 400 kV – 38,000 ckm
 - 220 kV – 35,000 ckm
 - HVDC – 9,440 ckm
 - Substations : about 2,83,000 MVA
 - 765 kV – 149,000 MVA
 - 400 kV – 45,000 MVA
 - 220 kV/132 kV – 76,000 MVA
 - HVDC - 13,000 MVA
 - Dynamic Compensation at 16 locations at 400 kV level
 - National Grid Capacity (end of 12th Plan)- 65,000 MW
- Few Major Transmission Projects
 - Creation of 11 High Capacity Transmission Corridors for 55 IPPs (55,000 MW)
 - Transmission System for 6 UMPPs (24000MW)
 - Transmission system for DVC generation projects (5000MW)
 - Transmission system for Evacuation of power from NER & Bhutan
- Grid Integration of Renewable Energy-Mitigating Measures
 - Strong Grid interconnections to enlarge balancing areas
 - Forecasting of Renewable generation on different time scale
 - Energy Storage: Large Scale (like Pumped Hydro) for balance of power, fast acting storage for stability
 - Load management & Demand Response
 - Dynamic Reactive Compensation (SVC/STATCOM) at strategic locations
 - Wide Area Monitoring System (WAMS) establishing Smart Grid
 - Establishment of Renewable Energy Management Centers (REMC) integrated with SCADA/control centers
- Green Energy Corridors-12th Plan
 - “Green Energy Corridors” - Comprehensive plan on renewable integration in 12th Plan (33,000 MW envisaged RE capacity)
 - Inter State Transmission System
 - Transmission Line : 3,400 ckm - 765kV : 2,780 ckm - 400kV : 620 ckm
 - Substations : 18,000 MVA (6 nos.) - 765kV : 15,000 MVA (5 nos.) -400kV : 3,000 MVA (1 no.)
 - Intra State Transmission System
 - Transmission Line : 15,000 ckm - 765kV : 300 ckm - 400kV : 5500 ckm - 220kV/132kV : 9200 ckm
 - Substations : 15,500 MVA (32 nos.) - 400kV : 11,000 MVA (12 nos.) - 220kV/132kV : 4,500 MVA (20 nos.)

- Additional Investment requirements : Rs. 3911 Cr
 - Control infrastructure : Rs. 3,677 Crores
(Dynamic Compensation- Rs 1204 Crores
Real time measurement- Rs 473 Crores
Energy Storage –Rs 2000 Crores)
 - Setting up of REMC : Rs. 234 Crores
(REMC: Renewable Energy Management Center)
- Way Forward
 - Forecasting of Renewable Generation- Hardware & Software
 - Grid Scale Energy Storage & its Management System
 - Renewable Energy Control Center
 - Market & tariff design for flexible generation /load

2.3.3 Financial Liabilities of DISCOMs: UDAY

In India, tariffs for the agriculture are held to low levels as a matter of government policy, and as the DISCOMs in each state are forced to have a tariff system that operates at a loss, the structure is such that many DISCOMs fall into a deficit. For this reason, DISCOMs that are in deficits are unable to purchase sufficient electricity to fulfill demand, and as a result, an irrational vicious cycle continues in which outages occur despite there being a surplus of power at power plants.

The losses of DISCOMs from FY 2009 to FY 2014 are shown in the below figure. The total losses over the past six years have reached 3,662 billion rupees.



source: Towards UjwalBharat UDAY: The Story of Reform, November 2015, MoP, MoC, MNRE (Appendix 2-66)

Figure 2.3.3-1 Annual DISCOM losses and debt

For this reason, in November 2015, the Central Government presented the Ujwal DISCOM Assurance Yojna (UDAY) scheme, which aims to improve the total deficits of state DISCOMs. The following is an outline of UDAY.³¹

³¹ UDAY (Ujwal DISCOM Assurance Yojana) for financial turnaround of Power Distribution Companies, 5th November

- ✧ States shall take over 75% of DISCOM debt as on 30 September 2015 over two years - 50% of DISCOM debt shall be taken over in 2015-16 and 25% in 2016-17.
- ✧ Government of India will not include the debt taken over by the States as per the above scheme in the calculation of fiscal deficit of respective States in the financial years 2015-16 and 2016-17.
- ✧ States will issue non-SLR including SDL bonds in the market or directly to the respective banks / Financial Institutions (FIs) holding the DISCOM debt to the appropriate extent.
- ✧ DISCOM debt not taken over by the State shall be converted by the Banks / FIs into loans or bonds with interest rate not more than the bank's base rate plus 0.1%. Alternately, this debt may be fully or partly issued by the DISCOM as State guaranteed DISCOM bonds at the prevailing market rates which shall be equal to or less than bank base rate plus 0.1%.
- ✧ States shall take over the future losses of DISCOMs in a graded manner and shall fund them as follows:

Year	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Previous Year's DISCOM loss to be taken over by State	0% of the loss of 2014-15	0% of the loss of 2015-16	5% of the loss of 2016-17	10% of the loss of 2017-18	25% of the loss of 2018-19	50% of the previous year loss

- ✧ State DISCOMs will comply with the Renewable Purchase Obligation (RPO) outstanding since 1st April, 2012, within a period to be decided in consultation with Ministry of Power.
- ✧ States accepting UDAY and performing as per operational milestones will be given additional / priority funding through Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY), Integrated Power Development Scheme (IPDS), Power Sector Development Fund (PSDF) or other such schemes of Ministry of Power and Ministry of New and Renewable Energy.
- ✧ Such States shall also be supported with additional coal at notified prices and, in case of availability through higher capacity utilization, low cost power from NTPC and other Central Public Sector Undertakings (CPSUs).
- ✧ States not meeting operational milestones will be liable to forfeit their claim on IPDS and DDUGJY grants.
- ✧ UDAY is optional for all States. However, States are encouraged to take the benefit at the earliest as benefits are dependent on the performance.

As of June 2016 20 states have expressed the intention to participate in UDAY, and as of Oct, of these, 17 states have entered into agreements. The Central Government has extended the deadline for states to participate in UDAY to March 2017, and is appealing to the remaining states to participate.

2.3.4 Integrated Power Development Scheme (IPDS)

In November 2014, the Government of India announced the Integrated Power Development Scheme (IPDS). The purposes were as follows³²:

- Strengthening of sub-transmission and distribution network in the urban areas;
- Metering of distribution transformers /feeders / consumers in the urban areas.
- IT enablement of distribution sector and strengthening of distribution network as per CCEA approval dated 21th June 2013 for completion of targets laid down under Restructured Accelerated Power Development and Reforms Programme (RAPDRP) for 12th and 13th Plans by carrying forward the approved outlay for RAPDRP to IPDS.

The scheme will help in reduction in AT&C losses, establishment of IT enabled energy accounting / auditing system, improvement in billed energy based on metered consumption and improvement in collection efficiency.

The scheme will cover works relating to strengthening of sub-transmission & distribution system, including provisioning of solar panels, metering of distribution transformers/ feeders/ consumers in the urban areas, and IT enablement of distribution sector.

All DISCOMs including private sector Discoms and State Power Department will be eligible for financial assistance under the scheme.

The following table shows DISCOM wise AT&C Loss trajectory up to 2021-22 (Finalised by MoP in consultation with DISCOMs).

Table 2.3.4-1 AT&C Loss trajectory

State	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Eastern										
Bihar										
NBPDCL	56.00		46.63	42.63	38.13	34.00	30.00	27.00	24.00	21.00
SBPDCL	53.97		46.63	42.63	38.13	34.00	30.00	27.00	24.00	21.00
Bihar Total	54.63		46.63	42.63	38.13	34.00	30.00	27.00	24.00	21.00
Jharkhand	47.49	43.49	39.49	36.49	32.49	29.49	27.00	24.00	21.00	18.00
Orissa										
CESCO	43.61	39.55	37.58	35.55	33.51	30.98	28.44	25.90	23.36	20.82
NESCO	39.61	35.92	34.13	32.29	30.44	28.14	25.83	23.52	21.22	18.91
SESCO	49.36	44.76	42.53	40.23	37.93	35.06	32.19	29.31	26.44	23.56
WESCO	41.87	37.97	36.07	34.12	32.17	29.74	27.30	24.86	22.42	19.99
Orissa Total	42.94	38.94	37.00	35.00	33.00	30.50	28.00	25.50	23.00	20.50
Sikkim	53.51	49.51	45.51	41.51	37.51	33.51	29.00	26.00	23.00	20.00
West Bengal	34.43	30.51	29.00	28.00	26.00	24.00	23.00	22.00	21.50	21.00
North-Eastern										
Arunachal Pr.	60.26	56.76	53.26	49.76	46.26	42.76	39.26	36.00	33.00	30.00
Assam	31.85	29.85	28.35	26.85	25.35	23.85	22.00	20.00	18.50	17.00
Manipur	85.49	78.49	71.49	64.49	56.49	48.00	40.00	34.00	28.00	22.00
Meghalaya	26.60	33.11	31.29	29.79	28.29	26.79	25.29	23.79	22.29	20.79
Mizoram	27.55	27.02	26.14	25.77	24.59	23.49	22.13	21.13	19.75	18.62
Nagaland	75.30	67.21	64.21	59.21	53.21	47.21	41.21	35.21	29.21	24.21
Tripura	33.85	29.85	27.35	24.85	22.35	20.85	20.00	18.00	17.00	16.00
Northern										
Delhi										

³² http://www.ipds.gov.in/Form_IPDS/About_IPDS.aspx

BRPL	15.16	14.67	14.17	13.92	13.67	13.17	12.95	12.45	12.21	11.96
BYPL	17.94	17.35	16.76	16.46	16.17	15.58	15.32	14.73	14.44	14.14
NDPL	13.12	12.69	12.25	12.04	11.82	11.39	11.20	10.77	10.56	10.34
Delhi Total	15.22	14.72	14.22	13.97	13.72	13.22	13.00	12.50	12.25	12.00
Haryana										
DHBVNL	28.31	26.14	23.96	21.35	18.74	17.01	15.66	14.79	13.92	13.05
UHBVNL	36.97	34.13	31.29	27.88	24.48	22.20	20.44	19.31	18.17	17.04
Haryana Total	32.55	30.05	27.55	24.55	21.55	19.55	18.00	17.00	16.00	15.00
H.P.	9.53	14.50	13.50	12.50	11.50	10.50	10.00	10.00	10.00	10.00
J&K	60.87	55.87	51.87	47.87	43.87	39.87	35.00	30.00	26.00	22.00
Punjab	17.66	17.16	16.66	16.16	15.66	15.16	15.00	14.50	14.25	14.00
Rajasthan										
AVVNL	19.90	21.78	19.60	18.50	17.50	16.50	15.50	14.50	14.25	14.00
JDVVNL	18.97	26.31	21.14	19.22	17.30	16.00	15.00	14.50	14.25	14.00
JVVNL	20.91	30.69	24.50	22.50	20.50	19.00	17.50	16.00	15.00	14.00
Rajasthan Total	20.00	26.74	21.75	20.00	18.50	17.25	16.00	15.00	14.50	14.00
Uttar Pradesh										
DVVN	45.69	41.42	37.16	33.96	30.76	27.56	24.36	21.32	18.13	15.99
MVVN	45.83	41.55	37.27	34.07	30.86	27.65	24.44	21.39	18.18	16.04
PaVVN	33.39	30.27	27.16	24.82	22.48	20.14	17.81	15.58	13.25	11.69
PoVVN	52.37	47.48	42.59	38.93	35.26	31.59	27.93	24.44	20.78	18.33
KESCO	37.61	34.10	30.59	27.96	25.32	22.69	20.06	17.55	14.92	13.17
UP Total	42.85	38.85	34.85	31.85	28.85	25.85	22.85	20.00	17.00	15.00
Uttaranchal	23.18	21.68	20.18	18.68	17.68	16.68	16.00	15.00	14.50	14.00
Southern										
Andhra Pradesh										
APSPDCL	12.74		14.94	14.73	14.31	13.95	13.58	13.58	13.58	13.58
APEPDCL	9.90		10.69	10.33	10.23	10.02	9.89	9.89	9.89	9.89
Andhra Total	11.58		13.13	12.88	12.58	12.28	12.00	12.00	12.00	12.00
Telangana										
TSSPDCL			15.90	15.40	14.90	14.40	13.90	13.40	12.90	12.40
TSNPDCL			13.13	12.88	12.58	12.28	12.00	12.00	12.00	12.00
Telangana total			13.13	12.88	12.58	12.28	12.00	12.00	12.00	12.00
Karnataka										
BESCOM	20.45	16.52	15.36	14.89	14.23	13.37	12.72	11.87	11.51	10.91
GESCOM	18.28	25.51	25.03	24.37	23.92	23.41	22.84	22.44	21.72	21.01
HESCOM	20.44	20.40	20.00	19.66	18.99	18.56	17.96	17.43	17.00	16.36
MESCOM	14.57	14.31	13.10	12.70	12.08	11.65	11.28	10.79	9.92	9.32
CHESCOM	30.42	16.50	15.81	15.35	14.92	14.27	13.59	12.99	12.51	12.19
Karnataka Total	20.78	18.25	17.90	17.43	16.86	16.29	15.72	15.15	14.57	14.00
Kerala	10.53	11.15	10.80	10.50	10.25	10.00	10.00	10.00	10.00	10.00
Pondicherry	9.13	19.00	18.00	17.00	16.00	15.00	14.00	13.00	12.00	11.00
Tamilnadu	20.72	20.22	19.72	19.22	18.97	18.72	18.47	18.22	18.00	18.00
Western										
Chattisgarh	25.12	24.48	22.37	20.66	19.07	17.49	16.17	15.11	14.52	14.00
Goa	14.14	13.89	13.64	13.39	13.14	12.64	12.00	12.00	12.00	12.00
Gujarat										
DGVCL	10.40	13.58	14.48	14.48	14.48	14.48	14.48	14.48	14.48	14.48
MGVCL	14.94	17.41	16.64	15.80	15.01	14.26	14.26	14.26	14.26	14.26
UGVCL	14.37	11.75	16.39	15.57	14.80	14.80	14.80	14.80	14.80	14.80
Gujarat Total	19.87	18.58	21.58	20.41	19.29	18.24	17.25	16.31	15.42	14.58
Madhya Pr.										
MPMKVVCL	29.97	29.61	27.00	25.00	23.00	21.00	19.00	17.00	16.00	15.00
MPPKVVCL	28.16	23.67	21.58	19.96	19.13	18.29	17.44	16.58	15.72	15.00
MPPuKVVCL	36.40	23.68	21.68	20.00	19.00	18.00	17.00	16.00	15.50	15.00
MP Total	31.15	25.86	24.47	23.10	21.73	20.38	18.83	16.50	15.75	15.00
Maharashtra	21.95	20.45	18.95	17.45	16.45	15.45	15.00	14.50	14.25	14.00

source: DISCOM wise AT&C Loss trajectory up to 2021-22 (Finalised by MoP in consultation with Discoms)³³, MoP

³³ http://www.apdrp.gov.in/IPDS_Order_Guidelines/AT_And_C_Loss_Trajectory.pdf

2.3.5 Rural Electrification: DDUGJY

In 1969, the MoP established the Rural Electrification Corporation Limited (REC) in India. REC provides loan assistance to SEBs/State Power Utilities for investments in rural electrification schemes.

In February 2005, under the "Power for all by 2012" initiative, the MoP integrated the rural electrification scheme to accelerate rural electrification and announced the Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY)³⁴. Under the programme, 90% grant was provided by Central Government and 10% as loan by REC to the State Governments. Habitations above 100 population were covered under the scheme.

From October 1997 on, the definition of electrified village was as follows³⁵:

- ✓ Basic infrastructure such as Distribution Transformer and Distribution lines are provided in the inhabited locality as well as the Dalit Basti hamlet where it exists.
- ✓ Electricity is provided to public places like Schools, Panchayat Office, Health Centers, Dispensaries, Community centers etc.
- ✓ The number of households electrified should be at least 10% of the total number of household in the village

In November 2014, the Cabinet approved a new rural electrification policy "Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY)" that included RGGVY. The components of DDUGJY were as follows³⁶:

- Separation of agriculture and non-agriculture feeders facilitating judicious restoring of supply to agriculture & non-agricultural consumers in the rural areas; and
- Strengthening and augmentation of sub-transmission & distribution infrastructure in rural areas, including metering of distribution transformers/ feeders/ consumers
- Rural electrification, as per CCEA approval dated 1st August 2013 for completion of the targets laid down under RGGVY for 12th and 13th Plans by carrying forward the approved outlay for RGGVY to DDUGY.

The scheme will cover works relating to feeder separating, strengthening of sub-transmission & distribution systems including metering of distribution transformers/ feeders/ consumers and rural electrification.

All DISCOMs including private sector DISCOMs and State Power Departments will be eligible for financial assistance.

2.3.6 Global Warming Prevention Measures

India is currently the world's third largest emitter of greenhouse gases (GHG). The National Action

³⁴ <https://india.gov.in/rajiv-gandhi-grameen-vidyutikaran-yojana>

³⁵ http://www.ddugjy.gov.in/mis/portal/definition_electrified_village.html

³⁶

http://www.pmindia.gov.in/en/news_updates/pm-condemns-the-terror-attack-in-kabul-condoles-loss-of-innocent-lives-in-the-attack/?comment=disable

Plan on Climate Change (NAPCC) (Appendix 2-97), announced on June 30, 2008, one week prior to the Hokkaido Toyako Summit, was the first time the Indian government presented measures to deal with the problem of warming on a global scale. In India, surface temperature, rainfall, extreme weather events, rise in sea level, and impact on Himalayan glaciers have already been observed. NAPCC has established eight missions for climate change mitigation and adaptation.

- I. National Solar Mission
- II. National Mission for Enhanced Energy Efficiency in Industry
- III. National Mission on Sustainable Habitat
- IV. National Water Mission
- V. National Mission for Sustaining the Himalayan Ecosystem
- VI. National Mission for “Green India”
- VII. National Mission for Sustainable Agriculture
- VIII. National Mission on Strategic Knowledge for Climate Change

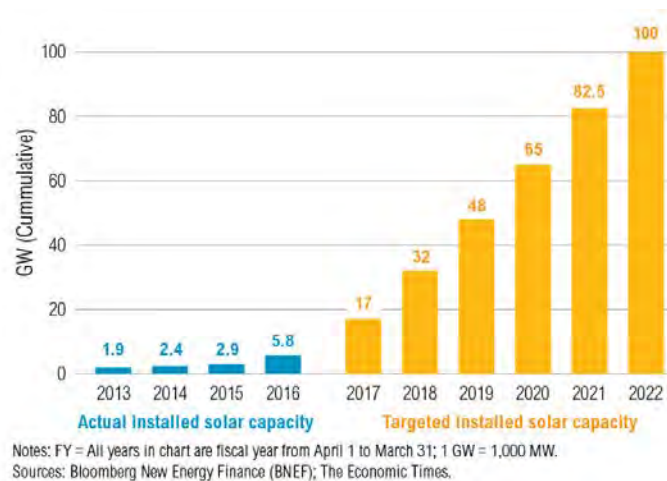
The Jawaharlal Nehru National Solar Mission (JNNSM) was launched in January 2010, set the ambitious target of deploying 20 GW of grid connected solar power by 2022. It is aimed at reducing the cost of solar power generation in the country through (i) long term policy; (ii) large scale deployment goals; (iii) aggressive R&D; and (iv) domestic production of critical raw materials, components and products, as a result to achieve grid tariff parity by 2022.

JNNSM then was 20,000 MW by 2022. But in 2014, when BJP took the power, Prime Minister Narendra Modi increased the target by five times to 100 GW by 2022. The present BJP government has set an further ambitious target of generating 175 GW power by 2022 from renewable sources, including 100 GW from solar, 60 GW from the wind, 10 GW from biomass and 5 GW from small hydroelectric projects³⁷.

MNRE has released a year-by-year breakdown of solar capacity targets by states to reach its overall 100 GW solar capacity target by 2022. Various policy options have been being adopted to achieve the goal, including renewable tariff regulations with RPO, accelerated depreciation, MNRE also launched the scheme for ‘Development of Solar Parks and Ultra Mega Solar Power Projects’ in 2014.

³⁷ http://niti.gov.in/writereaddata/files/writereaddata/files/document_publication/report-175-GW-RE.pdf

Year wise solar power targets is shown below.



source: WORLD RESOURCES INSTITUTE³⁸

Figure 2.3.6-1 India sets year-on-year targets to reach ambitious 2022 solar goal

Perform, Achieve and Trade (PAT) was adopted in 2012 for the National Mission for Enhanced Energy Efficiency in Industry. PAT is a market based mechanism to enhance cost effectiveness of improvements in energy efficiency in energy intensive large industries and facilities, through certification on energy savings that could be traded. This system imposes an obligation on businesses targeted by the system (including thermal power plants) to reduce energy consumption, with fines if they are unable to achieve targets.

In October 2015, prior to COP21 held in Paris, the Government of India submitted the Intended Nationally Determined Contribution (INDC) to UNFCCC (Appendix 2-99). The target was to reduce GHG emissions per unit of GDP by 33-35% from 2005 levels by the year 2030. In terms of specific efforts, the INDC included policies to increase the share of non-fossil fuel power generation (such as nuclear and renewable energy) to 40% of total power generation capacity by 2030.

With regard to the Clean Development Mechanism (CDM), as of January 2016, UNFCCC's CDM Executive Board had approved 1,623 CDM projects in India, placing it second in the world after China, and accounting for 20% of the global total.

Aside from global climate change, air pollution is becoming an increasingly serious problem due to India's rapid economic growth. In December 2015, the Ministry of Environment, Forests, and Climate Change (MoEFCC) issued notification of emissions standards for coal-fired thermal power plants according to provisions in the Environment Protection Act 1986. In addition, SO_x, NO_x, and mercury became newly subject to regulation (Appendix 2-100).

³⁸ <http://www.wri.org/blog/2016/05/india-charts-roadmap-achieve-ambitious-solar-targets>

2.4 POLICY AND CURRENT SITUATION OF PSP

2.4.1 Renewable Energy Policy

The Central Government has made renewable energy the centerpiece of its global warming prevention measures, and set a goal of introducing 175GW of renewable energy by FY2022 as an important means of solving power deficits and electrifying rural areas.

The following table shows a tentative breakdown by state and energy type of the 175GW to be achieved by 2022.

Table 2.4.1-1 Tentative State-wise break-up of Renewable Power Target

Unit: MW

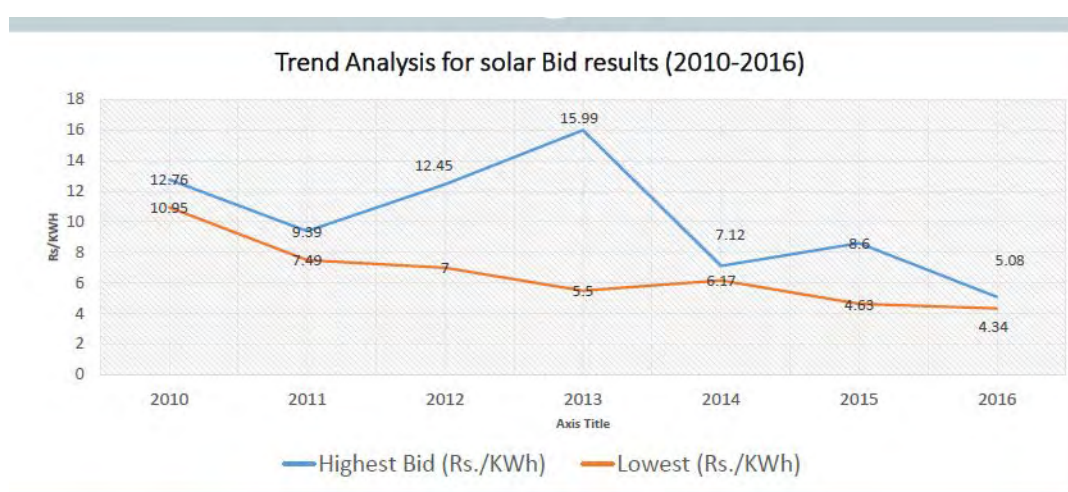
State/UTs	Solar	Wind	Small hydro	Biomass
Delhi	2,762			
Haryana	4,142		25	209
Himachal Pradesh	776		1,500	
Jammu & Kashmir	1,155		150	
Punjab	4,772		50	244
Rajasthan	5,762	8,600		
Uttar Pradesh	10,697		25	3,499
Uttarakhand	900		700	197
Chandigarh	153			
Northern Region	31,120	8,600	2,450	4,149
Goa	358			
Gujarat	8,020	8,800	25	288
Chhattisgarh	1,783		25	
Madhya Pradesh	5,675	6,200	25	118
Maharashtra	11,926	7,600	50	2,469
D. & N. Haveli	449			
Daman & Diu	199			
Western Region	28,410	22,600	125	2,875
Andhra Pradesh	9,834	8,100		543
Telangana		2,000		
Karnataka	5,697	6,200	1,500	1,420
Kerala	1,870		100	
Tamil Nadu	8,884	11,900	75	649
Puducherry	246			
Southern Region	26,531	28,200	1,675	2,612
Bihar	2,493		25	244
Jharkhand	1,995		10	
Orissa	2,377			
West Bengal	5,336		50	
Sikkim	36		50	
Eastern Region	12,237		135	244
Assam	663		25	
Manipur	105			
Meghalaya	161		50	

State/UTs	Solar	Wind	Small hydro	Biomass
Nagaland	61		15	
Tripura	105			
Arunachal Pradesh	39		500	
Mizoram	72		25	
North Eastern Region	1,205		615	
Andaman & Nicobar Islands	27			
Lakshadweep	4			
Other (New States)		600		120
All India	99,533	60,000	5,000	10,000

source: Tentative State-wise break-up of Renewable Power target to be achieved by the year 2022, MNRE³⁹

To promote renewable energy, some states started Feed in Tariffs (FIT) in 2009 and Renewable Power Obligations (RPOs) in 2010. In addition, all states are obligated to introduce RPOs by 2022 in accordance with the National Tariff Policy, revised in January 2016. Further, the New Tariff Policy 2016 defines states to endeavor to procure power from renewable energy sources through competitive bidding to keep the tariff low. The trend analysis for solar bid results is shown below. Price is in decreasing trend.

Furthermore, it should be noted that in October 2016 the Power Minister (Goyal) announced to lift 25MW cap for renewable hydropower to reclassify large hydro (including PSPs) as “renewable”. It not only support 175GW goal from renewable sources by 2022, but further enlarge the target to 230GW. Furthermore, it may allow hydro power projects (including PSPs) to adopt various incentives applied to renewable sources such as RPOs, Renewables Tariff regulations, or lower cost financing sources for renewables. It can lead state governments intensions inclined to develop hydro and PSPs sources.⁴⁰



source: MNRE

Figure 2.4.1-1 Trend analysis for solar bid results (2010-2016)

³⁹ <http://mnre.gov.in/file-manager/UserFiles/Tentative-State-wise-break-up-of-Renewable-Power-by-2022.pdf>

⁴⁰ Such as energy live news,

<http://www.energylivenews.com/2016/10/24/india-to-classify-large-hydro-as-renewables-to-meet-green-targets/>

In July 2016, the MoP presented RPO guidelines to state DISCOMs to accelerate the adoption of renewable energy. RPOs are divided into solar and non-solar, with the final target for DISCOMs set by the SERC of each state.

Table 2.4.1-2 RPO Trajectory recommended by MoP

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

source: The Economic Times, 27 July 2016⁴¹

For the reference, in 2011, the National Tariff Policy 2006 had been amended to require the State Electricity Regulators to fix a percentage of energy purchase from solar power under the RPOs. It was intended to prescribe solar-specific RPO be increased from a minimum of 0.25 per cent in 2012 to 3 per cent by 2022. The following table shows the solar power RPO targets then for each state at that point. These are the SERCs Order on RPO Regulations collected by MNRE. As described, as of now the further accelerated RPO guideline in the above table has been issued in 2016.

Table 2.4.1-3 State-wise Solar RPO targets

States	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Andhra Pradesh	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%					
Arunachal Pradesh	Not regulation issued for RPO by the Power Department										
Assam	0.10%	0.15%	0.20%	0.25%							
Bihar	0.25%	0.25%	0.50%	0.75%	1.00%	1.25%	1.50%	1.75%	2.00%	2.50%	3.00%
Chhattisgarh	0.25%	0.50%									
Delhi	0.10%	0.15%	0.20%	0.25%	0.30%	0.35%					
JERC (Goa & UT)	0.30%	0.40%									
Gujarat	0.50%	1.00%									
Haryana	0.00%	0.05%	0.75%								
Himachal Pradesh	0.01%	0.25%	0.25%	0.25%	0.25%	0.25%	0.50%	0.75%	1.00%	2.00%	3.00%
Jammu and Kashmir	0.10%	0.25%									
Jharkhand	0.50%	1.00%									
Karnataka	0.25%										
Kerala	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%
Madhya Pradesh	0.40%	0.60%	0.80%	1.00%							
Maharashtra	0.25%	0.25%	0.50%	0.50%	0.50%						
Manipur	0.25%	0.25%									
Mizoram	0.25%	0.25%									
Meghalaya	0.30%	0.40%									
Nagaland	0.25%	0.25%									
Orissa	0.10%	0.15%	0.20%	0.25%	0.30%						
Punjab	0.03%	0.07%	0.13%	0.19%							
Rajasthan	0.50%	0.75%	1.00%								
Sikkim	Not regulation issued for RPO by the Power Department										
Tamil Nadu	0.05%										
Tripura	0.10%	0.10%									
Uttarakhand	0.03%	0.05%									
Uttar Pradesh	0.50%	1.00%									
West Bengal			0.25%	0.30%	0.40%	0.50%	0.60%				

source: MNRE⁴²

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<http://economictimes.indiatimes.com/industry/energy/power/power-ministry-sets-green-energy-target-for-state-discoms/article53407454.cms>

Regarding solar power, the Jawaharlal Nehru National Solar Mission (JNN Solar Mission) was started in 2010 based on the 2008 National Action Plan on Climate Change. The Mission has set the ambitious target of deploying 20GW of grid connected solar power by 2022. Solar parks have been constructed at 33 locations in 21 states, and as of the end of March 2016, generation capacity had reached 19.9GW.

In January 2015, Prime Minister Modi announced that he wanted 100 GW of solar power. In response to this, MNRE set the following yearly targets in April 2016.

Table 2.4.1-4 Year wise and cumulative target of Grid connected Solar power

SI. No.	Year	Yearly Target (MW)	Cumulative Target (MW)
1	2015-16	2,000	5,000
2	2016-17	12,000	17,000
3	2017-18	15,000	32,000
4	2018-19	16,000	48,000
5	2019-20	17,000	65,000
6	2020-21	17,500	82,500
7	2021-22	17,500	100,000

source: Office Memorandum, 6th April 2016, MNRE⁴³

With regard to wind power, a major share of renewable power capacity in India is from wind energy. India started harnessing of the wind power prior to 1990. The present installed capacity is over 27 GW⁴⁴ which is fourth largest in the world after China, USA and Germany. Most of the wind-turbines installed up to the year 2000 are of capacity below 500 kW and are at sites having high wind energy potential. It is estimated that over 3,000 MW capacity installation are from wind turbines of around 500 kW or below. In order to optimally utilize the wind energy resources repowering is required.

MNRE announced the Policy for Repowering of the Wind Power Projects in August 2016⁴⁵. Objective of the Repowering Policy is to promote optimum utilisation of wind energy resources by creating facilitative framework for repowering.

Initially wind turbine generators of capacity 1 MW and below would be eligible for repowering under the policy.

Incentives are as follows:

- ✓ For repowering projects Indian Renewable Energy Development Agency (IREDA) will provide an additional interest rate rebate of 0.25% over and above the interest rate rebates available to the new wind projects being financed by IREDA.
- ✓ All fiscal and financial benefits available to the new wind projects will also be available to the repowering project as per applicable conditions.

⁴² 2016年11月8日アクセス <http://mnre.gov.in/file-manager/UserFiles/Solar%20RPO/state-wise-solar-RPO-targets.pdf>

⁴³

<http://mnre.gov.in/file-manager/UserFiles/OM-year-wise-cumulative-target-for-100000MW-grid-connected-SP-project.pdf>

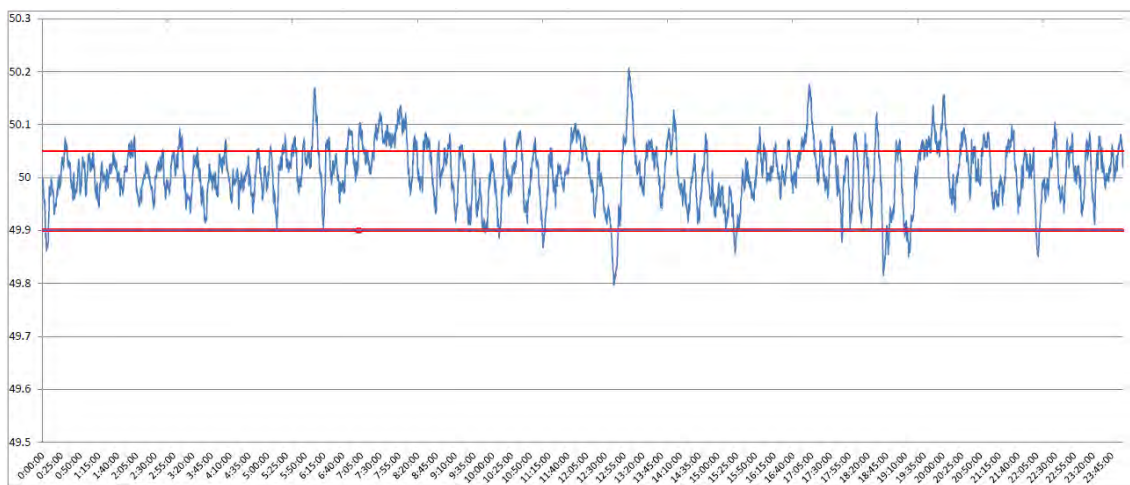
⁴⁴ 26,867 MW as of March, 2016 (CEA)

⁴⁵ Policy for Repowering of the Wind Power Projects, MNRE, 5th Aug., 2016 (Appendix 2-105)

In case of power being procured by State DISCOMs through PPA, the power generated corresponding to average of last three years' generation prior to repowering would continue to be procured on the terms of PPA in-force and remaining additional generation would either be purchased by DISCOMs at Feed-in-Tariff (FIT) applicable in the State at the time of commissioning of the repowering project and/or allowed for third party sale.

2.4.2 Challenge for Introduction of Large Scale Variable Energy

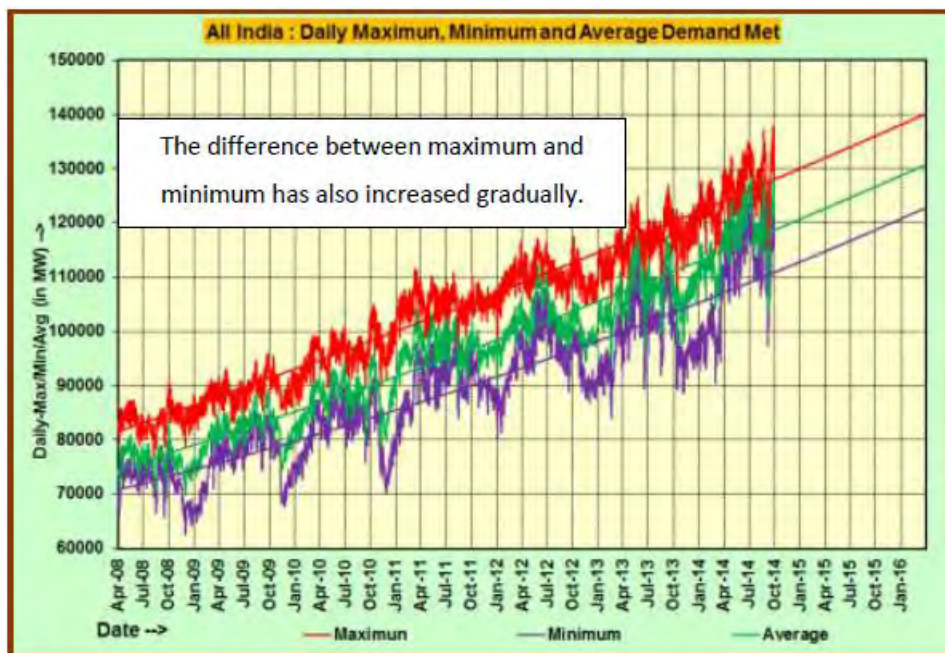
India's Grid Code was amended in 2014, and standards for frequency were strengthened to 49.90~50.05 Hz. However, frequency often deviates from this standard as showed below.



source: NLDC (Appendix 2-106)

Figure 2.4.2-1 National Grid Frequency Profile for 29th August 2016

Also, there is a growing difference between the maximum and minimum demand in a day.



source: Flexibility Requirement in Indian Power System, POSOCO, January 2016 (Appendix 2-107)

Figure 2.4.2-2 All India maximum, minimum and average demand met

India has set a target of introducing 175GW of renewable energy by FY2022. A tentative break-up puts the share of solar power at 57% and wind power at 34%. These two types of variable renewable energy account for 90% of the target.

Indian Grid Code defines system operator make efforts to make solar and wind power as a must-run station which have been criticized losing incentive on generators to invest in forecasting and submitting schedules to SLDCs⁴⁶. However, cases have already been pointed out where, due to a sudden increase in solar power generation, power could not be generated because inadequate transmission capacity prevented connection to the grid. According to the media, in the past, wind power had been curtailed during peak generation periods in Tamil Nadu, however in July 2016 solar power was curtailed in the range of 50-100% for the first time.⁴⁷

The media has also stated that the Central Government will, for the first time, conduct bidding for solar power equipped with batteries as part of a trial programme to make renewable energy more reliable. An advertisement in a local newspaper dated July 20, 2016 said the Solar Energy Corp. of India (SECI), the implementing agency for clean-energy projects, will conduct bidding for 300MW in Andhra Pradesh and Karnataka.⁴⁸

On the other hand, according to other media sources, CEA officials recently informed the media that

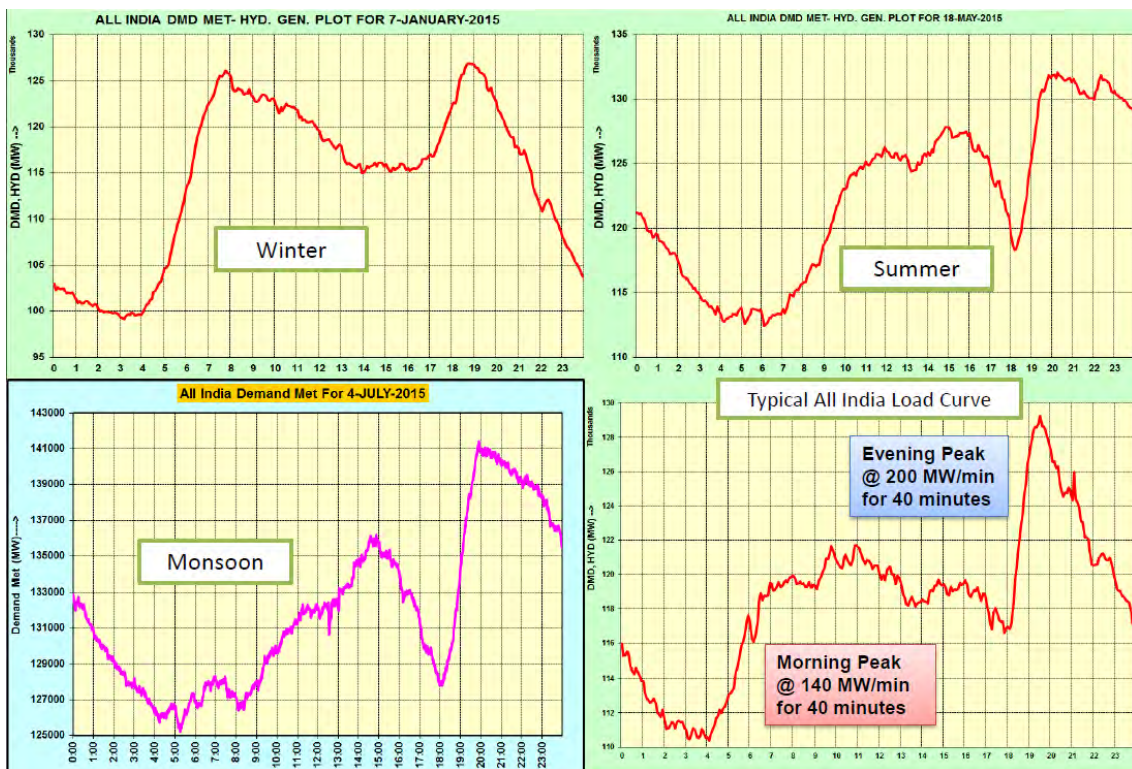
⁴⁶ This connects to the introduction of “Model Regulations on Forecasting, Scheduling and Deviation Settlement of Wind and Solar Generating Stations at the State level”, 2015, CERC, which mandates the submissions of day ahead generators projections.

⁴⁷ PV-Tech, 26th July 2016

⁴⁸ Bloomberg, 22th July 2016

the Central Government is planning to establish a 10GW PSP capacity for all of India.⁴⁹ The officials explained that the plan is to establish PSP and solar power together, in order to maximize use of renewable energy. Solar power projects will be set up near water reservoirs. This will make batteries unnecessary for storing solar power. If lithium-ion batteries are used to store solar power, electricity tariffs will increase by about Rs 10/kWh. By comparison, increased tariffs in the case of PSPs will be only be Rs 0.30–0.40/kWh. PSP's can maintain grid stability while increasing renewable energy at low cost.

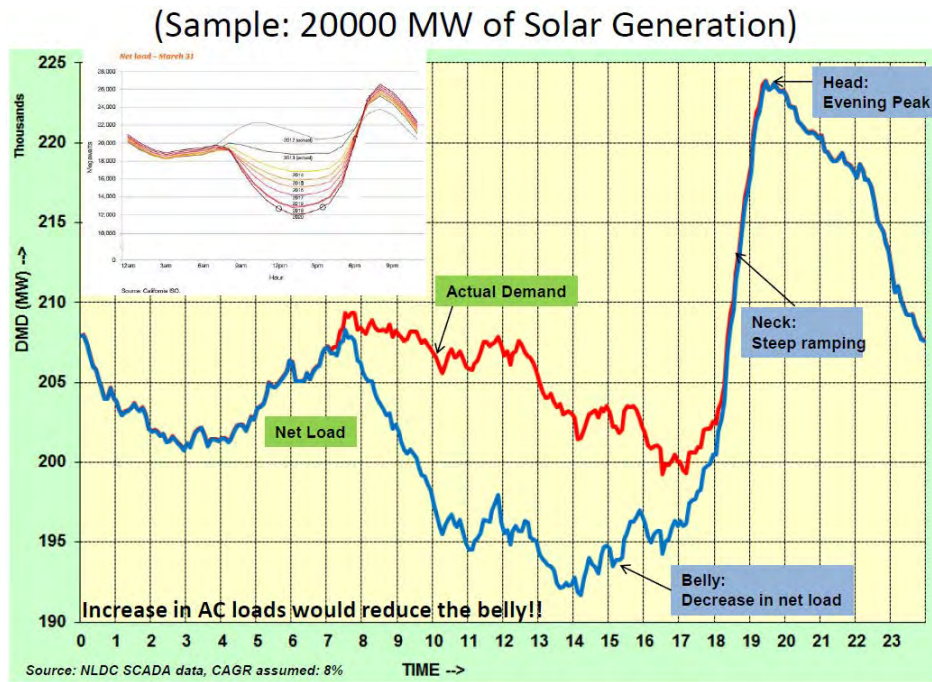
The following figures show all-India typical load curves and the expected duck curve if 20GW of solar PV is introduced.



source: Large Scale Integration of Renewables, August 2015, POSOCO (Appendix 2-111)

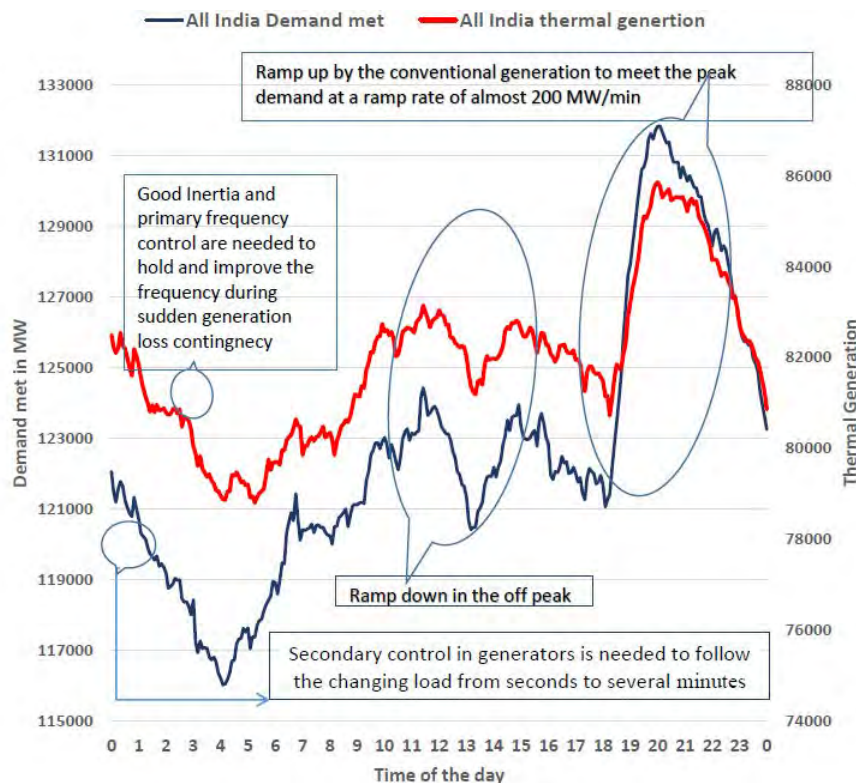
Figure 2.4.2-3 All India Typical Load Curve

⁴⁹ Clean Technica, 31th August 2016



source: Large Scale Integration of Renewables, August 2015, POSOCO (Appendix 2-111)

Figure 2.4.2-4 Expected All India Duck Curve



source: Flexibility Requirement in Indian Power System, POSOCO, January 2016 (Appendix 2-107)

Figure 2.4.2-5 All India Demand Met and Thermal Generation

Above Figure shows the demand met curve of India on July 29th 2015. There is an evening peak requirement coherent with Sunset timing. In winters, a morning peak can also be observed.

Inertial response, Primary response (through governor action), Automatic Generation control (AGC), quick Ramp up and Ramp down facilities, turndown capabilities, storage and other modern technological supports etc. are all needed in the overall generation mix. These above mentioned capabilities needed in the grid also should be cost effective to the possible extent.

The quantum and type of flexibility required depends on the time scale of operation. For example for seconds to minutes, increased frequency response and secondary control reserves is required. Ramping capabilities are accounted in hours and scheduling flexibility can be done from day ahead to hour duration.

2.4.3 Necessity of Spinning Reserve and Electricity Storage

Government of India has set up aggressive renewable energy (RE) capacity addition target of 175 GW by 2022. The primary focus of Government is on the promotion and scaling up of electricity generation from the Renewable energy. High intermittency of Renewable energy makes it difficult to forecast and schedule for dispatches. Higher penetration of Renewable resources will ultimately (with rapid deployment) result in a stage where the grid will become unstable.

Possible countermeasures include construction of spinning reserve and large-scale electricity storage.

Large-scale storage facilities can arbitrage base load generation by storing electricity during non-peak hours and providing power in long-duration discharges and also provide low-cost ancillary services such as load following and spinning reserves. Large scale energy storage helps on both the supply and demand side of the wholesale generation market. Although they do help offset the need for additional peaking capacity, large-scale storage facilities are focused more as system optimizers rather than generation replacement.

2.4.4 PSP for Superior Spinning Reserve Capability and Electricity Storage

PSP provides flexibility to dispatch, if accompanied by short-term storage (pondage). This can be of value in balancing the intermittency that would be introduced by increased penetration of other Renewable sources such as wind and solar in the electricity mix. Similarly, PSP schemes utilise off-peak electricity from intermittent sources to pump water from a river or a lower reservoir, to a higher reservoir to allow its usage during peak times. Other advantages of PSP include increasing the availability of reactive capacity for regulation, provision of spinning reserves in the system to meet sudden load changes in the electricity grid. PSP may result in considerable savings in fuel usage when operated in an integrated manner. At present, for the purpose of calculating the trajectories, the capacity added through pumped hydro schemes have not been accounted for, as their usage is dependent on the extent of Renewable energy penetration in the grid.

At present nine PSP schemes with aggregate installed capacity of 4,786MW are available. Out of these, only five plants with aggregate installed capacity of 2,600MW are being operated in pumping mode. Purulia, Kadamparai, Ghatghar, Srisailam and Bhira PSP are working. Even in these, few units tend to be on outage now and then.

Table 2.4.4-1 List of PSP in India

S. No.	Name of Project/ State	Installed Capacity		Pumping Mode Operation	Reason for not working in Pumping mode
		No. of Units x MW	Total (MW)		
1	Kadana St. I&II Gujarat	2x60+2x60	240	Not working	Due to vibration problem
2	Nagarjuna Sagar Andra Pradesh	7x100.80	705.6	Not working	Tail pool dam under construction
3	Kadamparai Tamil Nadu	4x100	400	Working	-
4	Panchet Hill DVC	1x40	40	Not working	Tail pool dam not constructed
5	Bhira Maharashtra	1x150	150	Working	-
6	Srisaillam LBPH Andhra Pradesh	6x150	900	Working	-
7	Sardar Sarovar Gujarat	6x200	1,200	Not working	Tail pool dam not constructed
8	Purlia PSS West Bengal	4x225	900	Working	-
9	Ghtgar Maharashtra	2x125	250	Working	-
		Total	4,785.6		

source: Flexibility Requirement in Indian Power System, POSOCO, January 2016 (Appendix 2-107)

2.4.5 Future Power System: Flexibility Requirement

Indian Power System has evolved gradually, both in size and quality and it is meeting a peak demand of almost 130 GW-135 GW every day and is expected to grow in the future. A target of having 175GW of Renewable energy by 2022 as a mission for ensuring energy security of the country has been taken up by Government of India.

Wind and Solar generation outputs are variable and intermittent and are dependent on various natural phenomena. Load - Generation balance has to be maintained all the time in the power system. Other than renewables, the system conditions are also always changing. These necessitate the conventional generation to be 'flexible' enough to ramp up and ramp down.

Apart from fossil fuel based generating plants – transmission, demand, storage, system operation and even planning - all of these also have to be more flexible than today for an efficient future power system. Sufficient flexibility should be provided in the planning stage itself in all the fields to accommodate the future renewable generation.

Many plans are to be executed by team work of multiple agencies. The areas are once again briefly consolidated here:

- Plan and implement more pumped storage
- Plan Pelton turbine Hydro stations wherever there is a choice
- Operational norms for Hydro under SERC jurisdiction
- Plan for shift operation of thermal plants
- IEGC should have clauses on flexibility, ramp up and ramp down

- Look for incentives for flexible generation to promote competition
- Plan implementation of primary control
- Regulations on Reserves, Automatic Generation Control (AGC)
- Regulations on ancillary services, better market design
- Plan to override the present constraints in telemetry – all trending and analysis is done only when we have data! Regulations on communication requirement for Power sector
- Policies and planning on Low Voltage Ride Through (LVRT) and new technologies with wind and solar which can help the grid
- Introduction of Capacity Benefit Margin (CBM)
- Load factors and the necessity to have target load factors

source; Flexibility_Requirement_in_Indian_Power_System, POSOCO, 2016 (Appendix 2-107)

MNRE recently introduced and seeks Cabinet approval to the proposal of reclassifying the large hydropower plants as renewable projects. MNRE prospects removing the distinction between small hydro (up to 25MW) and large hydro projects can help the installed renewable energy capacity projections be 230GW by 2022, beyond the target of 175GW by 2022. It is expected to help hydro projects as they would be able to access “incentives” being provided to renewable energy projects by the government (such as RPO, RGO), or may even possibly receive grants for Renewables (such as NCEF).

The Planning Ministry had told to the Congress in March 2016 that hydropower capacity generation addition of 4,371 MW out of the target 10,897 MW of the 12th generation plan would not be completed. This reclassification would help enhancing the hydropower projects.⁵⁰

2.4.6 PSP relevant CERC regulation

PSP relevant CERC notifications and reports are shown in this section.

(1) Electricity tariff

CERC published the notification “Terms and Conditions of Tariff Regulations, 2014” (Appendix 2-113), which stipulates the calculation method of electricity tariff from April 2014 to March 2019 on 21st February 2014. Energy charge of PSP is stipulated below.⁵¹ Energy charge of PSP in pumping mode is set very cheap.

“The energy charge shall be payable by every beneficiary for the total energy scheduled to be supplied to the beneficiary in excess of the design energy plus 75% of the energy utilized in pumping the water from the lower elevation reservoir to the higher elevation reservoir, at a flat rate equal to the average energy charge rate of 20 paise per kWh, excluding free energy, if any, during the calendar month, on ex power plant basis.”

⁵⁰ For example, Indian Express, Oct. 8,

⁵¹ (3), 32. Pumped Storage Hydro Generating Stations:

CERC published the first amendment of “Terms and Conditions of Tariff Regulations, 2014” on 4th December 2015 (Appendix 2-114). There is no amendment for PSP relevant energy charge.

MoP published “Tariff Policy” on 28th January 2016. For the outline, refer to “2.2.6 ELECTRICITY POLICY: TARIFF POLICY.”

(2) Electricity tariff for renewable power generation

CERC published the notification “Terms and Conditions for Tariff determination from Renewable Energy Sources Regulations, 2012” (Appendix 2-115) on 6th February 2012, which stipulates the calculation method of electricity tariff from renewable power generation with five year control or review period. Commercial operation period and tariff period are also stipulated.

CERC published the first amendment of the notification (Appendix 2-116) on 18th March 2014, the second amendment of the notification (Appendix 2-117) on 5th January 2015 and the third amendment of the notification (Appendix 2-118) on 10th July 2015. The cost of biomass power generation was revised in these amendments. Municipal waste power generation was added in the fourth amendment (Appendix 2-119) published on 7th October 2015. Operation and Maintenance (O&M) cost of the final fiscal year of control period, FY2016, was reduced in the fifth amendment (Appendix 2-120) published on 30th March 2016.

(3) Renewable Energy Certificate

CERC published the notification “Terms and Conditions for recognition and issuance of Renewable Energy Certificate for Renewable Energy Generation Regulations, 2010 (Appendix 2-121)”, which stipulates issuance of Renewable Energy Certificate on 14th January 2010. The notification stipulates mainly agency of issuance (CERC), categories, registration, application, dealing (Power Exchange), pricing, validity, fees and charges.

The notification “Terms and Conditions for recognition and issuance of Renewable Energy Certificate for Renewable Energy Generation Regulations” was amended four times by March 2016 (Appendix 2-122~125). The fifth amendment relevant draft notification (Appendix 2-126) was published on 26th June 2016.

(4) Grid Code

CERC published the notification “Indian Electricity Grid Code Regulations, 2010 (Appendix 2-127)”, which binds technical and commercial rules for utilities connected to inter-transmission system. Indian Electricity Grid Code (IEGC) stipulates grid frequency band to comply. SLDCs or distributors shall make load shedding in case that grid frequency decreases below stipulated number. IEGC has been amended four times by April 2016 (Appendix 2-128~131) and grid frequency band to comply has been tightened gradually.

The fourth amendment (Appendix 2-131) published on 6th April 2016 stipulates the technical

minimum for operation in respect of a unit or units of a Central Generating Station of inter-State Generating Station shall be 55% of installed capacity of the unit of at generating station.

Grid Code mainly defines the frequency band to be compliance and its countermeasure method when it exceeds it. Meanwhile, there is a DSM described in the next section as a market mechanism to prevent deviation of frequency and absorb Deviation.

(5) Deviation Settlement Mechanism (DSM)

There were two major grid failures in India on consecutive days; one on 30th July 2012 and another on 31st July 2012 caused by over-drawals. There are overdrawing states and under drawing states in India. The grid failure has presented a case where these states were using the UI as a trading platform, which resulted in frequency variation in the specified range and at the same time making the grid unstable. In the wake of these grid disturbances, the Government of India had constituted an Enquiry Committee under CEA. The Enquiry Committee in its report submitted to the Government has identified The Enquiry Committee has inter-alia recommended as under:

- Frequency band needs to be further tightened and brought closer to 50 Hz.
- Frequency control through UI may be phased out in a time bound manner and generation reserves/ancillary services may be used for frequency control.

With the report, DSM was created newly and CERC published the notification “Deviation Settlement Mechanism and related matters Regulations, 2014” (Appendix 2-134) on 7th January 2014. Main amendment from UI mechanism is showed below⁵².

- Redefined frequency range and rates.
- Volume limits and deviation limits for generator and buyer, earlier there wasn't any volume limits on the overall injection or drawl.
- Redefined cap rate for generating stations using fuel which comes under Administrative Price Mechanism (APM) was reduced.
- Additional Charges

Main amendment in the second amendment of the notification (Appendix 2-136) published on 7th August 2015 is showed below.

- The wind or solar generators which are regional entities shall be paid deviation charge newly. This aimed to notify proactively for variable renewable power generator (assumed to be an inter-state generator mainly) which will enter the market in coming years.
- CERC admitted concerns that arbitration and false declaration thus they should be controlled by market mechanism in the future.
- LDC shall detect illegal players by monitoring scheduled generation plan. But issues addressed remain whether all participant comply with rules and whether LDC has an ability to implement monitoring actual situations.

⁵² Energy Sector News & Information

<http://www.energysector.in/power-news/cerc-regulation-deviation-settlement-mechanism-and-related-matters>

Main amendment in the third amendment of the notification (Appendix 2-137) published on 6th May 2016 is showed below.

- A State whose minimum combined installed capacity of wind and solar power is 1,000 MW or more is defined as a Renewable Rich State. This aims to regulate large inter-state variable renewable power generation.
- Methodologies for the computation of Charges for Deviation and Additional Charges for Deviation applicable to Renewable Rich States for crossing the volume limits specified for the over-drawal/under-injection is not a deviation from availability but MW as defined in the notification.

(6) Ancillary Services

CERC published the staff paper “Introduction of Ancillary Services in Indian Electricity Market” (Appendix 2-138) in April 2013, the draft notification “Draft Ancillary Services Operations Regulations, 2015” (Appendix 2-139) on 1st May 2015, the notification “Ancillary Services Operations Regulations” (Appendix 2-140) on 13th August 2015, and “Framework on Ancillary Services Operations Regulations 2015: Statement of Reasons” (Appendix 2-141) on 17th September 2015. NLDC published “Detailed Procedure For Ancillary Services Operations” in exercise of powers conferred by the notification “Ancillary Services Operations Regulations, 2015” (Appendix 2-142 in March 2016.

- ✓ The objective of Ancillary Services Regulations is to help in restoring the frequency level to the nominal level and to relieve the congestion in the inter-state transmission network.
- ✓ Inter-State Generating Stations (ISGSs) shall inject or back down the generation as per the instruction of RLDC as the Reserves Regulation Ancillary Services Provider (RRAS). RRAS shall on monthly basis submit details of fixed charge, variable charge and any other statutory charges to the Regional Power Committees (RPC) to account.
- ✓ While renewable power generation is exempted from RRAS, renewable power generators have an obligation to submit generation forecasting by DSM regulation. Considering the situation of operation, it is determined whether RRAS is applicable to renewable power generation.
- ✓ Currently only tertiary frequency control is applicable. Primary and control are seemed to be premature. Although CERC decided to introduce secondary (AGC) in 2017, it is doubtful whether it is possible.
- ✓ Fixed charge and variable charge are paid for regulation up service and variable charge is paid for down service. In case of regulation down service, RRAS shall repay the 75% of variable charge to DSM Pool.
- ✓ Ancillary service and payment of PSP in pumping mode is only stipulated in Terms and Conditions of Tariff Regulations, 2014. There is no stipulation of charge.
- ✓ It will be in force around April 2016. CERC considers that ancillary service charge is transitioned to ancillary service market in the future. But concerns are still remained whether RPC is accounted and operated adequately.

(7) Spinning Reserves

CERC published the order “Roadmap to operationalise Reserves in the country” (Appendix 2-143) on 13th October 2015. CERC recognized that UI mechanism was functioned to force 50 Hz but not functioned to adjust last mile imbalances, and spinning reserves are needed to handle demand deviation. National Electricity Policy (NEP) mandates that adequate reserves may be maintained and stipulates a spinning reserve of at least 5%, at national level by 2012. However, creation of adequate system reserve margin and spinning reserves at national level has not yet materialized. For this, CERC constituted a Committee to examine the technical and commercial issues in connection with spinning reserves and the Committee prepared a report in September 2015. The outline of the report is shown below.

- Spinning Reserves are required to be maintained of requisite quantum depending upon the grid conditions. Each region should maintain secondary reserves corresponding to the largest unit size in the region.
- Tertiary reserves should be maintained in a de-centralized fashion by each state control area for at least 50% of the largest generating unit available in the state control area.
- Volume of primary reserves and secondary reserves is shown below.

Table 2.4.6-1 Required Primary and Secondary reserves

Region	Primary reserves	Secondary reserves
All India	4,000 MW	
Southern		1,000 MW
Western		800 MW
Northern		800 MW
Eastern		660 MW
North-Eastern		363 MW
Total	4,000 MW	3,600 MW (approx.)

source: Roadmap to operationalise Reserves in the country, CERC (Appendix 2-143)

- The Automatic Generation Control (AGC), secondary control, may be planned to be operationalised in the power system from 1st April 2017.
- Ancillary Services Operations Regulations, 2015 may be amended to incorporate the necessary changes in introducing a spinning reserves.

With the report of the committee, CERC starts to introduce spinning reserves in generating stations regulated by CERC from 1st April 2016 to 31st March 2017. For this, NLDC/ POSOCO is directed to submit a detailed procedure. In the long term, a market based framework is required for efficient provision of secondary reserves from all generators across the country. For this, NLDC/POSOCO is directed to commission a detailed study to create a framework of spinning reserves market.

(8) Forecasting for renewable energy power generation

CERC developed “Model Regulations on Forecasting, Scheduling and Deviation Settlement of Wind and Solar Generating Stations at the State level, 2015” (Appendix 2-144) for Forum of Regulators in 2015, which indicates the regulation of deviation charge and spinning reserves.

- Imbalance regulation for variable renewable power generation was stipulated. The variable renewable power generators shall submit the forecasting their day ahead and week ahead power generation. Deviation commercial impact shall be borne by the variable renewable power generators.
- Deviation between scheduled day ahead power generation forecast and actual power generation is charged progressively. In case of under injection, progressive penalty shall be paid depending on deviation level. In case of injection, charge shall be reduced progressively depending on deviation level.
- The accounting shall be done by the SLDC. In case there is deficit in the overall pool at the end of the year, the SLDC may approach the National Funds such as PSDF or NCEF to cover such deficit.

CERC published the draft notification ”Draft Procedure for Implementation of the Framework on Forecasting, Scheduling and Imbalance Handling for Renewable Energy (RE) Generating Stations on Wind and Solar Energy at Inter-State Level” (Appendix 2-145) on 12th February 2016. It is applicable for inter-state renewable power generation. Variable renewable power generator shall submit forecast of day ahead power generation. Deviation charge shall be payable/ receivable to/ from Regional DSM Pool.

(9) Electricity market

CERC published the notification “Power Market Regulations, 2010” (Appendix 2-146) on 20th January 2010, which stipulates electricity transaction procedure transacted through OTC and Power Exchange. For the outline of electricity transaction, refer to “2.2.8 ELECTRICITY POLICY: SHORT-TERM POWER MARKET.”

First amendment of the notification (Appendix 2-147) was published on 3rd April 2014, which stipulates the directors of power exchange shall be fair.

With DSM and tightening the operating band of grid frequency to comply, CERC published the staff paper “Extended Market Session on Power Exchanges” (Appendix 2-148) in July 2014, which aims to extend market session, which sought comments/ views of the stakeholders. A public hearing on the staff paper was held. Based on comments/views and hearing, CERC published the order ”Extended Market Session on Power Exchanges” (Appendix 2-149) on 8th April 2015, ordered Power Exchanges to extend market session. Two Indian Power Exchanges extended market session from 20th July 2015, according to the CERC’s order,

CERC published “Review of the Functioning of Round the Clock Intraday/Contingency Market (Extended Market Session) on Power Exchanges” (Appendix 2-150) six months after starting the extended market session. Volume of Electricity Transacted through Intra-day and Day Ahead

Contingency Contracts in Power Exchanges in two Indian Power Exchanges is shown below. There is a negative growth of -5% in the volume of electricity transacted through intraday and day ahead contingency contracts in both power exchanges from the period July 2014 to January 2015 to the period July 2015 to January 2016.

Table 2.4.6-2 Volume of Electricity Transacted through Intra-day and Day Ahead Contingency Contracts in Power Exchanges

Power Exchange	Volume of Jul. 14 to Jan. 15 (GWh)	Volume of Jul. 15 to Jan. 16 (GWh)
IEX	120.51	159.13
% increase	-	32%
PXIL	332.74	271.93
% increase	-	-18%
Total	453.24	431.06
% increase	-	-5%

source: Review of the Functioning of Round the Clock Intraday/Contingency Market (Extended Market Session) on Power Exchanges, CERC (Appendix 2-150)

Volume of Electricity Transacted through intra-day and Day Ahead Contingency contracts during Normal Hours and Extended Hours in two Indian Power Exchanges, July 2015 to January 2016, is shown below. 65% of the volume, 280.89 GWh, was transacted in extended hours, and the rest 35% of the volume, 150.18 GWh was transacted in normal hours during July 2015 to January 2016.

Table 2.4.6-3 Volume of Electricity Transacted through intra-day and Day Ahead Contingency contracts during Normal Hours and Extended Hours in Power Exchanges, July 2015 to January 2016

Power Exchange	Volume in Normal Hours (GWh)	Volume in Extended Hours (GWh)	Total (GWh)
IEX	102.14	56.99	159.13
% to total	64%	36%	
PXIL	48.04	223.90	271.93
% to total	18%	82%	
Total of IEX and PXIL	150.18	280.89	431.06
% to total of IEX and PXIL	35%	65%	

note: Extended Hours are trades cleared between 5:00 PM to 10:00 AM Next day
source: Review of the Functioning of Round the Clock Intraday/Contingency Market (Extended Market Session) on Power Exchanges, CERC (Appendix 2-150)

Price of Electricity Transacted through intra-day and Day Ahead Contingency contracts during Normal Hours and Extended Hours in Power Exchanges, July 2015 to January 2016 is shown below. The price of electricity transacted through intraday and day ahead contingency contracts was relatively low during extended hours, INR 2.67/ kWh, when compared with normal hours, INR 2.78/ kWh, during July 2015 to January 2016.

Table 2.4.6-4 Price of Electricity Transacted through intra-day and Day Ahead Contingency contracts during Normal Hours and Extended Hours in Power Exchanges, July 2015 to January 2016

Power Exchange	Price in Normal Hours (INR/ kWh)	Price in Extended Hours (INR/ kWh)
IEX	3.47	3.20
PXIL	2.78	2.67

note: Extended Hours are trades cleared between 5:00 PM to 10:00 AM Next day
 source: Review of the Functioning of Round the Clock Intraday/Contingency Market (Extended Market Session) on Power Exchanges, CERC (Appendix 2-150)

(10) Repots

- 1) Large Scale Grid Integration of Renewable Energy Sources - Way Forward (Appendix 2-151)

CEA published a report in November 2011, which collected information like current situation and future forecast of variable renewable power generation in India, balancing measures of other countries, etc, from the technical aspect. Main suggestions are shown below.

- Need for analysis of balancing capability and load curve
- Need for 10-15 % merchant capacity in generating plants in order to provide liquidity in the electricity market
- Enhancement of the flexibility of conventional generation to increase the balancing capacity of the grid
- Establishment of Renewable Energy Management centers (REMC) equipped with advanced forecasting tools
- Wind farms may also be set up through competitive bidding in order to reduce tariff
- Need for healthiness of grid protection schemes through regular monitoring and updating
- International cooperation for developing REMCs in the RE rich states

- 2) Ramp Management & Integration of Renewables, 31th January 2014, POSOCO (Appendix 2-152)

POSOCO made a presentation document in January 2014, which suggested the need for flexibility in electricity system and valuing flexibility.

- ✓ Rapid economic development
 - Indian Power System experiencing a double digit growth.
- ✓ Changing load curve
 - Increasing peak to off-peak ratio, load changeovers, and increasing penetration of renewable energy sources.
 - Sharp changes and steep ramps in the load curve.
- ✓ Ramp management
 - A challenge to the system operators specially in the context of higher penetration of renewable sources.

Specific measures for flexibility in electricity system and valuing flexibility are same as”2.4.5 Future Power System: Flexibility Requirement”

3) Flexibility Requirement in Indian Power System (Appendix 2-107)

It is expected that large amount of renewable power generation will be injected to power grid in the future. NLDC prepared a report to analyze the requirement of flexibility in power system in January 2016. Many part of the report are referred in this study.

4) Large Scale Integration of Renewable Energy, need for balancing, Deviation Settlement Mechanism (DSM) and associated issues (Appendix 2-153)

Technical Committee of MoP prepared a report to recommend required regulation in order to maintain grid stability from introducing variable renewable power generation in April 2016.

- Appropriate Regulatory Framework for handling Inter-State Deviations especially for Large and High RE Penetration States
- Suitable regulatory framework for Forecasting, Scheduling and Imbalance Settlement for RE generators at both inter-state and intra-state level needs to be in place.
- Necessary incentives to the generator may be provided for maintaining and deploying the reserves by March 2017.
- There is need for augmenting the transmission corridors from renewable rich states with coordinated transmission planning.
- Ancillary services framework needs to be implemented in the States.
- A balanced portfolio needs to be demonstrated and maintained at each state Discom and SLDC.
- A regulatory framework and roadmap for frequency control may be put in place.
- Regulatory intervention is required to incentivize flexibility of conventional generation, PSP, Demand Side Management. The introduction of Flexible Generation Planning and Flexible Generation Obligation may be explored in the future.
- There is need for more frequent market clearing in power exchanges e.g real time markets, flexibility markets, capacity markets etc.
- Communication in power sector like RMEC is to be implemented by March 2017.
- Capacity Building of LDCs particularly in RE Rich States.

ADDENDUM OF CHAPTER 2

Draft National Electricity Plan was prepared by CEA on the end of 2016 (7th and 28th December, 2016) including the demand projection till 2022-36 with the (previous) 14th Plan (2022-2027), 15th Plan (2027-2032) and first three years of 16th (2032-2036) Plan.

The brief content of the NEP is as follows but it is noticeable that

- 1) **There will be no need for coal-based power generation capacity addition in the country from 2017 to 2022 from the projection made by CEA, except those projects currently on track.**
- 2) **Integration of renewable energy into the grid will be a focus area, and it promotes Hydroelectric Power generation including Pumped Storage Projects (PSP) to provide adequate peaking reserves, reliable grid operation and integration of variable renewable energy sources.**

The chapters of the Volume I (Generation) are:

1. INTRODUCTION
2. REVIEW OF CAPACITY ADDITION DURING 12TH FIVE YEAR PLAN (2012-17)
3. DEMAND SIDE MANAGEMENT , ENERGY EFFICIENCY AND CONSERVATION
4. DEMAND PROJECTIONS
5. GENERATION PLANNING
6. RENEWABLE ENERGY SOURCES
7. HYDRO POWER IN INDIA
8. GAS BASED POWER PLANTS
9. COAL REQUIREMENT
10. KEY INPUTS
11. FUND REQUIREMENT
12. EMISSIONS FROM POWER SECTOR
13. RESEARCH AND DEVELOPMENT IN POWER SECTOR
14. HUMAN RESOURCE DEVELOPMENT
15. CONCLUSIONS AND RECOMMENDATIONS

The noticeable information in the 2016 NEP (in the “Highlight” of the document) is as follows.

- The projected Peak Demand is 235 GW and Energy requirement is 1,611 BU (after considering DSM measures) at the end of year 2021-22 which is around 17% and 15.4 % lower than the corresponding projections made by 18th Electric Power Survey (EPS) report.
- The projected Peak Demand is 317 GW and Energy requirement is 2,132 BU at the end of year 2026-27 which is around 20.7% and 21.3% lower than the corresponding projections made by 18th EPS report.
- Considering capacity addition from Gas – 4,340 MW, Hydro 15,330 MW, Nuclear -2800 MW and RES – 115,326 MW as committed capacity during 2017-22, the study reveals that no coal based capacity addition is required during the years 2017-22. However, a total capacity of 50,025

MW coal based power projects is currently under different stages of construction and are likely to yield benefits during the period 2017-22. Thereby, the total capacity addition during 2017-22 is likely to be 187,821 MW.

“That is,

India may not see any new thermal power plants being installed after 2022 as MOP has set up 72 GW of conventional power capacity between 2017 and 2022 including 50,025 MW of coal-fired capacity.”

- For the period 2022-27, committed capacity addition is Nuclear - 4,800 MW, Hydro-12,000 MW and RES 100,000 MW. Considering the demand projections for the year 2026-27, study for the period 2022-27 reveals that a coal based capacity addition of 44,085 MW is required. However, as coal based capacity of 50,025 MW is already under construction which is likely to yield benefits during 2017-22, this coal based capacity would fulfil the capacity requirement for the years 2022-27.
- The Renewable Energy Generation will contribute about 20.3 % and 24.2 % of the total energy requirement in 2021-22 and 2026-27 respectively.

It also emphasizes the importance of hydropower development (in Chapter 7).

- There are several different Ancillary services or grid stabilizing services of hydropower, thus facilitating the integration of variable RES into the power system and providing a key tool to maintain a stable and balanced grid in terms of :
 - ✓ Quick-start capability
 - ✓ Black start capability
 - ✓ Regulation and frequency response
 - ✓ Voltage support
 - ✓ Spinning reserve
- It also stresses Pumped Storage Plants as– BEST FRIEND OF ELECTRICITY GRID ;
 - ✓ In view of infusion of high RES, Pump Storage Development has to be treated as a separate category. Separate Policy instrument is required to incentivize PSPs.
 - ✓ While benefits of having pumped storage hydro power are known but current market structures and regulatory frameworks do not present an effective means of achieving this goal. There is need for regulatory mechanism/ market incentives and Regulatory Commissions may incentivize Tariff for PSPs and financial institutions should consider providing attractive terms for financing of PSPs.
 - ✓ Hydro plants shall be considered for compensation for balancing the grid by implementing differential tariff for peak and off-peak power. Pump storage plants should be encouraged to operate in pump mode by providing incentive for its operation.
 - ✓ Infrastructure cost from the Hydro project may be excluded for determining tariff. As the need for generation resources that can provide system flexibility increases with an increased proportional penetration of variable renewables, the value of hydropower and pumped storage will become more significant.

CHAPTER 3

ENVIRONMENTAL
AND
SOCIAL CONSIDERATIONS

CHAPTER 3 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

3.1 LEGISLATIONS AND RELEVANT AUTHORITIES

PSP projects should follow various kinds of environmental and social Acts and Regulations. Following sections describe these legislations, guidelines, procedures and relevant authorities.

3.1.1 Environmental legislations

There are many legislations which cover Environmental and social issues in India. The legislations cover EIA, Noise, Air, Water, Forest, Wildlife, Scheduled Tribes/ Caste, Cultural asset and so on. Following tables shows the list of the legislations and relevant authorities.

Table 3.1.1-1 Environmental legislations in India

Category	Name of the legislations
Environment and EIA	Environmental protection act, 1986 National environment policy,2006 Environmental protection rules, 1986 Environment (Siting for Industrial Projects) Rules, 1999 EIA, environmental impact assessment notification, 1994, 2006 Coastal Regulation Zone (CRZ) Notification 2011
Hazardous Chemical and plastic	The Manufacture, Storage, and Import of Hazardous Chemical Rules, 1989 The Recycled Plastics Manufacture and Usage Rules, 1999 Factories Act,1948 Factories (Amendment) Act, 1987 (Act 20 of 1987)) Explosive act 1884
Noise	The Noise Pollution (Regulation and Control) Rules, 2000
Air	The Air (Prevention and Control of Pollution) Act, 1981 The Air (Prevention and Control of Pollution) Rules, 1982 Revised National Ambient Air Quality Standards, Notification, 2009 The Air (Prevention and Control of Pollution) (Union Territories) Rules, 1983
Water	The Water (Prevention and Control of Pollution) Act, 1974 The Water (Prevention and Control of Pollution) Rules, 1975 The Water (Prevention and Control of Pollution) Cess Act, 1977 The Water (Prevention and Control of Pollution) Cess Rules, 1978
Forest	Indian forest Act, 1927 National forest policy, 1988 Forest conservation act, 1980, 1988, etc. Forest conservation amendment rules, 2004 Forest rights act, 2006
Wildlife	Widlife Protection Act 1972 The Wild Life (Protection) Amendment Act, 2002 The wild life (Protection) Rules, 1995 Biological Diversity Act, 2002
Compensation	The Right of Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 THE RIGHT TO FAIR COMPENSATION AND TRANSPARENCY IN LAND ACQUISITION, REHABILITATION AND RESETTLEMENT (AMENDMENT) SECOND ORDINANCE, 2015
ST/SC	The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006
Cultural asset	Antikvitis and Art Trejres Act 1972

Table 3.1.1-2 Relevant Authorities

Name	Address	Relevant matters
Ministry of Environment, Forests & Climate Change (MoEF & CC)	Indira Paryavaran Bhavan Jorbagh Road New Delhi - 110 003	Environment Clearance, Forest Clearance, Wildlife Clearance
Central Pollution Control Board (MOEF)	Parivesh Bhawan, CBD-cum-Office Complex East Arjun Nagar, DELHI - 110 032	Pollution
Ministry of Water Resources	Shram Shakti Bhavan, Rafi Marg, Sansad Marg Area, New Delhi, Delhi 110001	Water resources
The Ministry of Tribal Affairs	Ground floor, 'D' wing, Shastri Bhawan, New Delhi, Delhi 11000	SC/SC
Inland Waterways Authority (Ministry of Shipping)	Head Office, A-13, Sector -1, Noida,U.P.	Inland waterways
Central Ground Water Board (Ministry of Water Resources, River Development and Ganga Rejuvenation)	Bhujal Bhawan, NH-IV, Faridabad, 121001	Ground water
Archaeological Survey of India (ASI)	Janpath, New Delhi - 110011	Archaeology

3.1.2 Environmental procedures of PSP

There are some Environmental and Social guidelines and manuals for implementing the Hydropower projects. Not only CEA, but also Ministry of Environment and Forest (MOEF) and MINISTRY OF WATER RESOURCES has issued Guidelines, Guidance manual, Handbook, or Best Practices. Followings are the list of the Guidelines.

- Guidelines for diversion of forest land for non-forest purposes under the forest conservation act. (1980)
- GUIDELINES FOR ENVIRONMENTAL IMPACT ASSESSMENT OF RIVER VALLEY PROJECTS (1985, MOEF)
- HANDBOOK OF Forest (Conservation) Act, 1980 (With Amendments made in 1988), Forest (Conservation) Rules, 2003 (With Amendments made in 2004), Guidelines & Clarifications (2004, MOEF)
- Model TOR for Hydropower Projects (2006, MOEF)
- Guidelines for preparation of pre-feasibility report for obtaining prior environmental clearance in terms of the provisions of EIA notification (2006, MOEF)
- DRAFT Guidance Manual for Environmental Impact Assessment and Clearance of River Valley Projects (2009, National Environmental Engineering Research Institute (NEERI))
- GUIDELINES FOR PREPARATION OF DETAILED PROJECT REPORT OF IRRIGATION & MULTIPURPOSE PROJECTS (MINISTRY OF WATER RESOURCES, 2010)
- Guidelines for Formulation of Detailed Project Reports for Hydro Electric Schemes, their Acceptance and Examination for Concurrence Revision 5.0 (CEA, 2015)

- Best Practices in Hydro Electric Power Generation (CEA, 2016)

Referring the above guidelines, required certificates and major procedures are summarized as follows.

(1) Required Clearances

Required NOC and Clearances are different from the project stages. During Pre-feasibility stage, Prior Environmental Clearance and Village consent are required. During DPR stage, 1st Stage Forest Clearance, Environmental Clearance and other Clearances are needed. Following table shows the list of the required Certificates by project stages.

Table 3.1.2-1 Required Clearance or Certificate

Required Certificate/Reporting	Project stage	Laws/ Regulations	Condition	Responsible Authority
Prior Environmental Clearance (Site Clearance)	Pre-Feasibility Report (PFR)	MOEF Notification S.O. 1533 (14 September 2006)	hydroelectric power generation Category A: ≥ 50 MW Category B: < 50 MW ≥ 25 MW	Ministry of Environment, Forests & Climate Change (MoEF & CC) or State Level Environmental Impact Assessment Authority (SEIAA)
Village consent or Consent from Gran Sabha	Between project initiation request (PIR) and PFR	Panchayat Extension to Scheduled Areas Act (PESA), 1996	Scheduled area more than 50% tribal pop	State level SC/ST Authority
1 st stage Forest Clearance	Detailed Project Report (DPR)	Forest conservation act, 1980, 1988, etc.	If Forest area is affected	Ministry of Environment, Forests & Climate Change (MoEF & CC) or State Level Forest Department
1 st stage Wildlife NOC	DPR	Wildlife Protection Act 1972	5 km ESZ Within 10-15 km from boundary of NP or Sanctuary	Ministry of Environment, Forests & Climate Change (MoEF & CC) or State Level Forest Department
Environmental Clearance	DPR	The Environment (protection) Act 1986	hydroelectric power generation Category A: ≥ 50 MW Category B: < 50 MW ≥ 25 MW	Ministry of Environment, Forests & Climate Change (MoEF & CC) or State Level Environmental Impact Assessment Authority (SEIAA)
2 nd Stage Forest Clearance/ Wildlife clearance	DPR	Forest (Conservation) Act 1980, 1988, etc./ Wildlife Protection Act 1972	if Forest or Wildlife area is affected	Ministry of Environment, Forests & Climate Change (MoEF & CC) or State Level Forest Department
Clearance of REHABILITATION AND RESETTLEMENT (R&R) PLAN	DPR	The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006	if Scheduled Tribe population is affected	Ministry of Tribal Affairs
Coastal Regulation Zone (CRZ) clearance	DPR	Coastal Regulation Zone (CRZ) Notification 2011	if the project area fall under CRZ-I, II, III and IV	State/UT Coastal Zone Management Authority (CZMA)
Clearance from Inland Waterways Authority	DPR	National Waterways Act, 2016	in case of navigational channels	Inland Waterways Authority
NOC from Central Ground	DPR	Environment	In case of	Central Ground Water

Required Certificate/Reporting	Project stage	Laws/ Regulations	Condition	Responsible Authority
Water Board		(Protection) Act, 1986	drawing ground water in notified blocks	Board
NOC from Archaeological Survey of India (ASI) with respect to protected monuments	DPR	Antikvitis and Art Trejres Act 1972 (No. 52 of 1972)	All	Archaeological Survey of India (ASI)
Consent for Establishment (CfE)	Pre-Construction	The Water (Prevention and Control of Pollution) Act 1974 The Air (Prevention and Control of Pollution) Act 1984	All	State/UT Pollution Control Board (SPCB)
Chemical storage permit	Construction	Factories Act,1948	All	SPCB
Consent for Operation (CfO)	Construction	The Water (Prevention and Control of Pollution) Act 1974 The Air (Prevention and Control of Pollution) Act 1984	All	SPCB
NOC from District Magistrate or Director General of Mines Safety	Construction	Explosive act 1884	All	District Magistrate or Director General of Mines Safety
Hazardous Wastes Authorisation (HWA)	Construction	The Hazardous Wastes (Management, Handling & Transboundary Movement) Rules, 2008	All	SPCB

1) Prior Environmental Clearance

All the hydropower projects in Category A or B (not less than 25 MW) have to acquire Prior Environmental Clearance in pre-FS stage. Required documents are Pre-FS reports and Form 1. Following table shows the contents of Form 1.

Table 3.1.2-2 Contents of Form 1 for the Prior Environmental Clearance

(I) Basic Information
(II) Activity
1. Construction, operation or decommissioning of the Project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.)
2. Use of Natural resources for construction or operation of the Project (such as land, water, materials or energy, especially any resources which are non-renewable or in short supply):
3. Use, storage, transport, handling or production of substances or materials, which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health.
4. Production of solid wastes during construction or operation or decommissioning

(MT/month)
5. Release of pollutants or any hazardous, toxic or noxious substances to air (Kg/hr)
6. Generation of Noise and Vibration, and Emissions of Light and Heat:
7. Risks of contamination of land or water from releases of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea:
8. Risk of accidents during construction or operation of the Project, which could affect human health or the environment
9. Factors which should be considered (such as consequential development) which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality
(III) Environmental Sensitivity
(IV) Proposed Terms of Reference for EIA studies

source: APPENDIX I, EIA notification, 1994, 2006

The environmental clearance process for new projects are stipulated by EIA notification, 1994, 2006 and it comprise of a maximum of four stages. These four stages are Stage (1) Screening (Only for Category 'B' projects and activities), Stage (2) Scoping, Stage (3) Public Consultation, and Stage (4) Appraisal.

2) Environmental Clearance

All the hydropower projects in Category A or B (no less than 25 MW) requires Environmental Clearance in DPR stage. The definition of the categories and procedures are as follows.

i) Categories and regulations

There are Category A and Category B for Environmental Clearance procedure. All the projects fall in Category A are reviewed by Central Government in MOEF. If the Category B project locates within 10km from boundary of notified protected areas, Critically Polluted Areas or Eco-sensitive areas, the projects should be reviewed by Central Government in MOEF. Following table shows the definition of the Categories and reviewers.

Table 3.1.2-3 Project type of Hydro power plants and EC regulations

	Project Type	Location	EC reviewers
Category A	(i) ≥ 50 MW hydroelectric power generation; (ii) $\geq 10,000$ ha. of culturable command area	All	Central Government in Ministry of Environment and Forests
Category B	(i) < 50 MW ≥ 25 MW hydroelectric power generation; (ii) $< 10,000$ ha. of culturable command area	Within the area: 10km from boundary of notified protected area/critically polluted area/ecosensitive area	
		Outside of the above area	State Environmental Assessment Authority (SEIAA)

source: EIA Notification, 2006

ii) Procedures of Environmental Clearance

The procedures of Environmental Clearance have four stages as follows. Stage I is Screening, Stage II is Scoping, Stage III is Public Consultation, and Stage IV is Appraisal. Following table shows the procedure.

Table 3.1.2-4 Four stages of Environmental Clearance

<p>Stage (I) – Screening (All B Category projects)</p> <p>The project requiring an EIA report shall be termed as B1 category and the remaining are B2 category.</p> <p>Stage (II) – Scoping</p> <ul style="list-style-type: none"> - New projects - the Expert Committee shall advise the applicant how to prepare EIA based on Form-1, TOR and Prefeasibility report submitted by the applicant. - Improvement projects – EIA to be prepared based on model TOR <p>Stage (III) – Public Consultation</p> <p>All Category A and B1 projects. Conducted by State Pollution Control Board (SPCB) or the Union Territory Pollution Control Committee (UTPCC)</p> <p>Stage (IV) – Appraisal</p> <p>Detailed scrutiny by the EAC (MOEF) or State level Expert Appraisal Committee (SEIAA). The recommendation of EAC or SEIAA submitted to competent authority for final decision based on Form-1, EIA, EMP, other documents and minutes of public consultation.</p>

source: EIA Notification, 2006

3) Forest Clearance

For diversion of forest land, forestry clearance is to be given in two stages. At the first stage, the proposal is to be agreed to in principle. Conditions relating to transfer, mutation and declaration of a Reserve Forest/Protected Forest of equivalent non-forest land for compensatory afforestation and funds for raising compensatory afforestation thereof, are stipulated at this stage. After receipt of report from the State Government regarding compliance with the stipulated conditions, formal approval under the Act is issued, also called the second stage of clearance or final clearance. Following tables shows the required documents for application at the first stage and the second stage.

Forest Clearance will be given by Regional Offices of MoEF or MOEF Delhi. If the forest area is up to 5 ha, clearance is issued by RO of MoEF. If the forest area is 5-40 ha, Forest Clearance will be processed by RO, and approved by MOEF Delhi. If the forest area is 40 ha or more, Forest Clearance will be processed and approved by MOEF Delhi.

Table 3.1.2-5 Documents required while submitting application

<ul style="list-style-type: none"> – Short narrative of the project – Map showing required forest land, boundary of adjoining forests (1:50,000) – Cost of project – Justification for locating the project in forest area – Cost – benefit analysis (not applicable upto 20 ha in plains and 5 ha in hills) – Employment likely to be generated – Purpose-wise breakup of total land required – Details of displacement of people – Requirement of Environmental Clearance – Undertaking to bear the costs of Compensatory Afforestation – DGPS map of the area under diversion and of the areas identified for CA
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source: Forest conservation act, 1980, 1988

Table 3.1.2-6 Documents required for final clearance

<ul style="list-style-type: none"> – Proof of depositing amount for Compensatory Afforestation – Proof of depositing amount for Net Present Value – Proof of depositing amount for meeting other conditions – roadside plantations, compensation for damage / dismantling of assets, etc. – Strip chart for roadside plantations – Undertakings for compliance on other generic and specific conditions – Certificate from the District Collector(s) on settlement of all rights under the Forest Rights Act, 2006
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source: Forest conservation act, 1980, 1988

(2) Conditions of site selection

There are some areas which should be avoided in site selection of PSP projects. Activities in some areas are limited by some notifications (See Table 3.1.2-7).

Table 3.1.2-7 Areas of limited activities by notifications

Notification	Area	Hydro
6th January 1989	Prohibiting location of industries except those related to Tourism in a belt of 1 km from high tide mark from the Revdanda Creek up to Devgarh Point (near Shrivardhan) as well as in 1 km belt along the banks of Rajpuri Creek in Murud Janjira area in the Raigarh district of Maharashtra	Prohibited
1st February 1989	Restricting location of industries, mining operations and regulating other activities in Doon Valley	Restricting
19th February 1991	Regulating activities in the coastal stretches of the country by classifying them as coastal regulation zone (upto 500 metres from the High Tide Line) and prohibiting certain activities	
6th June 91	Restricting location of industries and regulating other activities in Dahanu Taluka in Maharashtra	
7th May 1992	Restricting certain activities in specified areas of Aravalli Range in the Gurgaon district of Haryana and Alwar district of Rajasthan	
5th July 1996	Regulating industrial and other activities, which could lead to pollution and congestion in an area north west of Numaligarh in Assam	

Scheduled areas are defined by The Constitution (Scheduled Tribes) Order (1950, 1951, etc.), Protected Areas notified under the Wild Life (Protection) Act, 1972, and Critically Polluted areas notified by the Central Pollution Control Board had better be avoided for the project locations. Names and locations of the Scheduled areas and Protected areas are described in Section 3.2 and 3.3. Notified Critically Polluted Areas are shown in the following table.

Table 3.1.2-8 Critically Polluted areas as notified by the Central Pollution Control Board

State	Name of the Critically Polluted Area
Andhra Pradesh	1. Vishakhapatnam
Chhatisgarh	2. Korba
Delhi	3. Najafgarh-Drain basin including Anand Parbat, Naraina, Okhla, Wazirpur
Gujarat	4. Ahmedabad
	5. Ankleshwar
	6. Bhavnagar
	7. Junagarh
	8. Vapi
Haryana	9. Vatva
	10. Faridabad
Jharkhand	11. Panipat
	12. Dhanbad
Karnataka	13. Bhadravati
	14. Mangalore
Kerala	15. Greater Kochin
Madhya Pradesh	16. Indore
Maharashtra	17. Aurangabad
	18. Chandrapur
	19. Dombivalli
	20. Navi Mumbai
	21. Tarapur
	Mahul, Ambapada & Chembur (dated-17.10.16)
Orissa	22. Angul Talchar
	23. Ib-Valley
	24. Jharsugula
Punjab	25. Ludhiana
	26. Mandi Govindgarh
Rajasthan	27. Bhiwadi
	28. Jodhpur
	29. Pali
Tamil Nadu	30. Vellore -North Arcot
	31. Cuddalore
	32. Manali
	33. Coimbatore
Telangana	34. Patancheru-Bollaram
Uttar Pradesh	35. Agra
	36. Ghaziabad
	37. Kanpur
	38. Noida
	39. Singrauli
West Bengal	40. Varanasi-Mirjapur
	41. Asansole
	42. Haldia
	43. Howrah

source: Central Pollution Control Board

3.2 ENVIRONMENTAL CONDITION IN INDIA

3.2.1 Population

Per the census reports of Indian Census 2011 (<http://www.censusindia.gov.in/>), the population of India is 1,210,854,977. The total population growth in this decade was 17.64 percent. The total literacy rate in the country at present is 74.04%. The density of population is 382 persons/km².

3.2.2 Greenhouse gas emission

Per Carbon Dioxide Information Analysis Center (<http://cdiac.ornl.gov/>) CO₂ emission by from fossil-fuel burning, cement production, and gas flaring in 2013 total is 554882 thousand metric tons of carbon, which is the third in the world.

3.2.3 Land use

Base on the **GLCNMO** version 3¹ (2013) 67.8 % the land cover of India is Agricultural land, 17.8 % is Forest, and 1.0% is Urban area. Forests remain mainly at Barail Range, Shillong Plateau, Dafla Hills, Sikkim and Western Ghats and Eastern Ghats.

3.2.4 Forest

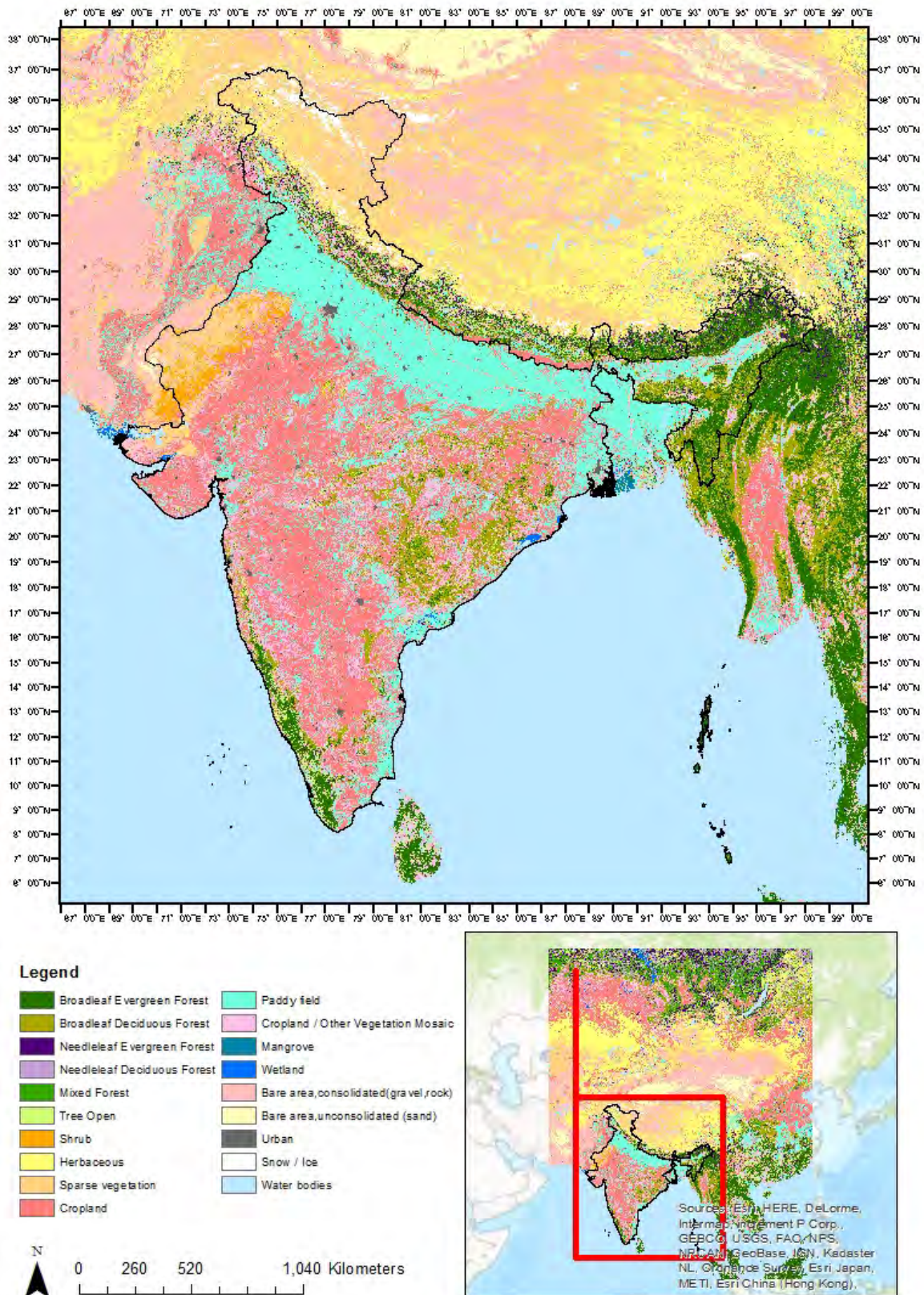
According to State of Forest Report 2015² (Forest Survey of India) the forest cover in India is 701,673 km² (21.34%) which includes Very Dense Forest 85,904 km² (2.61%), Moderately Dense Forest 315,374 km² (9.59%), and Open Forest 300,395 km² (9.14%).

3.2.5 Protected Area

There are 733 protected areas (160,901.74 km², 4.89%) including 103 National Park (40,500.13 km², 1.23 % of India), 537 Wildlife reserves (118,005.30 km², 3.59 %), 67 Conservation Reserves (2349.38 km², 0.07%), and 26 Community Reserves (46.93 km², 0.001%) in India. Exact boundaries of these protected areas are not disclosed to public.

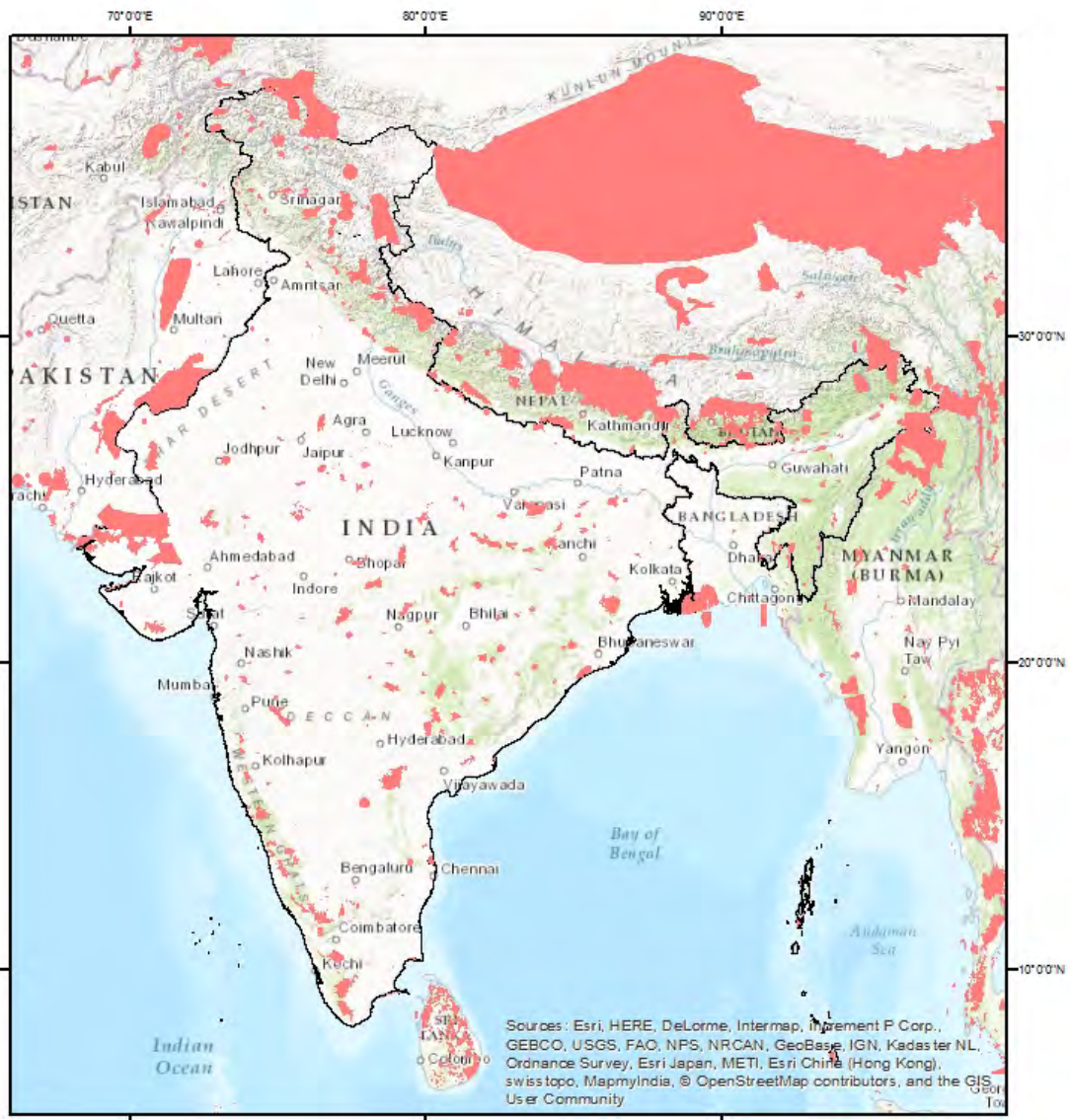
¹ **GLCNMO** (<https://globalmaps.github.io/glcnm.html>)

² State of Forest Report 2015 (http://fsi.nic.in/details.php?pgID=sb_62)



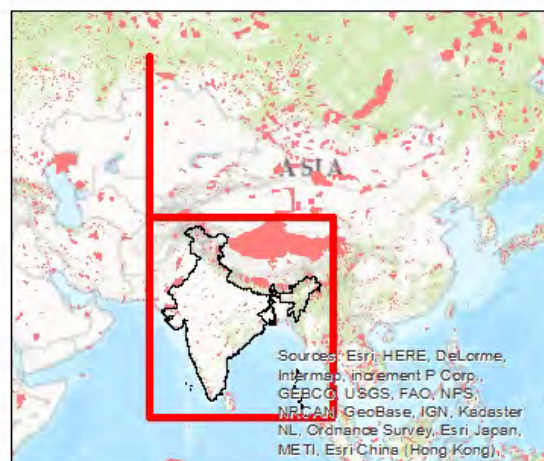
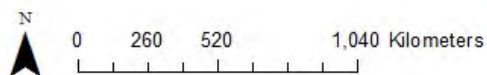
source: GLCNMO version 3 (2013)

Figure 3.2.5-1 Land use Map of India



Legend

Protected Areas



source: Protected Planet (<https://www.protectedplanet.net/>)

Figure 3.2.5-2 Protected Areas of India

3.2.6 Protected species

Number of Schedule faunal species listed in the Indian Wildlife (Protection) Act, 1972 is 1,129 which includes 453 Mammal, 144 Birds, 43 Amphibians and Reptiles, 12 fishes, 453 Insects, and 24 Mollusca.

Table 3.2.6-1 Number of Protected Species in India (fauna)

	WPA, 1972			CITES		Total
	Sch I	Sch II	Sch IV	Appendix –I	Appendix – II	
Mammal	127	306	20	0	1	453
Bird	61	0	83	11	3	144
Amphibians and Reptiles	24	13	6	1	1	43
Fishes	12	0	0	0	1	12
Insect	127	306	20	0	1	453
Mollusca	9	0	15	0	0	24
Total	360	625	144	12	7	1129

source: ENVIS Centre on Wildlife & Protected Areas (<http://www.wiienvis.nic.in>)

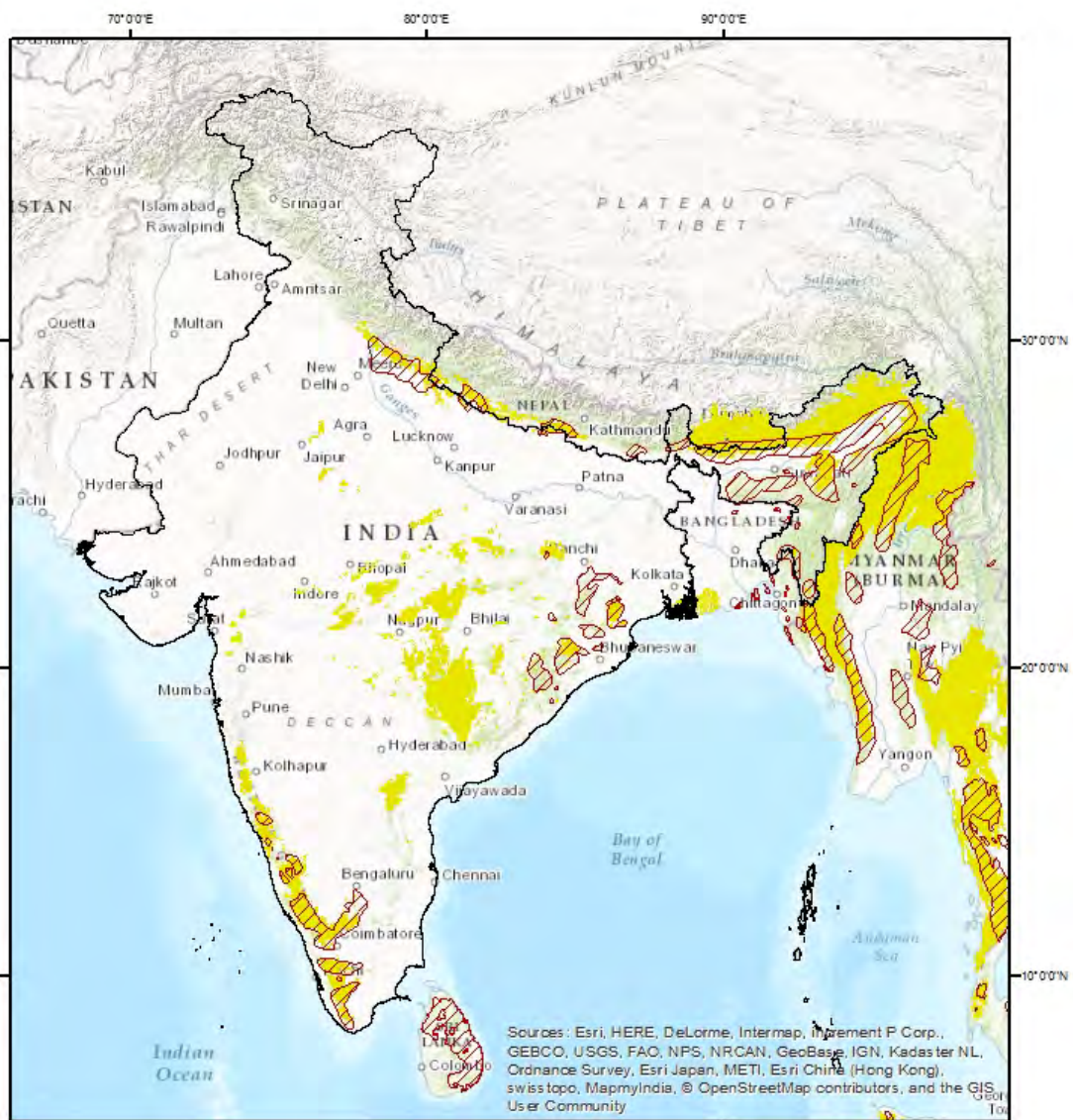
IUCN red list mammals which has distribution areas in India (higher than LC) are 60 species including Critically endangered (CR) 4, Endangered (EN) 20, Vulnerable (VU) 19, and Near threatened (NT) 17. Distribution areas of *Elephas maximus* (EN) and *Panthera tigris* (EN) are shown in the following figure.

3.2.7 Tribes

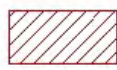

Scheduled Tribes are notified in 30 States/UTs. Census 2011 (<http://www.censusindia.gov.in/>) revealed that the Number of individual ethnic groups, etc. notified as Scheduled Tribes is 705 (MINISTRY OF HOME AFFAIRS, 2013). Population of the Scheduled Tribes is 30,130,184 in 1961 and 104,281,034 in 2011 (8.6% of total population of India). Decadal growth rate is 23.7% to 35.8%. 50% of the Scheduled Tribes are in five States, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, and Gujarat.

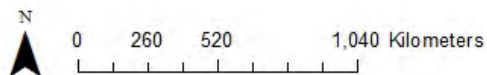
3.2.8 Security

High risk areas in India are shown on the Overseas Travel Safety Information by Ministry of Foreign Affairs of Japan (<http://www.anzen.mofa.go.jp>). In 2016 Level 4 (Evacuate and Avoid all travel) and Level 3 (Avoid all travel) is in JAMMU & KASHMIR state. Level 2 (Avoid Non-essential travel) covers Maharashtra state, Odisha state, Telangana state and others. The other areas are Level 1 (Exercise caution).



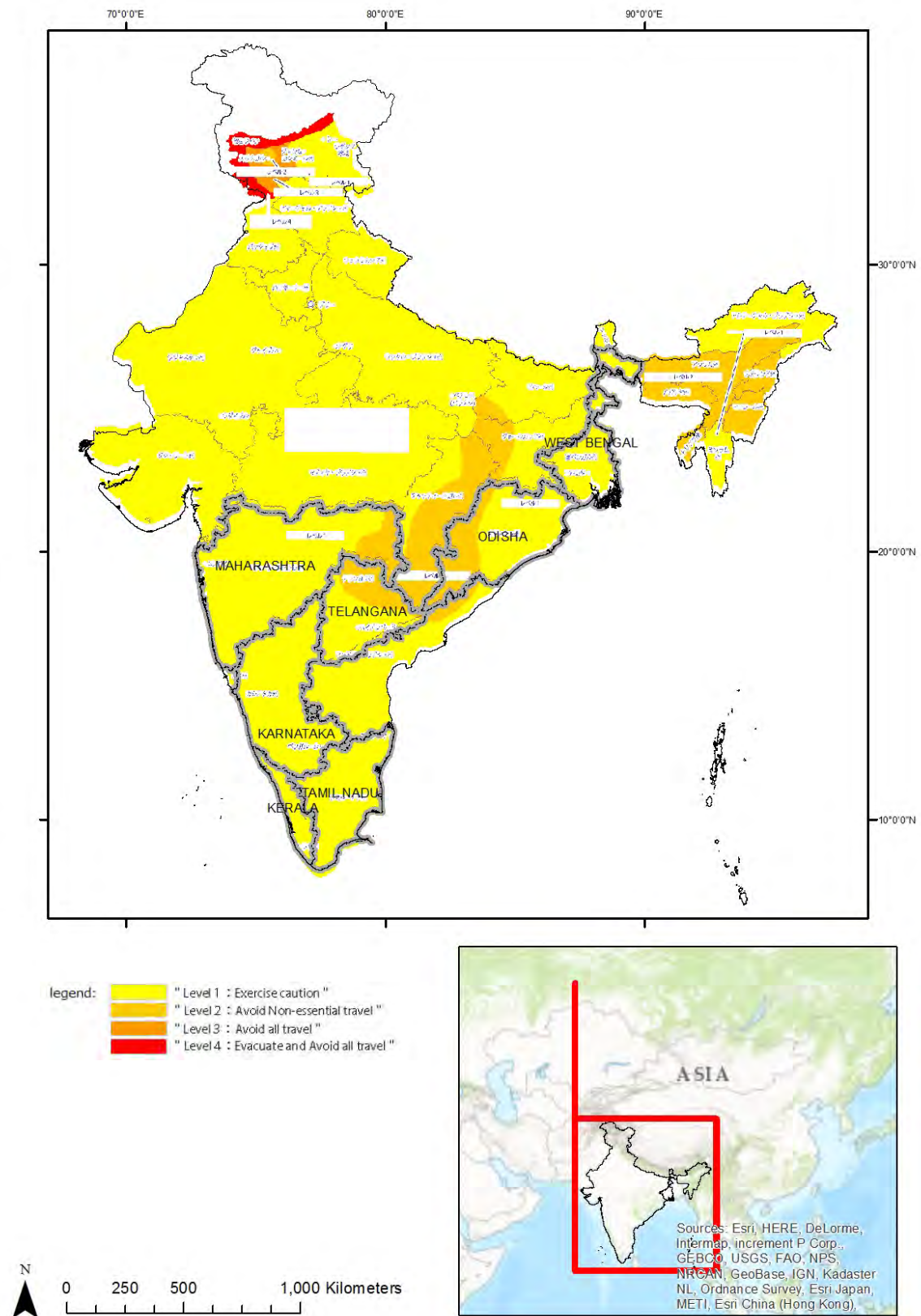
Legend

-  Elephas maximus
-  Panthera tigris



source: IUCN (<http://www.iucnredlist.org/>)

Figure 3.2.8-1 Distribution Areas of Elephant and Tiger in India



source: MOFA Japan (<http://www.anzen.mofa.go.jp>)

Figure 3.2.8-2 MOFA's "Overseas Travel Safety Information"

3.3 ENVIRONMENTAL CONDITIONS BY STATES

3.3.1 Maharashtra State (MS)

(1) Environment

1) Population

Total population of Maharashtra as per 2011 census is 112,374,333, the second largest state. The total population growth in this decade was 15.99 percent while in previous decade it was 22.57 percent. The population of Maharashtra forms 9.28 percent of India in 2011.

2) Greenhouse gas emission and emission source

According to T.V. Ramachandra (2012)³ CH₄ emission of Maharashtra is 1,101.4 Gg (4th rank and 6.5% of India), CO emission is 2,649.7 Gg (1st rank and 11.8% of India), and CO₂ emission is 105,259.9 Gg (1st rank and 10.9% in India). Number of registered motor vehicles is 8,968,733 (5th rank and 12.3% of India). Cement production is 8481.3kt(6th rank, 6.5% of India) and Steel production is 4360 kt (3rd rank and 9.5% of India).

3) Critical Polluted Areas

Five areas are identified as Critical Polluted Areas in Maharashtra State. The Comprehensive Environmental Pollution Index (CEPI) in 2013 is 68.87 to 81.9 which is decreasing from 2009.

Table 3.3.1-1 Comprehensive Environmental Pollution Index (CEPI) in Maharashtra State

Industrial Cluster/Area	Potential Impact Zones	CEPI SCORE			Status
		2009	2011	2013	
Chandrapur	Chandrapur (MIDC Chandrapur, Tadali, Ghuggus, Ballapur)	83.88	83.82	81.9	As-Ws-Lc
Dombivalli	MIDC Phase-I, Phase-II	78.41	85.21	72.29	As-Wc-Ln
Aurangabad	MIDC Chikhalthana, MIDC Waluj, MIDC Shendra, and Paithan Road	77.44	83.1	68.87	As-Ws-Ls
Navi Mumbai	TTC Industrial Area, MIDC, Navi Mumbai (including Blocks-D, C, EL, A, R, General, Kalva)	73.77	78.51	72.87	An-Wc-Ln
Tarapur	MIDC Tarapur	72.01	85.24	73.3	As-Wc-Ln

note: Ac = Air critical ; As = Air severe ; An = Air normal
Wc = Water critical ; Ws = Water severe ; Wn = Water normal
Lc = Land critical ; Ls = Land severe ; Ln = Land normal

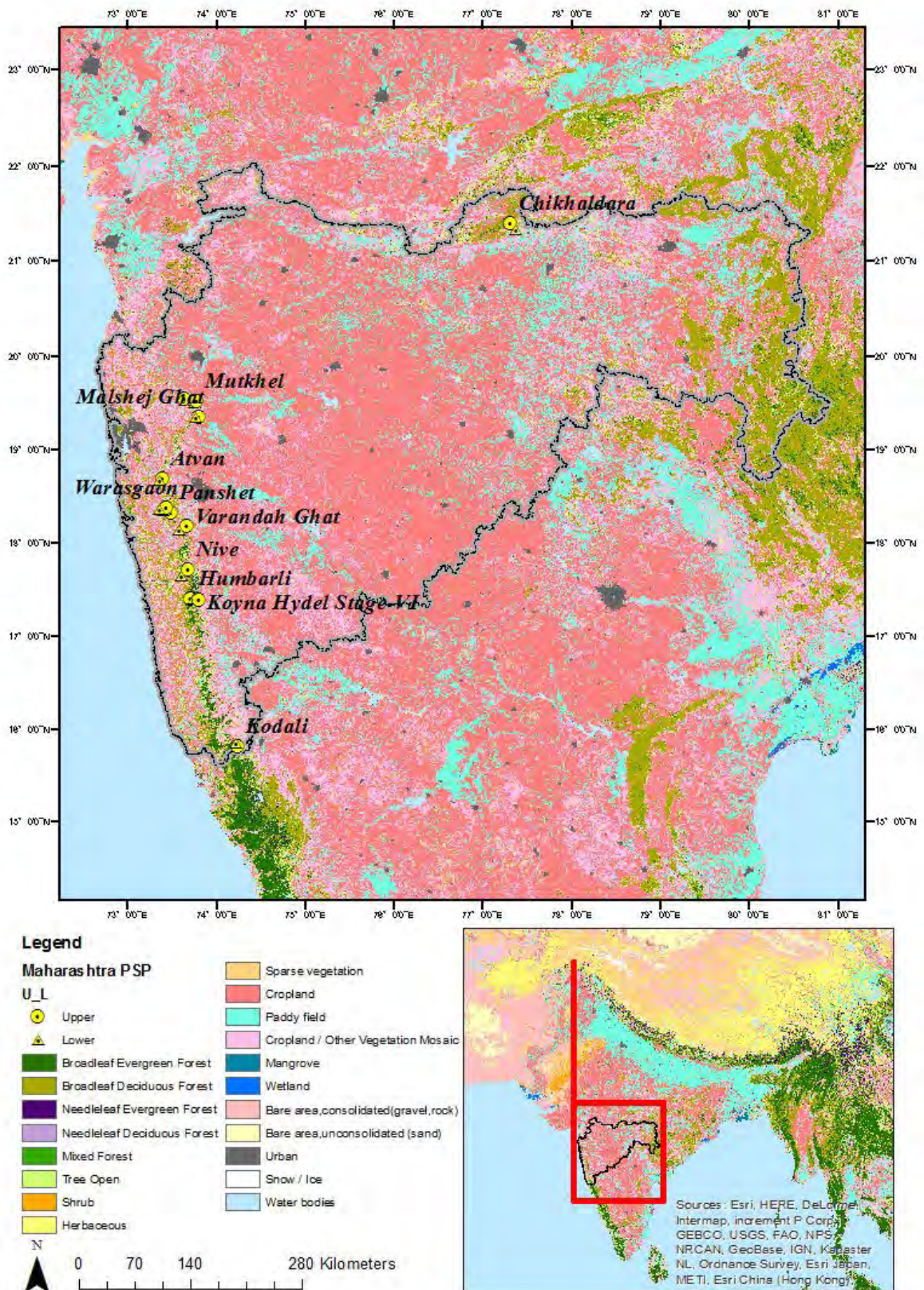
source: The Central Pollution Control Board (CPCB) (<http://cpcb.nic.in/>)

4) Land use

Base on the **GLCNMO**⁴ version 3 (2013) 87.1 % the land cover of Maharashtra State is Agricultural land, 10.7 % is Forest, and 1.1% is Urban area. Forest areas are remaining along the Western Ghats.

³ Decentralised carbon footprint analysis for optimal climate change mitigation strategies in India (2012, T.V. Ramachandra)

⁴ Geospatial Information Authority of Japan, Chiba University and collaborating organizations



source: GLCNMO version 3 (2013) (<https://globalmaps.github.io/glcno.html>)

Figure 3.3.1-1 Land Use in Maharashtra State

5) Forest

According to State of Forest Report 2015 (Forest Survey of India) the forest cover in Maharashtra is 50,628 km² (16.45%) which includes Very Dense Forest 8,712 km², Moderately Dense Forest 20,747 km² and Open Forest 21,169 km². The forest is 4 km² decreasing by 2013.

6) Protected area

There are 55 protected areas including 6 National Parks, 41 Wildlife Sanctuaries, 6 Tiger Reserves, and 2 Conservation Reserves in Maharashtra State. The exact boundaries of the protected areas are not clear.

Table 3.3.1-2 Protected Areas in Maharashtra State

Type	Name	Year	Area (km ²)	District
Conservation Reserves	Bhorkada (Bhorgad)		3.49	Nashik
	Kolamarka		180.72	Gadchiroli
National Park	Chandoli NP	2004	317.67	Sangli, Satara, Kolhapur, Ratnagiri
	Gugamal NP	1975	361.28	Amravati
	Nawegaon NP	1975	133.88	Bhandara (Gondia)
	Pench (Jawaharlal Nehru) NP	1975	257.26	Nagpur
	Sanjay Gandhi (Borivilli) NP	1983	86.96	Thane & Mumbai
	Tadoba NP	1955	116.55	Chandrapur
Tiger Reserves	Melghat		2,768.52	
	Tadoba-Andhari		1,727.59	
	Pench		741.22	
	Sahyadri		1,165.57	
	Nawegaon-Nagzira		653.67	
	Bor		138.12	
Wildlife Sanctuaries	Amba Barwa WLS	1997	127.11	Buldhana
	Andhari WLS	1986	509.27	Chandrapur
	Aner Dam WLS	1986	82.94	Dhule
	Bhamragarh WLS	1997	104.38	Gadchiroli
	Bhimashankar WLS	1985	130.78	Pune & Thane
	Bor WLS	1970	61.10	Wardha & Nagpur
	Chaprala WLS	1986	134.78	Gadchiroli
	Deulgaon-Rehekuri WLS	1980	2.17	Ahmednagar
	Dhyanganga WLS	1997	205.23	Buldhana
	Gautala-Autramghat WLS	1986	260.61	Aurangabad & Jalgaon
	Great Indian Bustard WLS	1979	1,222.61	Solapur & Ahmednagar
	Jaikwadi WLS	1986	341.05	Aurangabad & Ahmednagar
	Kalsubai Harishchandragad WLS	1986	361.71	Ahmednagar
	Karnala Fort WLS	1968	4.48	Raigad
	Karanja Sohal Blackbuck WLS	2000	18.32	Akola
	Katepurna WLS	1988	73.63	Akola & Washim
	Koyana WLS	1985	423.55	Satara
	Lonar WLS	2000	1.17	Buldhana
	Malvan Marine WLS	1987	29.12	Sindhudurg
	Mansingdeo WLS	2010	182.59	Nagpur
	Mayureswar Supe WLS	1997	5.15	Pune
	Melghat WLS	1985	778.75	Amravati
	Nagzira WLS	1970	152.81	Gondia, Bhandara
	Naigaon Peacock WLS	1994	29.89	Beed
	Nandur Madhameshwar WLS	1986	100.12	Nashik
	Narnala Bird WLS	1997	12.35	Akola
	Nawegaon WLS	2012	122.76	Gondia
	New Bor WLS	2012	60.70	Nagpur-Wardha
	New Nagzira WLS	2012	151.33	Gondia
	Painganga WLS	1986	324.62	Yeotmal & Nanded
Phansad WLS	1986	69.79	Raigad	

	Radhanagari WLS	1958	351.16	Kolhapur
	Sagareshwar WLS	1985	10.87	Sangali
	Tansa WLS	1970	304.81	Thane
	Thane Creek Flamingo WLS	2015	16.91	Mumbai Suburban
	Tipeshwar WLS	1997	148.63	Yeotmal
	Tungareshwar WLS	2003	85.00	Thane
	Yawal WLS	1969	177.52	Jalgaon
	Yedsi Ramlin Ghat WLS	1997	22.38	Aurangabad (Osmanabad)
	Umred-Kharnghla WLS	2012	189.30	Nagpur & Bhandara
	Wan WLS	1997	211.00	Amravati

source: ENVIS Centre on Wildlife & Protected Areas (<http://www.wiienvis.nic.in>)

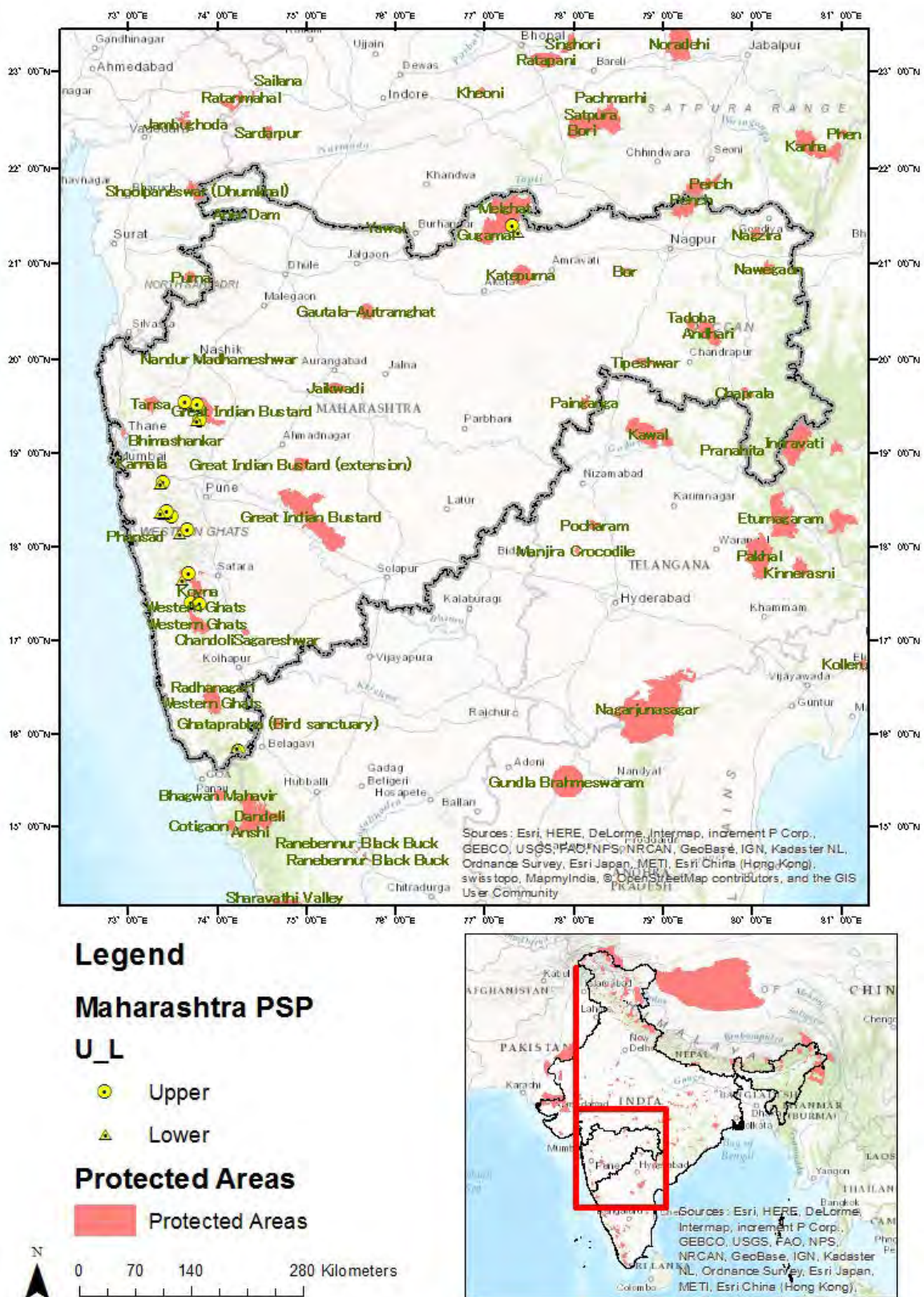
7) Protected species

IUCN red list mammals which has distribution areas in Maharashtra State are 17 species including Critically endangered (CR) 1, Endangered (EN) 5, Vulnerable (VU) 8, and Near threatened (NT) 3. Distribution areas of *Panthera tigris* (EN) are shown in the following figure.

Table 3.3.1-3 IUCN red list species which has known habitat in Maharashtra State

Category	Scientific name
CR	<i>Millardia kondana</i>
EN	<i>Bubalus arnee</i> <i>Cuon alpinus</i> <i>Hipposideros durgadasi</i> <i>Manis crassicaudata</i> <i>Panthera tigris</i>
VU	<i>Aonyx cinereus</i> <i>Bos gaurus</i> <i>Lutrogale perspicillata</i> <i>Melursus ursinus</i> <i>Prionailurus rubiginosus</i> <i>Rattus satarae</i> <i>Rusa unicolor</i> <i>Tetracerus quadricornis</i>
NT	<i>Antilope cervicapra</i> <i>Hyaena hyaena</i> <i>Panthera pardus</i>

source: IUCN (<http://www.iucnredlist.org/>)



source: ENVIS Centre on Wildlife & Protected Areas (<http://www.wiienvis.nic.in>) and Forest Department of Maharashtra

Figure 3.3.1-2 Protected Areas in Maharashtra State

8) Tribes

Based on the Scheduled Castes and Scheduled Tribes Orders (Amendment) Act (1976) 48 Scheduled Tribes are listed in Maharashtra. According to Census 2011 (<http://www.censusindia.gov.in/>), 10,061,722 peoples (9.49%) are scheduled Tribe. The districts of higher tribe rate are Nandurbar 69.28%, Gadchiroli 38.71%, and Dhule 31.56%. There are 27 Scheduled tahsils in Maharashtra State.

Table 3.3.1-4 Scheduled Areas in Maharashtra State

1. Palghar tehsil, 2. Vasai (Bassein), 3. Bhiwandi Tahsil, 4. Murbad tehsil, 5. Dindori tehsil, 6. Igatpuri tehsil, 7. Nasik tehsil, 8. Baglan tehsil, 9. Sakri tehsil, 10. Nandurbar tehsil, 11. Shahada tehsil, 12. Shirpur tehsil, 13. Chopda tehsil, 14. Yaval tehsil, 15. Raver tehsil, 16. Akole tehsil, 17. Ambegaon tehsil, 18. Junnar tehsil, 19. Kinwat Tahsil, 20. Maregaon Tahsil, 21. Ralegaon Tahsil, 22. Kelapur Tahsil, 23. Ghatanji Tahsil, 24. Gadchiroli Tahsil, 25. Armori Tahsil, 26. Chamorshi tehsil, 27. Rajura tahsil

source: The Ministry of Tribal Affairs (<http://tribal.nic.in>)

9) Security

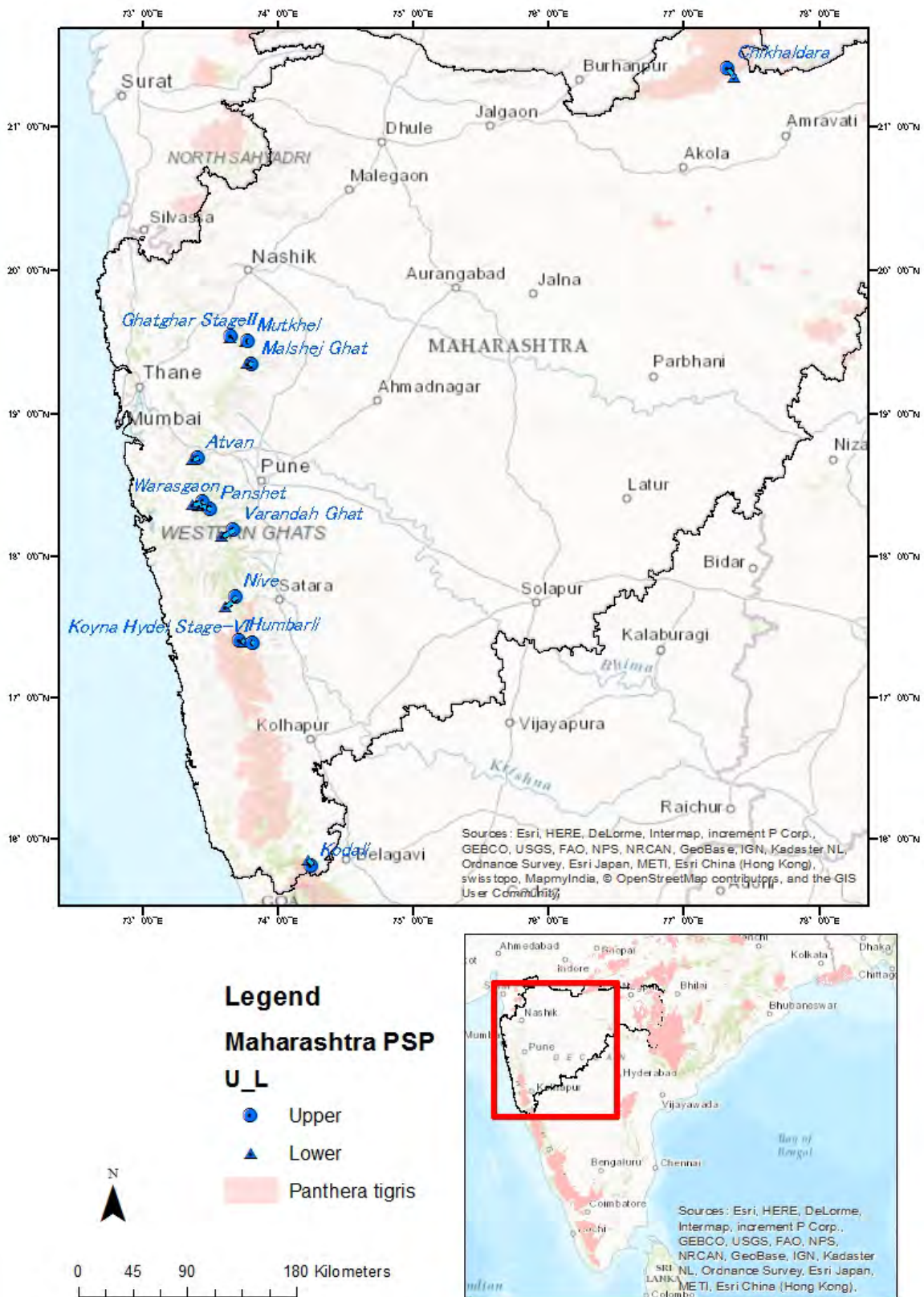
In terms of the Japanese MOFA's "Overseas Travel Safety Information" in 2016, Maharashtra state is Level 1 (Exercise caution) and Level 2 (Avoid Non-essential travel).

(2) Relevant authorities

Relevant Authorities of Environmental and Social issues in Maharashtra State are as follows.

Table 3.3.1-5 Relevant Authorities in Maharashtra State

Name	Address	Role
Maharashtra Pollution Control Board	Kalpataru Point, 3rd and 4th floor, Opp. CineMax Theatre, Sion (E), Mumbai-400 022	Pollution Control, Waste management
Regional Offices, Ministry of Environment and Forest, Climate Change	Regional Office(WCZ),Ground Floor East Wing, New Secretariat Building, Civil Line,Nagpur-440001	Environmental Clearance, Forest Clearance, Wildlife Clearance
Maharashtra Forest Department	Office of the Conservator of Forests (Wildlife) Nashik Aadhar Bungalow, Sadhu Waswani Road, Near Kulkurni Garden. Nashik 422 005	Wildlife Clearance
Environmental Department	Mantralaya, Madam Cama Road, Hutatma Rajguru Square, Nariman Point, Mumbai - 400032	Environmental Clearance
The Maharashtra Water Resources Regulatory Authority (MWRRA)	9th Floor, Centre - 1, World Trade Centre, Cuffe Parade, Mumbai - 400 005.	Water distribution, Water tariff, review water
Tribal Development Department	Mantralaya, Mumbai-400032	ST/SC
Rural Development Department	Construction of buildings, 25, marjhabana Road, Fort, Mumbai - 400001	



source: IUCN (<http://www.iucnredlist.org/>)

Figure 3.3.1-3 Tiger habitat in Maharashtra State

(3) Environmental and Social issues

Per “State of Environment Report: Maharashtra” following issues are listed in Maharashtra.

1) Water Resources

Per capita water availability in the state is lower than the national average. Water demand for various consumptive uses, such as drinking, agriculture, industrial etc., both from ground and surface water resources, is higher than the availability. Distribution of rainfall is highly uneven in the State and in many areas the soil conditions and topography are unfavourable to ground water recharge through percolation. Further, over-use and misuse of resources is responsible for the water scarcity. Wide disparities exist in the sanitation facilities in the urban and rural areas. Thus, meeting the increased needs for the water supply and sanitation facilities are a challenge for the authorities.

According to the pollution assessment is based on the bio-chemical oxygen demand (BOD) by Central Pollution Control Board (CPCB, 2014-15), 49 out of 302 polluted river stretches in India locate in Maharashtra State, which is the worst 1 state in India. The rivers are Wena, Wainganga, Godavari, Bhima, Krishna, Ulhas, Kundalika, Tapi, Girna, Panchganga, Nira, Bhatsa, Rangavali, Indrayani, Chandrabhaga, Vashisti, Mithi, Kanhan, Koyna, Amba, Amravati, Bindusara, Darna, Ghod, Gomai, Hiwara, Kan, Manjara, Mor, Morna, Mula, Mula- Mutha, Mutha, Panzara, Patalganga, Pawna, Pedhi, Pelhar, Penganga, Purna, Savitri, Sina, Surya, Urmodi, Vaitrana, Vel, Venna, Waghur, and Wardha.

2) Forest

India State of Forest Report (2015, MOEF) reports the Forest Area of Maharashtra State is 50,628 km² (16.45 % of geographical area, the fourth large forest cover state). The forest area of 4 km² is decreased comparing to 2013. The reasons for decrease in forest cover in Maharashtra are rotational felling, diversion of forest areas for non-forestry purposes, encroachment etc.. Increase in forest cover in certain pockets is due to plantations and mangrove rehabilitation.

3.3.2 Odisha State (OD)

(1) Environment

1) Population

Total population of Orissa as per 2011 census is 41,974,218. The total population growth in this decade was 14.05 percent. The population of Orissa forms 3.47 percent of India in 2011. The listed 4 projects are located in relatively low population density areas.

2) Greenhouse Gas emission and emission source

According to T.V. Ramachandra (2012)⁵ CH₄ emission of Odisha is 833.9 Gg (9th rank and 4.9% of India), CO emission is 771.9 Gg (12th rank and 3.4% of India), and CO₂ emission is 29,368.6 Gg (14th rank and 3.0% in India). Number of registered motor vehicles is 1,524,982 (14th rank and 2.1% of India). Cement production is 3081.5 kt(10th rank, 2.4% of India) and Steel production is 2888 kt (7th rank and 6.3% of India).

3) Critical Polluted Areas

Three areas are identified as Critical Polluted Areas in Odisha State. The Comprehensive Environmental Pollution Index (CEPI) in 2013 is 59.73 to 73.31 which is decreasing from 2009.

Table 3.3.2-1 Comprehensive Environmental Pollution Index (CEPI) in Odisha State

Industrial Cluster/Area	Potential Impact Zones	CEPI SCORE			Status
		2009	2011	2013	
Angul Talcher	a) MCL Coal Mining Area, Angul -Talcher region b) Exiting Industrial Area(60 km x 45 km)	82.09	89.74	72.86	Ac-Wc-Ln
Ib Valley	Ib Valley of Jharsuguda (Industrial and Mining area)	74.00	65.68	59.73	An-Wn-Ln
Jharsuguda	Ib Valley of Jharsuguda (Industrial and Mining area)	73.34	67.48	73.31	Ac-Ws-Ln

note: Ac = Air critical ; As = Air severe ; An = Air normal
Wc = Water critical ; Ws = Water severe ; Wn = Water normal
Lc = Land critical ; Ls = Land severe ; Ln = Land normal

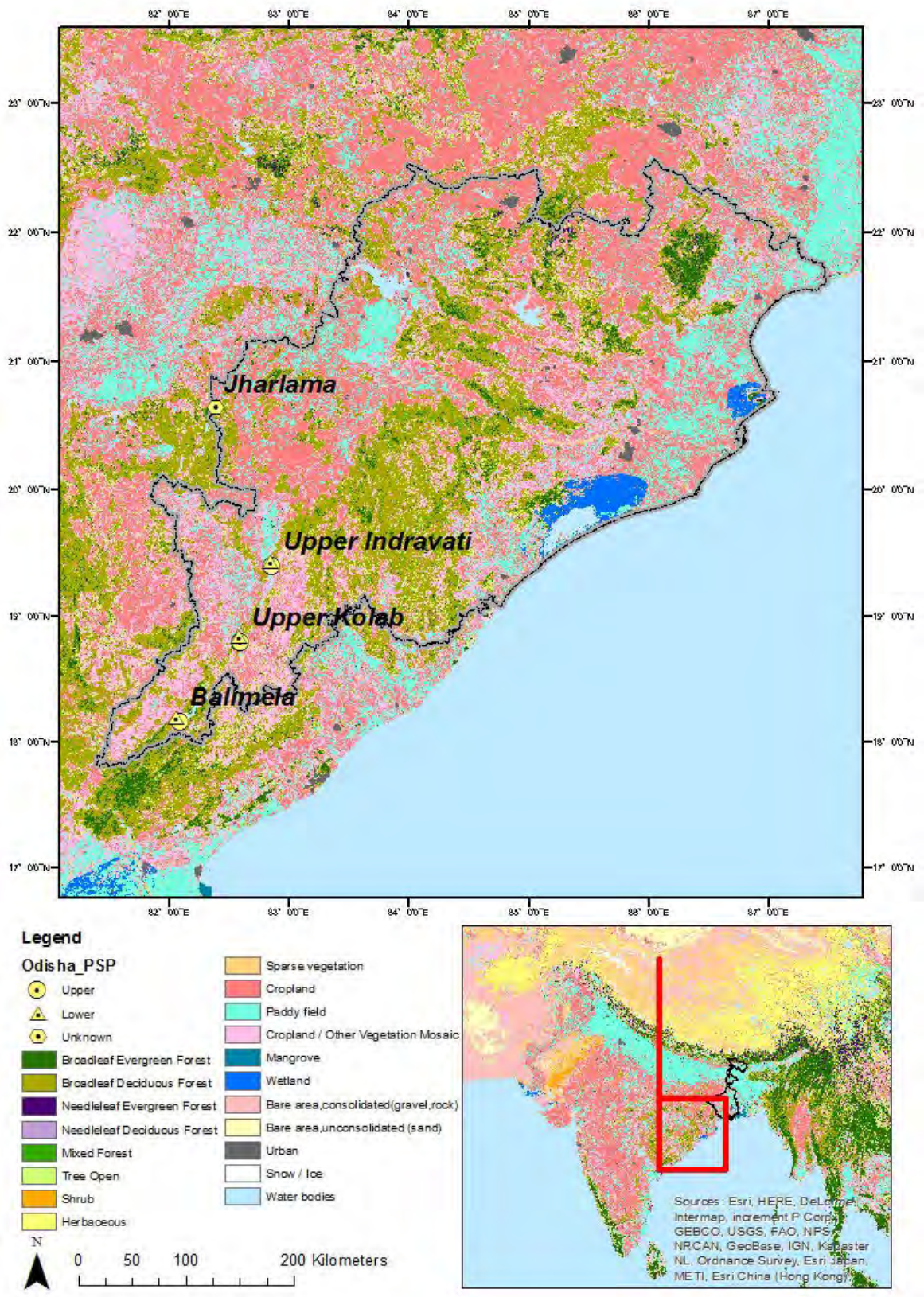
source: The Central Pollution Control Board (CPCB) (<http://cpcb.nic.in/>)

4) Land use

Base on the **GLCNMO**⁶ version 3 (2013) 62.5 % the land cover of Odisha State is Agricultural land, 33.1 % is Forest, and 0.4% is Urban area. Forest areas are remaining in Middle Mountainous and Highlands Region.

⁵ Decentralised carbon footprint analysis for optimal climate change mitigation strategies in India (2012, T.V. Ramachandra)

⁶ Geospatial Information Authority of Japan, Chiba University and collaborating organizations



source: GLCNMO version 3 (2013) (<https://globalmaps.github.io/glcnm.html>)

Figure 3.3.2-1 Land Use in Odisha State

5) Forest

According to State of Forest Report 2015 (Forest Survey of India) the forest cover in Odisha is 50,354 km² (32.34%) which includes Very Dense Forest 7,023 km², Moderately Dense Forest 21,470 km² and Open Forest 21,861 km². The forest is 7 km² increasing by 2013.

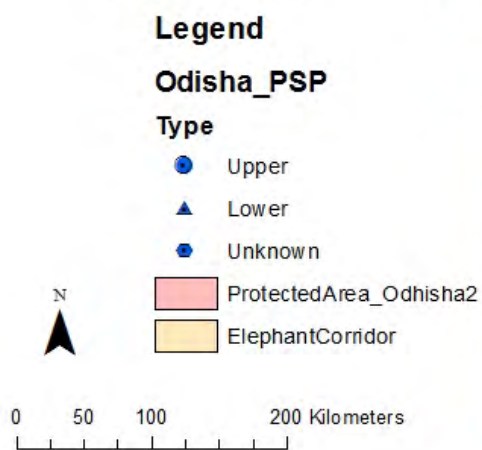
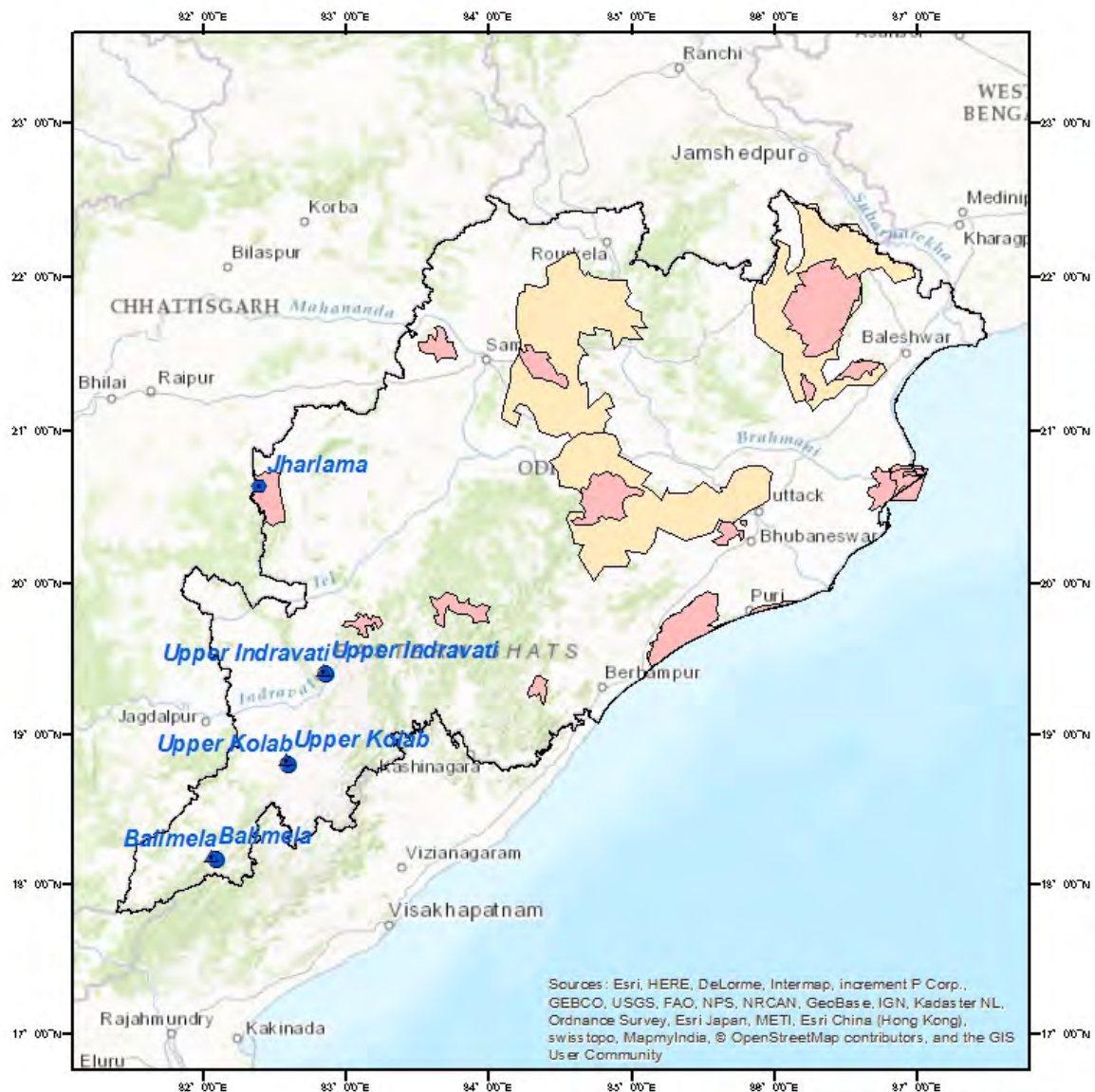
6) Protected area

There are 28 protected areas including 2 National Park, 2 Tiger Reserves, 19 Wildlife reserves and 5 Elephant Reserves in Odisha State. Exact boundaries of these protected areas are not disclosed.

Table 3.3.2-2 Protected Areas in Odisha State

Type	Name	Year	Area (km ²)	District
National Park	Bhitarkanika NP	1988	145.00	Kendrapara
	Simlipal NP	1980	845.70	Mayurbhanj
Tiger Reserves	Similipal		2,750.00	
	Satkosia		963.87	
Wildlife Sanctuaries	Badrama WLS	1962	304.03	Sambalpur
	Baisipalli WLS	1981	168.35	Nayagarh
	Balukhand Konark WLS	1984	71.72	Puri
	Bhitarkanika WLS	1975	525.00	Kendrapara
	Chandaka Dampara WLS	1982	175.79	Khurda & Cuttack
	Chilika (Nalaban) WLS	1987	15.53	Khurda, Puri & Ganjam
	Debrigarh WLS	1985	346.91	Sambalpur
	Gahirmatha (Marine) WLS	1997	1,435.00	Kendrapara
	Hadgarh WLS	1978	191.06	Keonjhar & Mayurbhanj
	Kapilash WLS		125.50	Dhenkanal
	Karlapat WLS	1992	147.66	Kalahandi
	Khalasuni WLS	1982	116.00	Sambalpur
	Kothagarh WLS	1981	399.50	Phulbani
	Kuldiha WLS	1984	272.75	Balesore
	Lakhari Valley WLS	1985	185.87	Gajapati
	Nandankanan WLS	1979	14.16	Khurda
	Satkosia Gorge WLS	1976	745.52	Angul, Boudh & Cuttack
	Simlipal WLS	1979	1,354.30	Mayurbhanj
	Sunabeda WLS	1988	500.00	Nuapada
Elephant Reserves	3. Mayurbhanj ER	29.9.01		
	4. Mahanadi ER	20.7.02		
	5. Sambalpur ER	27.3.02		
	6. Baitami ER			
	7. South Orissa ER			

source: ENVIS Centre on Wildlife & Protected Areas (<http://www.wiienvis.nic.in>)



source: Protected Planet (<https://www.protectedplanet.net/>)

Figure 3.3.2-2 Protected Areas in Odisha State

7) Protected species

IUCN red list mammals which has distribution areas in Odisha State are 15 species including Endangered (EN) 5, Vulnerable (VU) 7, and Near threatened (NT) 3. Distribution areas of *Elephas maximus* (EN) and *Panthera tigris* (EN) are shown in the following figure.

Table 3.3.2-3 IUCN red list species which has known habitat in Odisha State

IUCN Category	Scientific Name
EN	<i>Bubalus arnee</i> <i>Cuon alpinus</i> <i>Elephas maximus</i> <i>Manis crassicaudata</i> <i>Panthera tigris</i>
VU	<i>Aonyx cinereus</i> <i>Bos gaurus</i> <i>Lutrogale perspicillata</i> <i>Melursus ursinus</i> <i>Prionailurus rubiginosus</i> <i>Rusa unicolor</i> <i>Tetracerus quadricornis</i>
NT	<i>Antilope cervicapra</i> <i>Hyaena hyaena</i> <i>Panthera pardus</i>

source: IUCN (<http://www.iucnredlist.org/>)

8) Tribes

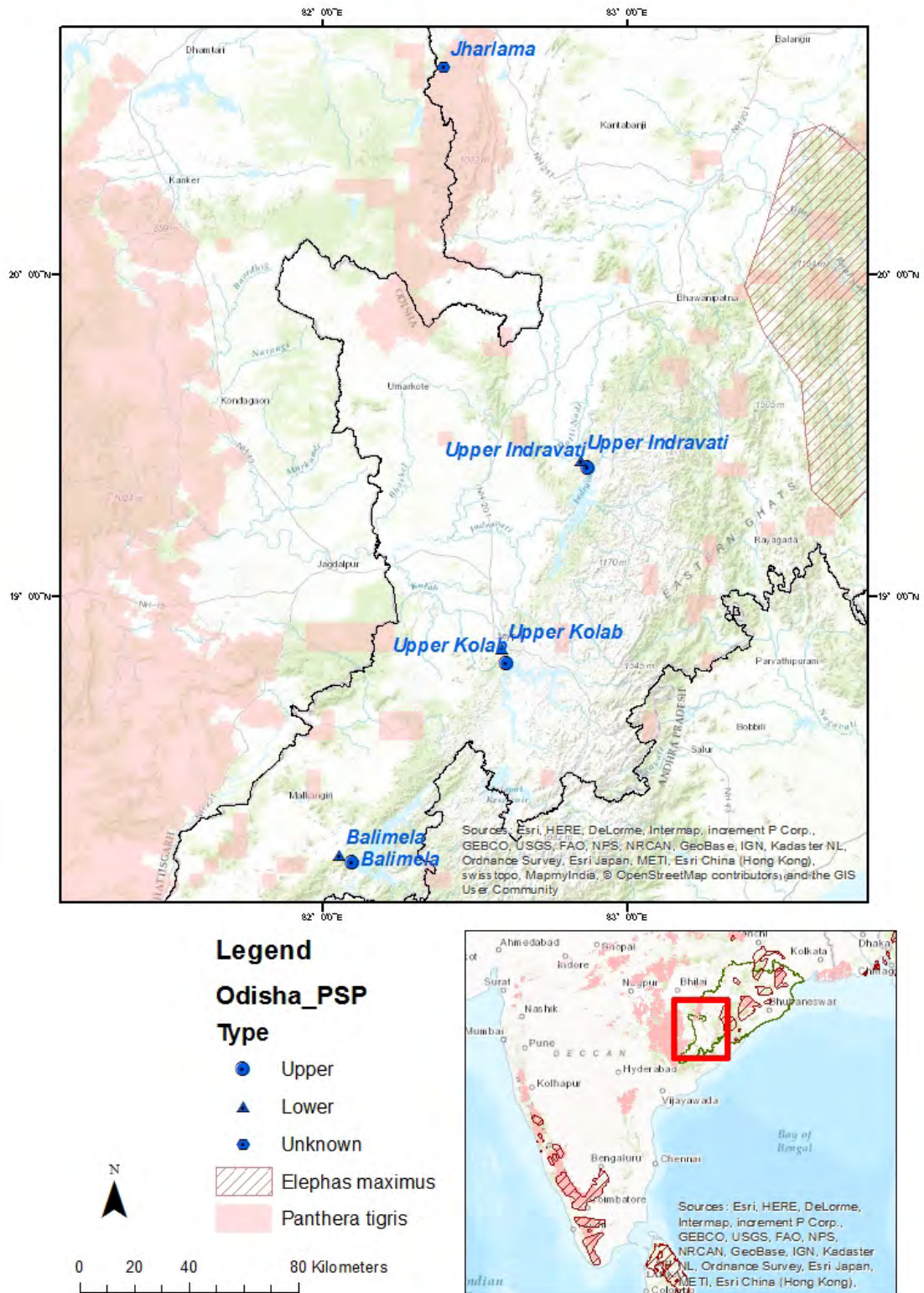
Based on the Scheduled Castes and Scheduled Tribes Orders (Amendment) Act (1976) 62 Scheduled Tribes are listed in Odisha. According to Census 2011 (<http://www.censusindia.gov.in/>), 9,590,756 peoples (22.85%) are scheduled Tribe. The districts which tribe rate are over 50% are Gajapati, Kandhamal, Koraput, Malkangiri, Mayurbhanj, Nabarangapur, Rayagada, and Sundargarh.

Table 3.3.2-4 Scheduled Areas in Odisha State

1. Mayurbhanj district, 2. Sundargarh district, 3. Koraput district, 4. Kuchinda tahsil in Sambalpur district, 5. Keonjhar and Telkoi tahsils of keonjhar sub-division, and champua and Barbil tahsils of Champua sub-division in Keonjhar district, 6. Khondmals tahsil of Khondmals sub-division, and Balliguda and G. Udayagiri tahsils of Balliguda sub-division in Boudh-khondmals district, 7. R. Udayagiri tahsil, and Guma and Rayagada Blocks of Parlakhemundi Tahsil of Parlakhemundi sub-division, and Surada tahsil, excluding Gazalbadi and Gocha Gram Panchayats of Ghumsur sub-division, in Ganjam district, 8. Thuamul Rampur Block of Kalahandi Tahsil, and Lanjigarh Block, falling in Lanjigarh and Kalahandi tahsils, in Bhawanipatna sub-division in Kalahandi district, 9. Nilgiri Community Development Block of Nilgiri tahsil in Nilgiri Sub-division in Balasore district.

The Scheduled area in the State of Orissa was originally specified by the Scheduled Areas (Part A States) Order, 1950 (Constitution Order, 9) dated 23.1.1950 and the Scheduled Areas (Part B States) Order, 1950, (Constitution Order, 26) dated 7.12.1950 and has been respecified as above by the Scheduled Areas (States of Bihar Gujarat, Madhya Pradesh and Orissa) Order, 1977, (Constitution Order, 109) dated 31.12.1977 after rescinding the Orders cited earlier in so far as they related to the State of Orissa.

source: The Ministry of Tribal Affairs (<http://tribal.nic.in>)



source: IUCN (<http://www.iucnredlist.org/>)

Figure 3.3.2-3 Elephant and Tiger habitat in Odisha State

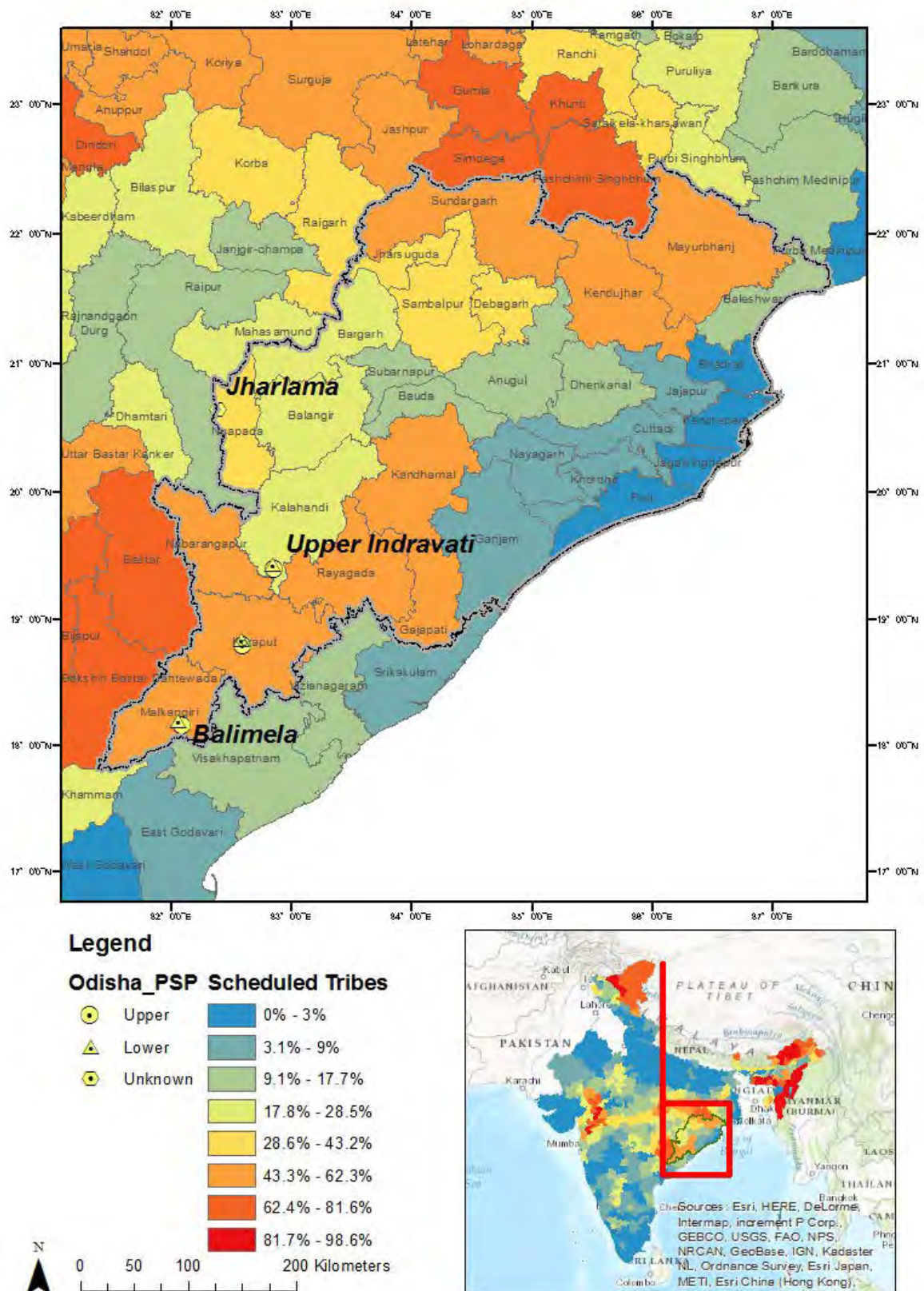


Figure 3.3.2-4 Scheduled Tribes in Odisha State

9) Security

In terms of the MOFA's "Overseas Travel Safety Information", Odisha state is Level 1 (Exercise caution) and Level 2 (Avoid Non-essential travel).

(2) Relevant authorities

Relevant Authorities to Environmental Social issues are shown in the following table.

Table 3.3.2-5 Relevant Authorities in Odisha State

Name	Address	Role
State Pollution Control Board	Paribesh Bhawan, A/118, Nilakantha Nagar, Unit - VIII, Bhubaneswar - 751012, Odisha	Pollution, Waste, Recycle
Regional Offices, Ministry of Environment and Forest, Climate Change	Regional Office (Eastern Zone), A/3, Chandrasekharapur, Bhubaneswar-751023	Environmental Clearance, Forest Clearance, Wildlife Clearance
The Forest and Environment Department	Government of Odisha, Secretariat, Bhubaneswar	Environmental Clearance, Forest Clearance, Wildlife Clearance
Department of Water Resources, Odisha	Government of Odisha, Secretariat, Bhubaneswar	Water resource policy, River system and basin planning
The Rural Development Department	SIRD Campus, Unit-VIII, Bhubaneswar-751012, Odisha,	
ST & SC Development & Welfare Department	Government of Odisha, Secretariat, Bhubaneswar	The policies, Programmes and schemes of the Department

(3) Environmental and Social issues

According to the pollution assessment is based on the bio-chemical oxygen demand (BOD) by Central Pollution Control Board (CPCB, 2014-15), 12 out of 302 polluted river stretches in India locate in Odisha State, which is the worst 9 state in India. The rivers are Baitrani, Brahamani, Budhabalnaga, Daya, Kathajodi, Koel, Kuakhai, Mahanadi Nagavalli, Rushikulya, Serua, and Vansadhara.

Per HOTTnHIT NEWSFEATURES (HNF) (Bhubaneswar, 05 June 2015) following Environmental issues are pointed out.

In 2007, Time magazine ranked Sukinda, which contains one of the largest open cast chromite ore mines in the world, as world's third most polluted place with 60% of the drinking water containing hexavalent chromium at levels more than double the international standards and about 85% of deaths caused due to chromite-related diseases. Comprehensive Environmental Pollution Index (CEPI) 2009 of the Central Pollution Control Board of India classified industrial and mining clusters of Angul-Talcher, Ib Valey and Jharsuguda as critically polluted and unsuitable for human habitation.

Since deforestation and loss of mangrove along the coast were believed to be the reasons of the massive damage caused by the super cyclone, coastal afforestation and generation of thick mangrove belt were suggested by several experts and agencies. Reports say, the mangrove cover had come down to less than 190 km² from 500 km² in a period of four decades from 1960.

3.3.3 Telangana State (TS)

(1) Environment

1) Population

Total population of Telangana as per 2011 census is 30,987,144, the twelfth largest state. The total population growth in this decade was 13.58 percent. The population of Telangana forms 2.91 percent of India in 2011.

2) Land Use

Based on the **GLCNMO** version 3 (2013) 82.9 % the land cover of Telangana State is Agricultural land, 14.6 % is Forest, and 1.1% is Urban area. Forest areas are remaining in North-East and Southern areas in the state.

3) Forest

According to State of Forest Report 2015 (Forest Survey of India) the forest cover in Telangana is 21,591 km² (18.80%) which includes Very Dense Forest 513 km², Moderately Dense Forest 12,712 km² and Open Forest 8,366 km². The forest is 168 km² decreasing by 2013.

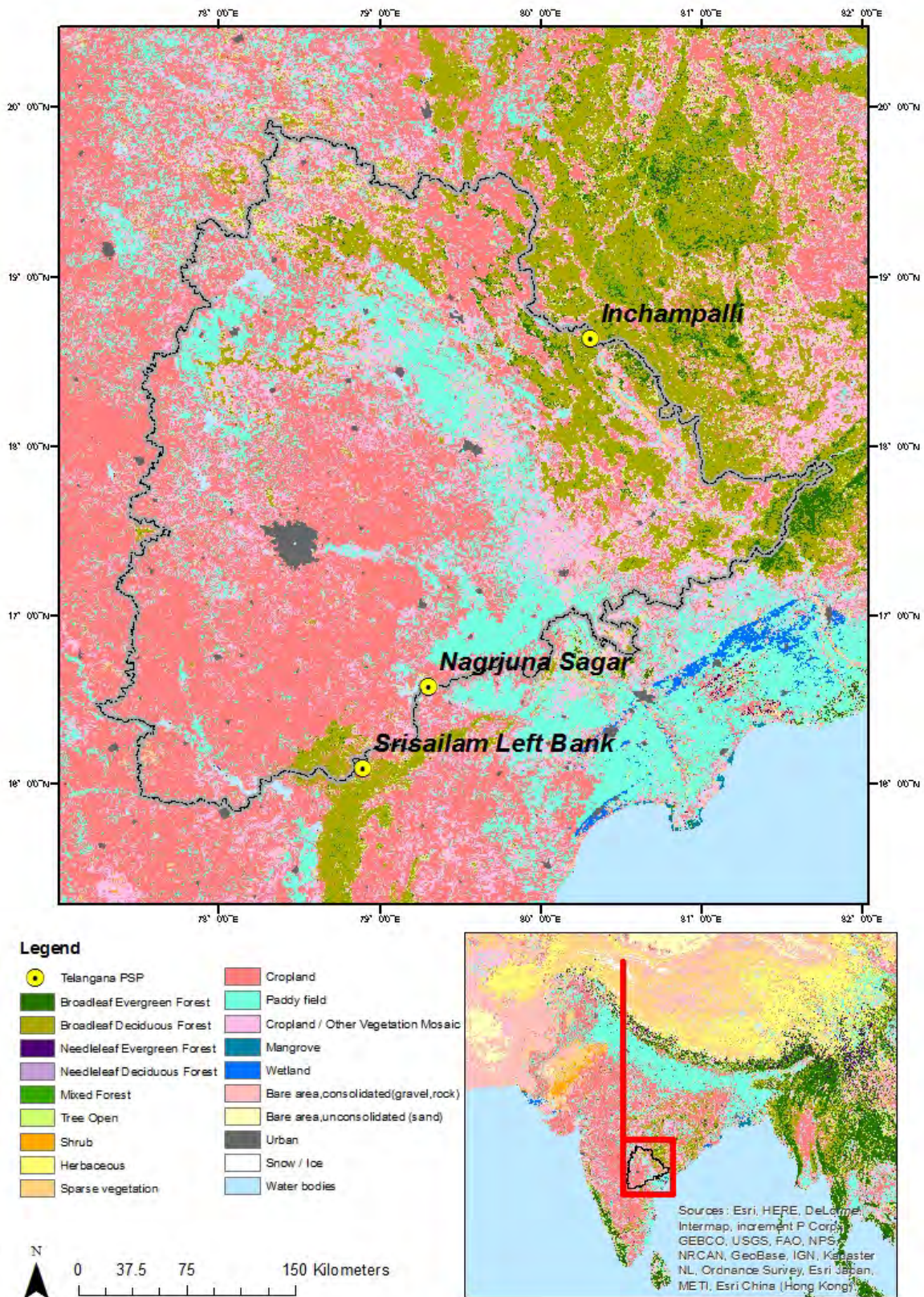
4) Protected area

There are 14 protected areas including 3 National Park 9 Wildlife reserves and 2 Tiger Reserves in Telangana State. The exact boundaries of the protected areas are not clear.

Table 3.3.3-1 Protected Areas in Telangana State

Type	Name	Year	Area (km ²)	District
National Park	Kasu Brahmananda Reddy NP	1994	1.43	Hyderabad
	Mahaveer Harina Vanasthali NP	1994	14.59	Ranga Reddy
	Mrugavani NP	1994	3.6	Ranga Reddy
Tiger Reserves	Kawal		2,019.12	
	Amrabad		2,611.39	
Wildlife Sanctuaries	Nagarjuna Sagar-Srisailam WLS	1978	3,568.09	Nalgonda & Mahaboobnagar
	Eturnagaram WLS	1953	806.15	Warangal
	Kawal WLS	1965	892.23	Adilabad
	Kinnersani WLS	1977	635.41	Khammam
	Lanja Madugu Siwaram WLS	1978	29.81	Adilabad & Karimnagar
	Manjeera Crocodile WLS	1978	20.00	Medak
	Pakhal WLS	1952	860.00	Warangal
	Pocharam WLS	1952	130.00	Medak
Pranahita WLS	1980	136.03	Adilabad	

source: ENVIS Centre on Wildlife & Protected Areas (<http://www.wiienviis.nic.in>)



source: GLCNMO version 3 (2013) (<https://globalmaps.github.io/glcnm.html>)

Figure 3.3.3-1 Land Use in Telangana State

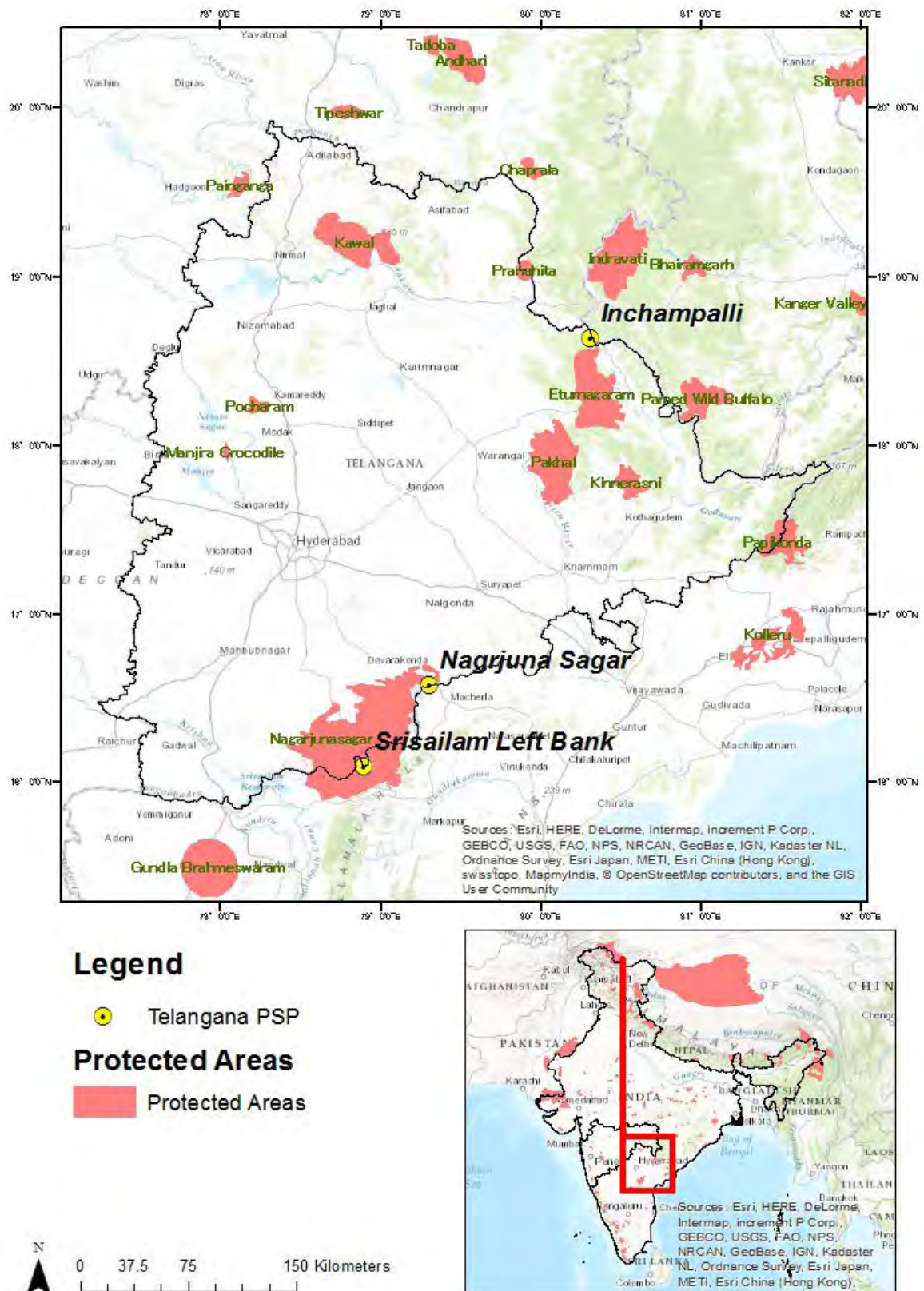


Figure 3.3.3-2 Protected Areas in Telangana State

source: Protected Planet (<https://www.protectedplanet.net/>)

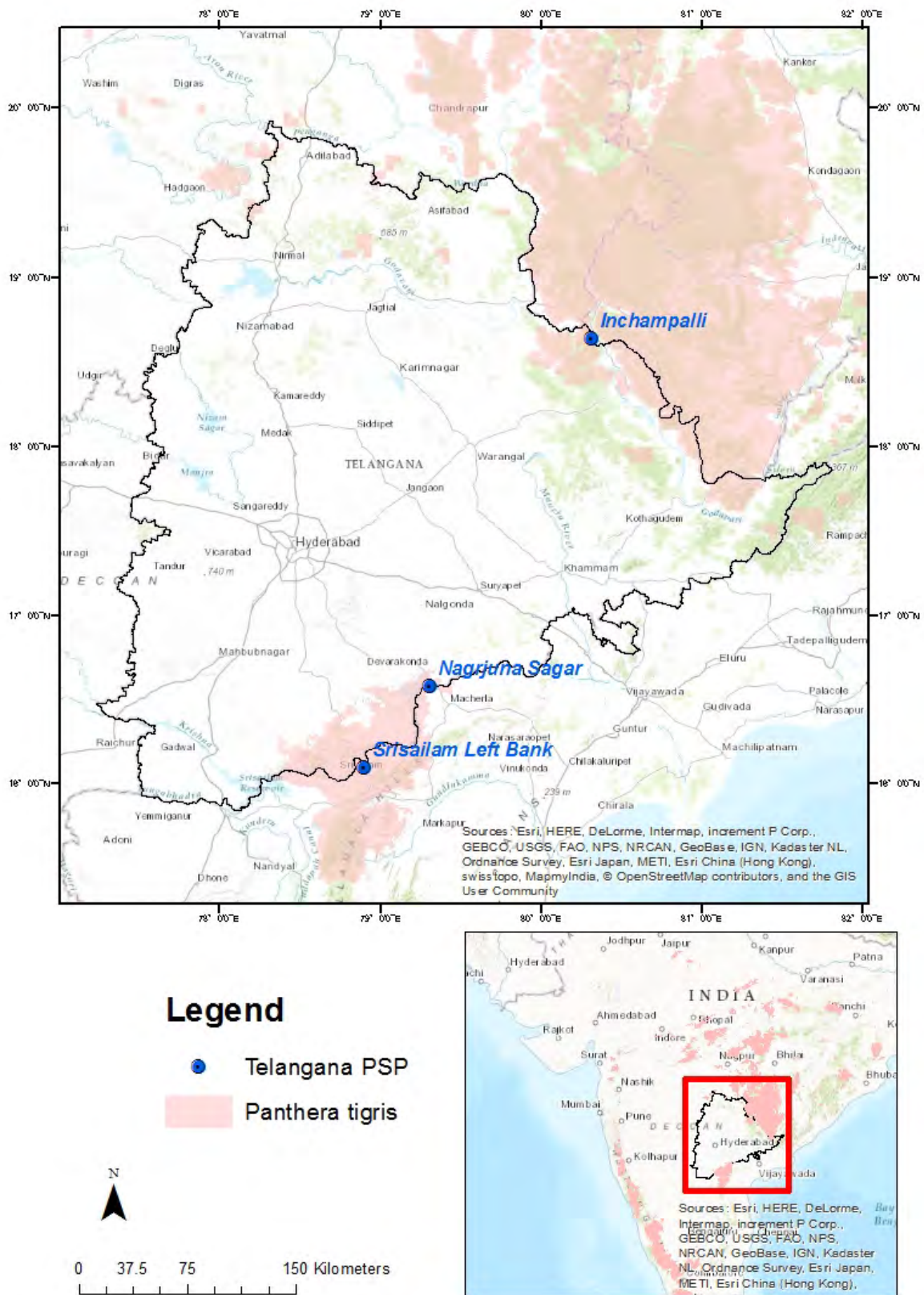
5) Protected species

IUCN red list mammals which has distribution areas in Telangana State are 14 species including Endangered (EN) 3, Vulnerable (VU) 7, and Near threatened (NT) 4. Distribution areas of *Panthera tigris* (EN) is shown in the following figure.

Table 3.3.3-2 IUCN red list species which has known habitat in Telangana State

Category	Scientific name
EN	<i>Cuon alpinus</i> <i>Manis crassicaudata</i> <i>Panthera tigris</i>
VU	<i>Aonyx cinereus</i> <i>Bos gaurus</i> <i>Lutrogale perspicillata</i> <i>Melursus ursinus</i> <i>Prionailurus rubiginosus</i> <i>Rusa unicolor</i> <i>Tetracerus quadricornis</i>
NT	<i>Antilope cervicapra</i> <i>Hyaena hyaena</i> <i>Panthera pardus</i> <i>Semnopithecus priam</i>

source: IUCN (<http://www.iucnredlist.org/>)



source: IUCN (<http://www.iucnredlist.org/>)

Figure 3.3.3-3 Tiger habitat in Telangana State

6) Tribes

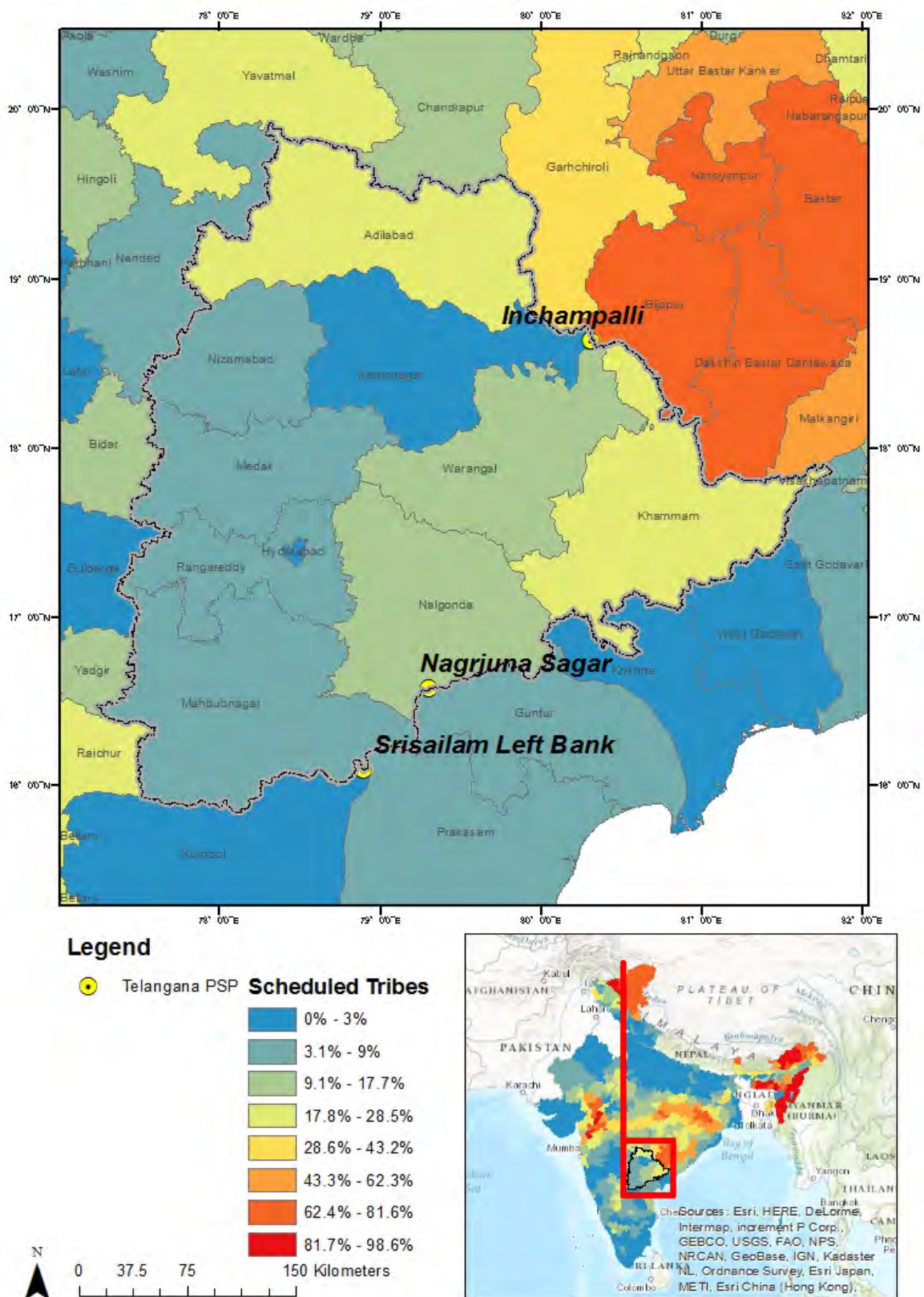
According to Census 2011 (<http://www.censusindia.gov.in/>), 3,286,928 peoples (9.34%) are scheduled Tribe. Following 13 areas are designated as Scheduled Area in Telangana State. The districts the tribal rate is higher are Khammam District (27.4%), Adilabad (18.1%) and Warangal (15.1%). 13 areas are designated as Scheduled Areas as follows.

Table 3.3.3-3 Scheduled Areas in Telangana State

(1)	Balmor, Kondnagol, Banal, Bilakas, dharawaram, Appaipali, Rasul Chernvu, Pulechelma, Marlapaya, Burj Gundal, Agarla Penta, Pullaipalli, Dukkan Penta, Bikit Penta, Karkar Penta, Boramachernvu, Yemlapaya, Irlapenta, Mudardi Penta, Terkaldari, Vakaramamidi Penta, Medimankal, Pandibore, Sangrigundal, Lingabore, Rampur, Appapur, Malapur, Jalal Penta, Piman Penta, Railet, Vetollapalli, Patur Bayal, Bhavi Penta, Naradi Penta, Tapasi Penta, Chandragupta, Ullukatrevu, Timmareddipalli, Sarlapalli, Tatigundal, Elpamaehena, Koman Penta, Kollam Penta, Mananur, Macharam, Malhamamdi, Venketeshwarla Bhavi, Amrabad, Tirmalapur, Upnootola, Madhavanpalli, Jangamreddi Palli, Pedra, Venkeshwaram, Chitlamkunta, Lachmapur, Udmela, Mared, Ippalpalli, Maddimadag, Akkaram, Ainol, siddapur, Bamanpalli, Ganpura and Manewarpalli Villages of Achempeth Taluq of Mahbubnagar district.
(2)	Malai Borgava, Ankapur, Jamul Dhari, Lokari, Vanket, Tantoli, Sitagondi, Burnoor, Navgaon, Pipal Dari, Pardi Buzurg, Yapalguda, Chinchughat, Vankoli, Kanpa, Avasoda Burki, Malkapur, Jaree, Palsi Buzurg, Arli Khurd, Nandgaon, Vaghapur, Palsikurd, Lingee, Kaphar Deni, Ratnapur, Kosai, Umari, Madanapur, Ambugaon, Ruyadee, Sakanapur, Daigaon, Kaslapur, Dorlee, Sahaij, Sangvee, Khogdoor, Kobai, Ponala, Chaprala, Mangrol, Kopa Argune, Soankhas, Khidki, Khasalakurd, Khasalabuzurg, Jamni, Borgaon, Sayedpur, Khara, Lohara, Marigaon, chichdari, Khanapur, Kandala, Tipa, Hati Ghoti, Karond Kurd, Karoni Buzurg, Singapur, Buranpur, Nagrala, Bodad, ChandPELLI, Peetgain, Yekori, Sadarpur, Varoor, Rohar, Takli and Ramkham villages of Adilabad taluq of Adilabad district.
(3)	Ambari, Bodri, Chikli, Kamtala, Ghoti, Mandw, Maregaon, Malborgaon, Patoda, Dahigaon, Domandhari, Darsangi, Digri, Sindgi, Kanakwari, Kopra, Malakwadi, Nispur, Yenda, Pipalgaon, Bulja, Varoli, Anji, Bhimpur Sirmeti, Karla, Kothari, Gokunda, Gogarwudi, Malkapur, Dhonora, Rampur, Patri, Porodhi, Boath, Darsangi, Norgaon, Unrsi, Godi, Sauarkher, Naikwadi, Sarkani, Wajhera, Mardap, Anjenkher, Gondwarsa, Pipalsendha, Jurur, Minki, Tulsi, Machauder Pardhi, Murli, Takri, Parsa, Warsa, Umra, Ashta, Hingni, Timapur, Wajra, Wanola, Patsonda, Dhanora, Sakur and Digri villages of Kinwat taluk of Adilabad district.
(4)	Hatnur, Wakri, Pardhi, Kartanada, Serlapalli, Neradi-konda, Daligaon, Kuntala, Venkatapur, Hasanpur, Surdapur, Polmamda, Balhanpur, Dharampuri, Gokonda, Bhotai, Korsekal, Patnapur, Tejapur, Guruj, Khahdiguda, Rajurwadi, Ispur, Ghanpur, Jaterla, Khantegaon, Sauri, Ichora, Mutnur, Gudi Hatnur, Talamedee, Gerjam, Chincholi, Sichelma, Mankapur, Narsapur, Harkapur, Dhampur, Nigni, Ajhar Wajhar, Chintalbori, Chintakarvia, Rampur, Gangapur and Gayatpalli villages of Boath taluk of Adilabad district.
(5)	All villages of Utnur taluq of Adilabad district. The Scheduled Areas in the State of Andhra Pradesh were originally specified by the Scheduled Areas (Part A States) Order, 1950 (C.O.No.9) dated 23.1.1950 and the Scheduled Areas (Part B States) Order, 1950 (C.O.No.26) dated 7.12.1950 and have been modified vide the Madras Scheduled Areas (Cesser) Order 1951 (C.O. 50) and the Andhra Scheduled Areas (Cesser) Order, 1955 (C.O.30)
(6)	Rajampet, Gunjala, Indhani, Samela, Tejapur, Kannargaon, Kantaguda, Shankepalli, Jamuldhari, Gundi, chorpalli, saleguda, Wadiguda, Savati, Dhaba, chopanguda, Nimgaon, Khirdi, Metapipri, Sakra, Sangi, Devurpalli, Khotara-Ringanghat, Nishani, Kota Parandoli, Mesapur, Goigaon, Dhanora, Pardha, Surdapur, Kerineri Murkilonki, Devapur, Chinta Karra, Iheri, Ara, Dasnapur, kapri, Belgaon, Sirasgaon, Moar, Wadam, Dhamriguda, Dallanpur, Chalwardi, Ihoreghat, Balijhari, Sakamgundi, Ara, Uppal Naugaon, Anksorpur, Chirakunta, Illipita Dorli, Mandrumera, Dantanpalli, Deodurg, Tunpalli, Dhagleshwar, Padibanda, Tamrin, Malangundi, Kandan Moar, Geonena, Kuteda, Tilani, Kanepelli, Bordoum Telundi, Maugi Lodiguda, Moinda-gudipet, Chinnedari, Koitelundi, Madura, Devaiguda, Areguda, Gardepalli, Takepalli,

- Choutepalli, Rane Kannepalli, Sungapur, Rala Samkepalli, Chopri, Doda Arjuni, Serwai, Rapalli, Tekamandwa and Meta Arjuni villages of Asaifabad taluq of Adilabad district.
- (7) Gudam, Kasipet, Dandepalli, Chelampeta, Rajampet, Mutiempet, Venkatapur, Rali, Kauwal, Tarapet, devapur, Gathapalli, Rotepalli, mandamari, dharmaraopet Venkatapur, Chintaguda and Mutiempalli villages of Lakshetipet taluq of Adilabad district.
- (8) Bendwi, Chincholi, Goigaon, Hirapur, Sakri, Balapur, Manoli, Antargaon, Wirur, Dongargaon, Timbervai, Sersi, Badora, Vmarjeeri, Lakarkot, Ergaon, Kirdi, Sondo, Devara, Khorpana, Kanargaon, chenai, Kairgaon, samalhira, Dhanoli, Marnagondi, Yellapur, katalbori, Isapur, Devti, Panderwani, Wansari, Perda, Wargaon Nokari, Mirapur, Pardhi, Kutoda, Parsewara, Mangalhra, Karki, Nokari, Manoli, Sonapur, Inapur, Mangi, Uparwai, Tutta, Lakmapur, Kirdi, Injapur, Jamni, Hargaon, Chikli, Patan, Kosundi, Kotara and sonorli villages of Rajura taluq of Adilabad district.
- (9) Ralapet, Kistampet, Takalapalli, Chakalpalli, Anaram, Bhepalli, Korsni Isgaon, Chintaguda, Ankora, Usurampalli, Arpalli, Bophalpatnam, Balasaga, Pardhi, Tumrihati, Chintalmanopalli, chintam, Gullatalodi, Damda, Dhorpalli, Kanki Garlapet, Gudlabori, Gurmpet, Lomveli, Mogurdagar, Wirdandi and Chilpurdubor villages of Sirpur taluq of Adilabad district.
- (10) Kannaiguda, Ankannaguda, Raghavpatnam, Medarmiola, koetla, Parsa Nagaram, Muthapur, Motlaguda, Venglapur, Yelpak, Kaneboenpalli, Medaram, Kondred, Chintaguda, Kondaparthi, Yelsethipalli, Allvammarihunpur, Rampur, Malkapalli, chettial, Bhupathipur, Gangaram, Kannaiguda, Rajannapet, Bhutaram, Akkela, Sirvapuri, gangaram Bhupathipur, Pumbapur, Rampur, Ankampalli, Kamaram, Kamsettigudam, Ashnaguda, Yellapur, Allaguda, Narsapur, Puschapur, Bhattupalli, Lavnal, Vadduguda, Kothur, Pegdapalli, Srvapur, Bhussapur, chelvai, Rangapur Govindraopet, Ballapali, dhumpallaguda, Kelapalli, Lakhanavaram, Pasra, Gonepalli, Padgapur Govindraopet, Ballapali, Dhumpallaguda, Kelapalli, Lakhanavaram, Pasra, Gonepalli, Padgapur, Narlapur, Kalvapalli, Uratam, Kondia, Maliat, Aclapur, Dodla, Kamaram, Tadvai, Boodiguda, Bannaji, Bandam, Selpak, Kantalpalli, Sarvai, Gangaguda, Tupalkalguda, Akulvari, Ghanpur, Shahpalli, Gagpelli, Chinna-beonnpli, Venkatapur, Narsapur, Anvaram, Lingal, Ballepalli, Bandal and Thunmapur villages of Mulug taluq of Warrangal district.
- (11) Vebelli, Polara, Bakkachintaphad, Ganjad, Thirmalguda, Gopalpur, Khistapur, Tatinari Venpalli, Pattal Bhoopati, Chandapur, Battalpalli, Advarampet, Satiahnagar, Dutla, Mothwada, Mangalwarpet, Karlai, Arkalkunta, Kodsapet, Gunderpalli, Masami, Battavartigudem, Mamidigudam, Pangonda, Roturai, Satreddipalli, Konapur, Kondapuram, Pogulapalli, Govindapuram, Makadapalli, Peddalapalli, Yerravaram, Kundapalli neelampalli Daravarinampalli, Karnegund, Mahadevagudem, Marrigudem, Jangalpalli, Bavarguda, Oarbak, Gangaramam, Mucherla Amaroncha, Kamaraam, Chintagudem, Nilavanacha, Kangargidda, Madagudem, Dalurpet, Kothagudem, Kotapalli, Goarur, Radhiapur, Gazalgudem, Rajvepalli and bollypalli villages of Narsampet taluk of Warrangal district.
- (12) All the villages of Yellandu taluq of Warrangal district (excluding the Yellandu, Singareni and Sirpur villages and the town of Kothaguda)
- (13) (i) All the villages of Palocha taluq of Warrangal district excluding Palondha, Borgampad, Ashwaraopet, Dammamet, Kuknur and Nelipak villages and (ii) Samasthan of Paloncha
1. Inserted by the Madras Scheduled Areas (Cesser) Order, 1951
 2. Inserted by the Andhra Scheduled Areas (Cesser) Order, 1955

source: The Ministry of Tribal Affairs (<http://tribal.nic.in>)



source: Census 2011 (<http://www.censusindia.gov.in/>)

Figure 3.3.3-4 Scheduled Tribes in Telangana State

7) Security

In terms of the MOFA's "Overseas Travel Safety Information", Telangana state is Level 1 (Exercise caution) and Level 2 (Avoid Non-essential travel).

(2) Relevant authorities

Relevant Authorities in Telangana State is as follows.

Table 3.3.3-4 Relevant Authorities in Telangana State

Name	Address	Role
Environment, Forests, Science and Technology Department	Telangana Secretariat Tankbund, Basheer Bagh, Near NTR Gardens, Telangana, Hyderabad, Telangana 500022	Environment Clearance
The Telangana State Pollution Control Board (TSPCB)	Paryavaran Bhavan, A-3, Industrial Estate, Sanathnagar, Hyderabad – 500 018	Pollution, Environmental Clarence
Telangana Forest Department	Aranya Bhavan, Saifabad, Hyderabad - 500004	Forest Clearance
Irrigation & CAD Department	Jalasoudha Building, Errum Manzil, Jalasoudha, HYDERABAD-500082	Water resource
Minorities Welfare Department	Telangana Secretariat Tankbund, Basheer Bagh, Near NTR Gardens, Telangana, Hyderabad, Telangana 500022	Minorities
Department of Rural Development	STREE NIDHI 5-10-192, 5th Floor, Hermitage Office Complex, Huda Building, Hill Fort Road, Nampally, Hyderabad-500004	Rural Development

(3) Environmental and Social issues

According to the pollution assessment is based on the bio-chemical oxygen demand (BOD) by Central Pollution Control Board (CPCB, 2014-15), 7 out of 302 polluted river stretches in India locate in Telangana State, which is the worst 18th state in India. The rivers are Godavari, Krishna, Manjeera, Musi, Nakkavagu, Sabari and Maner.

Forest cover in Telangana state is 26,446 km² (23.01 %) including Scrub. But it is still decreasing 251 km² from 2008 to 2012 (ANNUAL ADMINISTRATION REPORTS FOR THE YEAR - 2013-14, GOVERNMENT OF TELANGANA FOREST DEPARTMENT).

3.3.4 Karnataka State (KN)

(1) Environment

1) Population

As per details from Census 2011 (<http://www.censusindia.gov.in/>), Karnataka has population of

6.11 Crores, an increase from figure of 5.29 Crore in 2001 census. Total population of Karnataka as per 2011 census is 61,095,297. The total population growth in this decade was 15.60 percent while in previous decade it was 17.25 percent. The population of Karnataka forms 5.05 percent of India in 2011. In 2001, the figure was 5.14 percent.

2) Greenhouse Gas emission and emission source

According to T.V. Ramachandra (2012)⁷ CH₄ emission of Karnataka is 745.8 Gg (11th rank and 4.4% of India), CO emission is 1,523.9 Gg (6th rank and 6.8% of India), and CO₂ emission is 54,336.5 Gg (8th rank and 5.6% in India). Number of registered motor vehicles is 3,976,584 (7th rank and 5.5% of India). Cement production is 7131.7kt (8th rank, 5.5% of India) and Steel production is 2819.4 kt (8th rank and 6.2% of India).

3) Critical Polluted Areas

Two areas are identified as Critical Polluted Areas in Karnataka State. The Comprehensive Environmental Pollution Index (CEPI) in 2013 is 45.27 to 67.62 which is decreasing from 2009.

Table 3.3.4-1 Comprehensive Environmental Pollution Index (CEPI) in Karnataka State

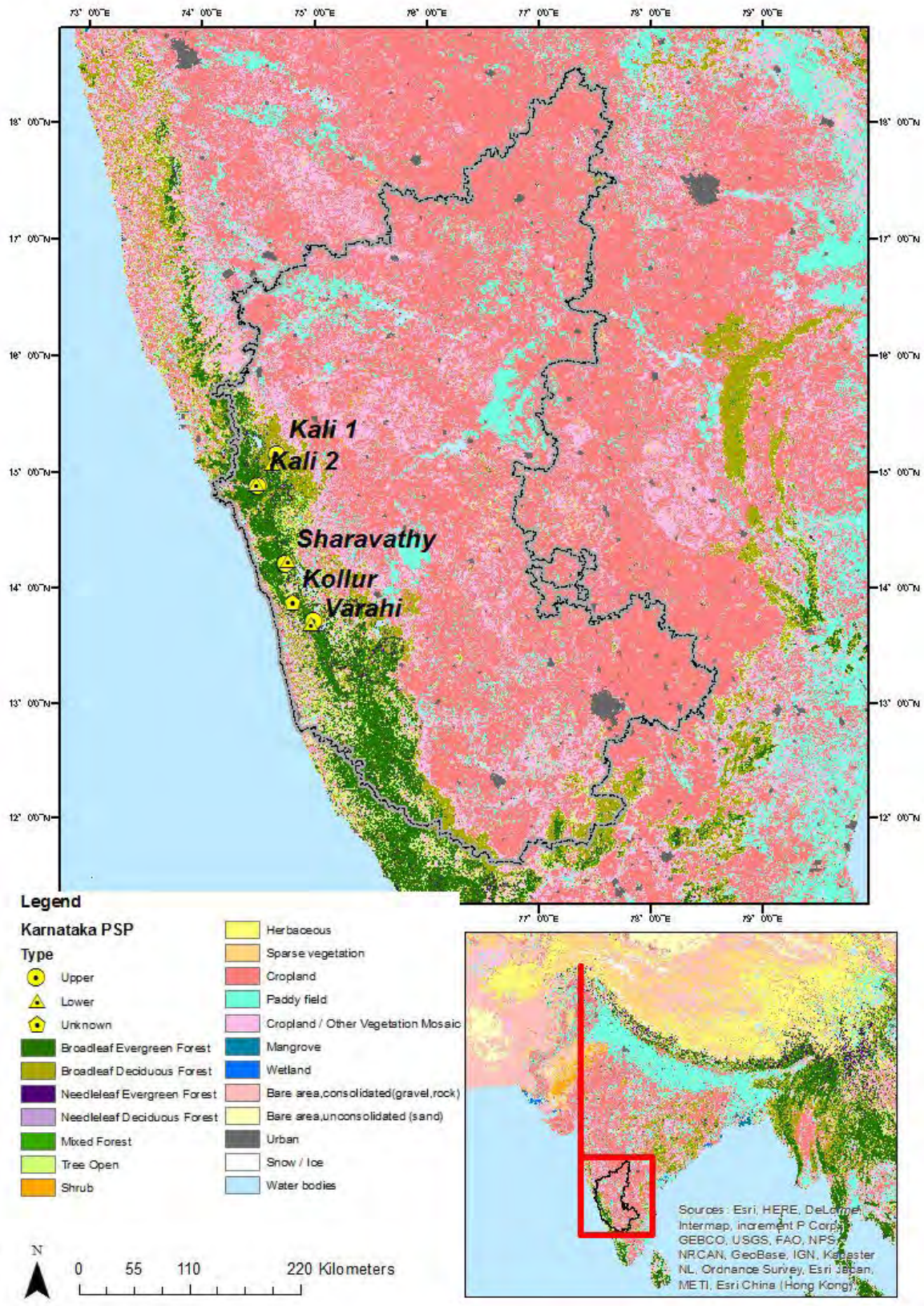
Industrial Cluster/Area	Potential Impact Zones	CEPI SCORE			Status
		2009	2011	2013	
Bhadravathi	KSSIDC Industrial Area Mysore Paper Mill & VISL Township Complex	72.33	62.64	45.27	An -W Ln
	Mangalore Baikampady Industrial Area	73.68	73.86	67.62	As-Ws-Ln

note: Ac = Air critical ; As = Air severe ; An = Air normal
 Wc = Water critical ; Ws = Water severe ; Wn = Water normal
 Lc = Land critical ; Ls = Land severe ; Ln = Land normal
 source: The Central Pollution Control Board (CPCB)

4) Land use

Base on the **GLCNMO** version 3 (2013) 80.9 % the land cover of Karnataka State is Agricultural land, 16.7 % is Forest, and 1.1% is Urban area. Forest areas are remaining along Western Ghats.

⁷ Decentralised carbon footprint analysis for optimal climate change mitigation strategies in India (2012, T.V. Ramachandra)



source: GLCNMO version 3 (2013) (<https://globalmaps.github.io/glcnm.html>)

Figure 3.3.4-1 Land Use in Karnataka State

5) Forest

According to State of Forest Report 2015 (Forest Survey of India) the forest cover in Karnataka is 36,421 km² (18.99 %) which includes Very Dense Forest 1,781 km², Moderately Dense Forest 20,063 km² and Open Forest 14,577 km². The forest is 289 km² increasing by 2013.

6) Protected area

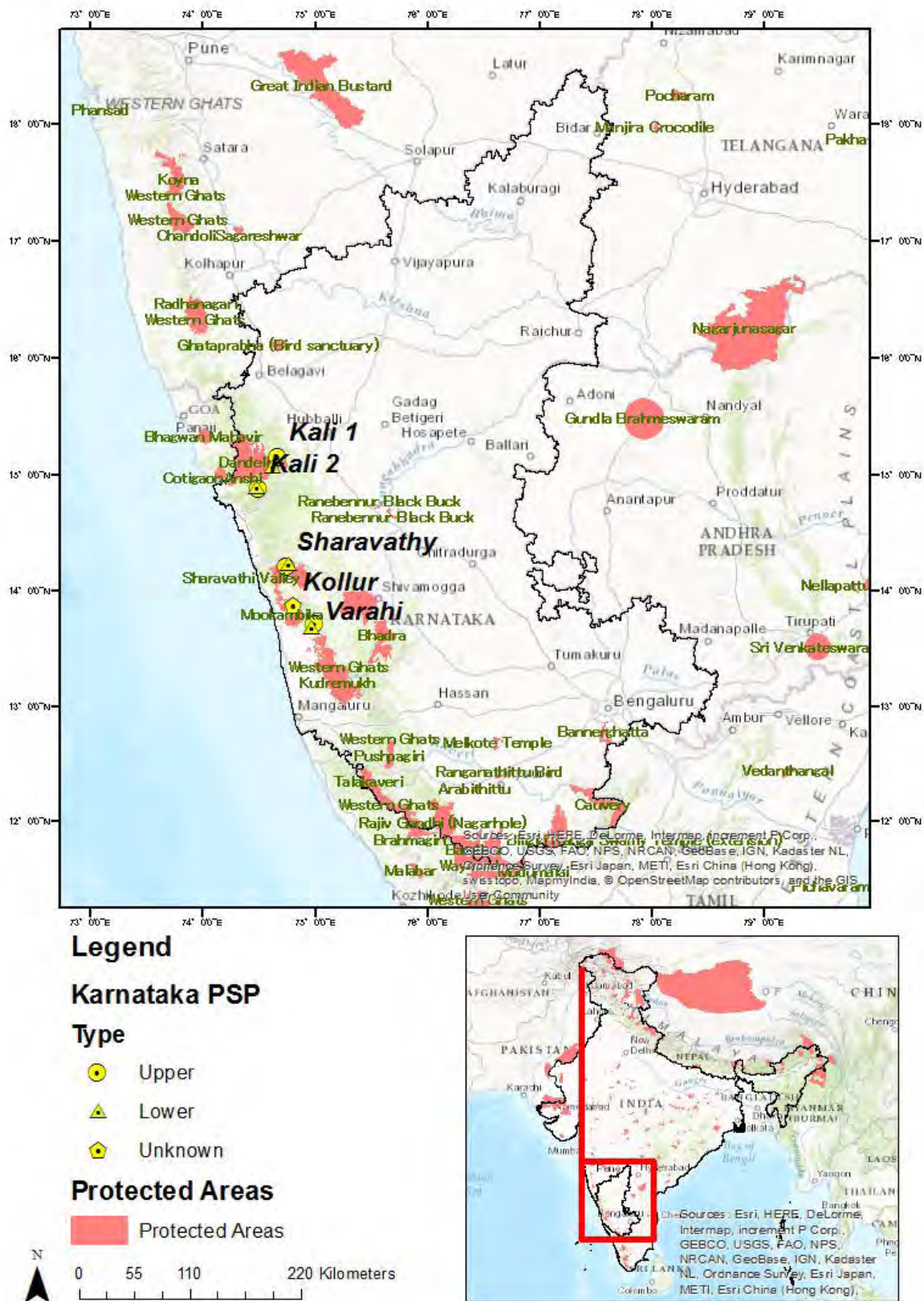
There are 47 protected areas including 5 National Park, 27 Wildlife reserves, 1 Community Reserves, 1 Elephant Reserve, 5 Tiger Reserves and 8 Conservation Reserves in Karnataka State. The exact boundaries of the protected areas are not clear.

Table 3.3.4-2 Protected Areas in Karnataka State

Type	Name	Year	Area (km ²)	District
COMMUNITY RESERVES	Kokkare Bellur	2007	3.12	Mandya
Conservation Reserves	Afghanashini		299.52	Uttara Kannanda
	Bedthi		57.30	Uttara Kannanda
	Bankapur Peacock		0.56	Haveri
	Basur Amruth Mahal Kaval		7.36	Chikmagalur
	Hornbill Con Res		52.50	Uttara Kannanda
	Jayamangali Blackbuck		3.23	Tumkur
	Shalmale Riparian Bio-System		4.89	N.A
	Thungabhadra Otter		25.00	Bellary & Koppal
Elephant Reserves	21. Mysore ER	25.11.02		
National Park	Anshi NP	1987	417.34	Uttara Kannada
	Bandipur NP	1974	874.20	Mysore & Chamarajanagar
	Bannerghatta NP	1974	260.51	Bangalore
	Kudremukh NP	1987	600.32	Dakshin Kannada, Udipi & Chikmagalur
	Nagarahole (Rajiv Gandhi) NP	1988	643.39	Kodagu & Mysore
Tiger Reserves	Bandipur		1,456.30	
	Bhadra		1,064.29	
	Dandeli-Anshi		1,097.51	
	Nagarahole		1,205.76	
	Biligiri Ranganatha Temple		574.82	
Wildlife Sanctuaries	Adichunchunagiri Peacock WLS	1981	0.84	Mandya
	Arabithittu WLS	1985	13.50	Mysore
	Attiveri Bird WLS	1994	2.22	Uttara Kannada
	Bhadra WLS	1974	492.46	Chikmagalur & Shimoga
	Bhingad WLS	2010	190.42	Belgaum
	Biligiri Rangaswamy Temple (B.R.T.) WLS	1987	539.52	Chamarajanagar
	Brahmagiri WLS	1974	181.29	Kodagu
	Cauvery WLS	1987	1,027.53	Mysore, Bangalore & Mandya

Chincholi WLS	2012	134.88	Gulbarga & Yadgir
Dandeli WLS	1987	886.41	Uttara Kannada
Daroji Bear WLS	1992	82.72	Bellary
Ghataprabha Bird WLS	1974	29.79	Belgaum
Gudavi Bird WLS	1989	0.73	Shimoga
Gudekote Sloth Bear WLS	2013	38.48	Bellary
Malai Mahadeshwara WLS	2013	906.19	Chamarajanagar
Melkote Temple WLS	1974	49.82	Mandya
Mookambika WLS	1974	370.37	Udipi
Nugu WLS	1974	30.32	Mysore
Pushpagiri WLS	1987	102.96	Kodagu & Dakshina Kannada
Ranebennur Black Buck WLS	1974	119.00	Dharwad
Ranganathittu Bird WLS	1940	0.67	Mysore
Ramadevara Betta Vulture WLS	2012	3.46	Ramanagara
Rangayyanadurga Four-horned antelope	2011	77.24	Davangere
Sharavathi Valley WLS	1974	431.23	Shimoga
Shettihalli WLS	1974	395.60	Shimoga
Someshwara WLS	1974	314.25	Udipi
Talakaveri WLS	1987	105.01	Kodagu

source: ENVIS Centre on Wildlife & Protected Areas (<http://www.wiienviis.nic.in>)



source: Protected Planet (<https://www.protectedplanet.net/>)

Figure 3.3.4-2 Protected Areas in Karnataka State

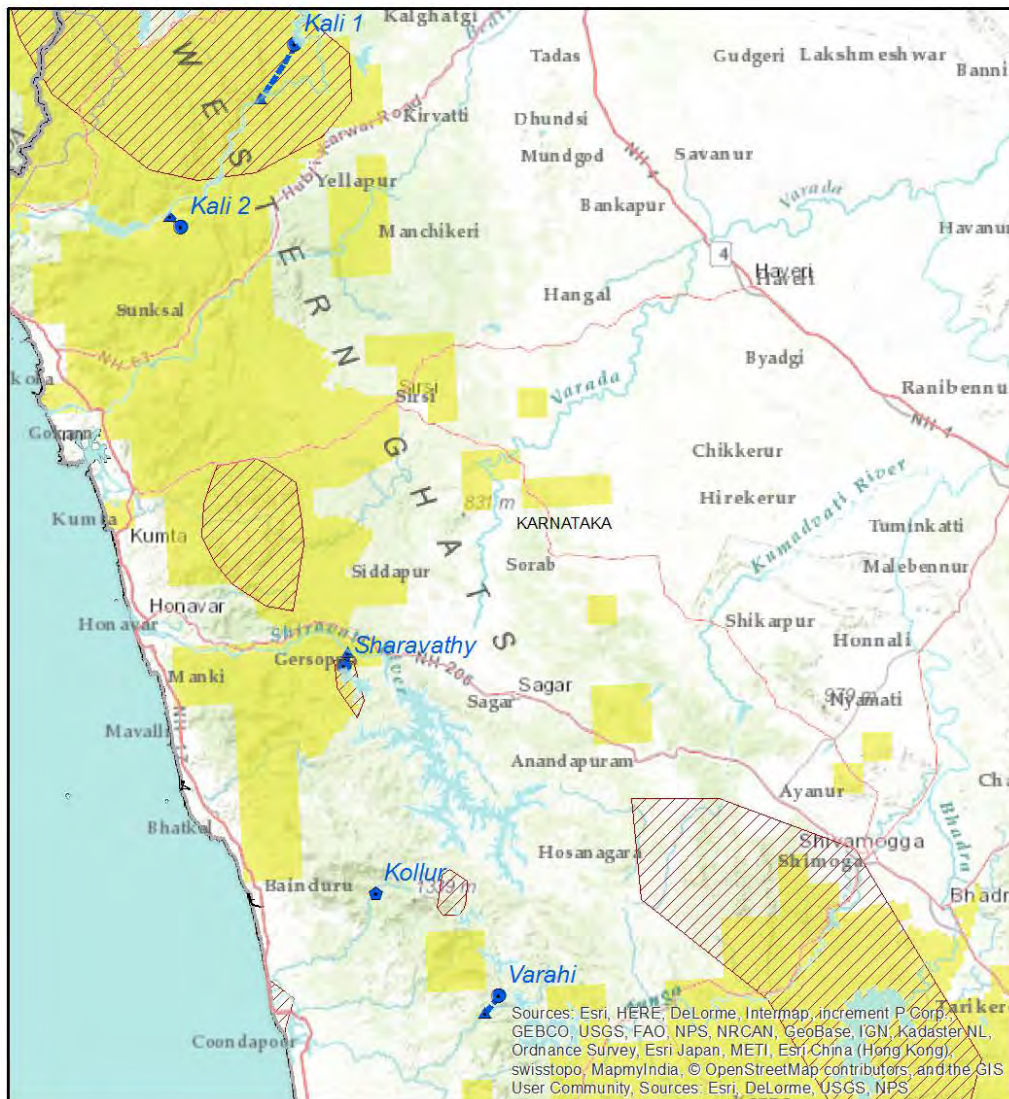
7) Protected species

IUCN red list mammals which has distribution areas in Karnataka State are 29 species including Critically endangered (CR) 1, Endangered (EN) 8, Vulnerable (VU) 14, and Near threatened (NT) 6. Distribution areas of *Elephas maximus* (EN) and *Panthera tigris* (EN) are shown in the following figure.

Table 3.3.4-3 IUCN red list species which has known habitat in Karnataka State

Category	Scientific name
CR	<i>Viverra civettina</i>
EN	<i>Cuon alpinus</i> <i>Elephas maximus</i> <i>Hipposideros hypophyllus</i> <i>Macaca silenus</i> <i>Manis crassicaudata</i> <i>Mus famulus</i> <i>Panthera tigris</i> <i>Vandeleuria nilagirica</i>
VU	<i>Aonyx cinereus</i> <i>Bos gaurus</i> <i>Funambulus sublineatus</i> <i>Lutrogale perspicillata</i> <i>Martes gwatkinsii</i> <i>Melursus ursinus</i> <i>Platacanthomys lasiurus</i> <i>Prionailurus rubiginosus</i> <i>Rattus satarae</i> <i>Rusa unicolor</i> <i>Semnopithecus hypoleucos</i> <i>Suncus montanus</i> <i>Tetracerus quadricornis</i> <i>Trachypithecus johnii</i>
NT	<i>Antilope cervicapra</i> <i>Hyaena hyaena</i> <i>Lutra lutra</i> <i>Panthera pardus</i> <i>Petinomys fuscicapillus</i> <i>Semnopithecus priam</i>

source: IUCN (<http://www.iucnredlist.org/>)

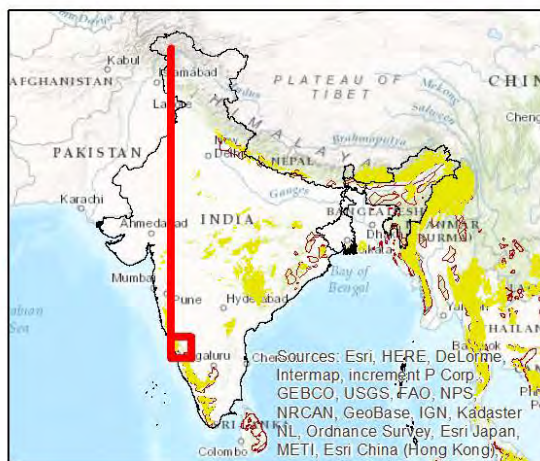
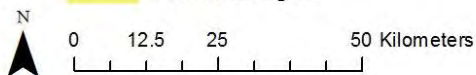


Legend

Karnataka PSP

Type

- Upper
- ▲ Lower
- ◆ Unknown
- ▨ Elephas maximus
- Panthera tigris



source: IUCN (<http://www.iucnredlist.org/>)

Figure 3.3.4-3 Elephant and Tiger habitat in Karnataka State

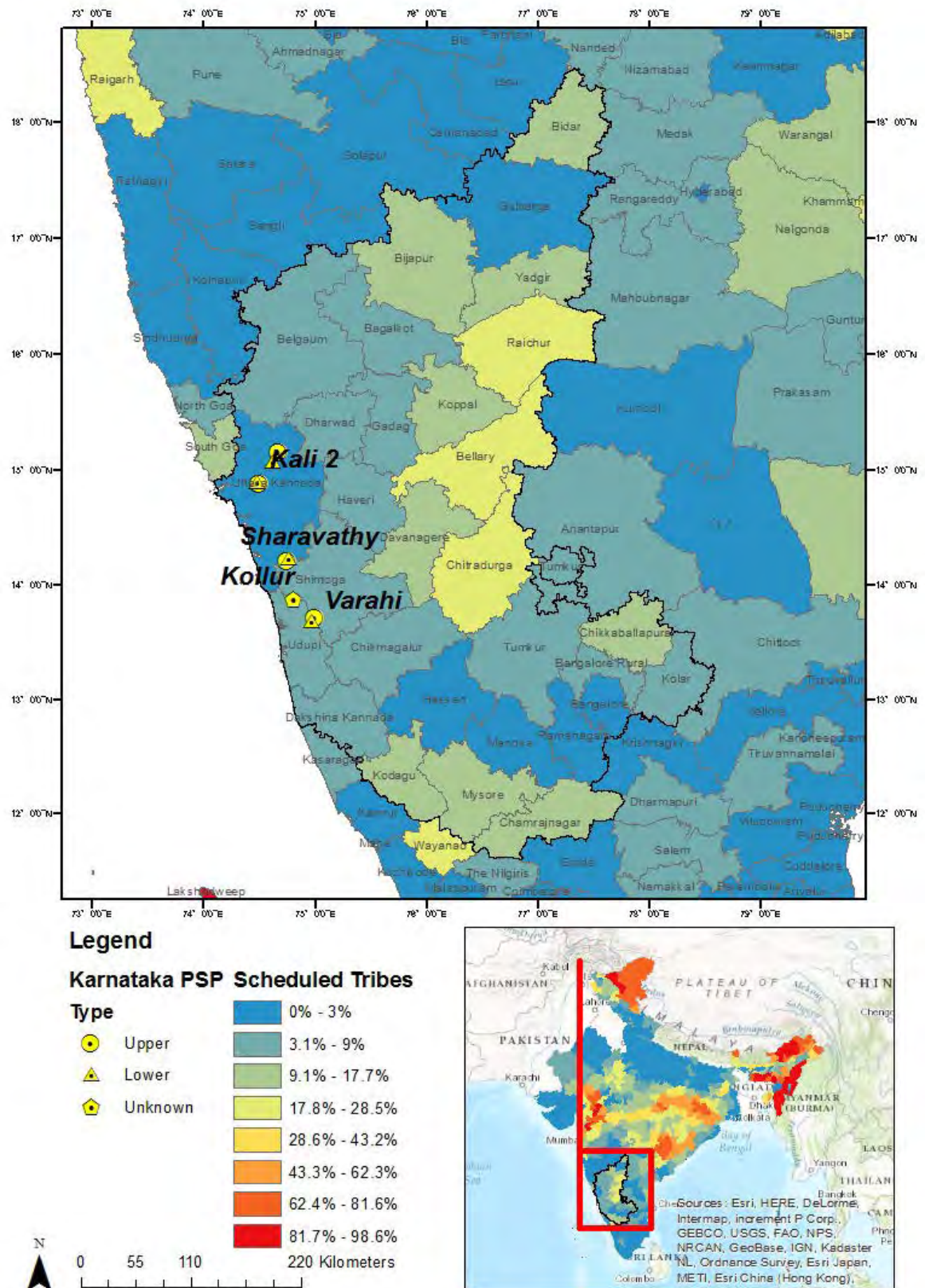
8) Tribes

Based on the Scheduled Castes and Scheduled Tribes Orders (Amendment) Act (1976) 43 Scheduled Tribes are listed in Karnataka. According to Census 2011 (<http://www.censusindia.gov.in/>), 4,209,673 peoples (7.14%) are scheduled Tribe. The districts which tribe rate are relatively higher are Raichur 19.03%, Bellary 18.41%, and Chitradurga 18.23%. There are 50 Scheduled Areas in Karnataka State.

Table 3.3.4-4 Scheduled Areas in Karnataka State

1. Adiyani 2. Barda 3. Bavacha, Bamcha 4. Bhil, Bhil Garasia, sholi Bhil, Dungri Bhil, Dungri Garasia, Mewasi Bhil, Rawal Bhil, Tadvi Bhil, Bhagalia, Bhilala, Pawra, Vasava, Vasave 5. Chenchu, Chenchwar 6. Chodhara 7. Dubla, Talavia, Halpati 8. Gamit, Gamta, Gaviti, Mavchi, Padvi, Valvi 9. Goud, Naikpod, Rajgond 10. Gowdalu 11. Hakkipikki 12. Hasalaru 13. Irular 14. Iruliga 15. Jenu Kuruba 16. Kadu Kuruba 17. Kammara (in South Kanara district and Kollegal taluk of Mysore district) 18. Kanivan, Kanyan (in Kollegal taluk of Mysore district) 19. Kathodi, Katkari, Dhor Kathodi, Dhor Katkari, Son Kathodi, Son Katkari 20. Kattunayakan 21. Kokna, Kokni, Kukna 22. Koli Dhor, Tokre Koli, Kolcha, Kolgha 23. Konda Kapus 24. Koraga 25. Kota 26. Koya, Bhine Koya, Rajkoya 27. Kudiyam Melekudi 28. Kuruba (in Coorg district) 29. Kurumans 30. Maha Malasar 31. Malaikudi 32. Malasar 33. Malayekandi 34. Maleru 35. Maratha (in Coorg district) 36. Marati (in south Kanara district) 37. Meda 38. Naikda, Nayaka, Chollivala Nayaka, Kapadia Nayaka, Mota Nayaka, Nana Nayaka, Naik Nayak, Beda, Bedar, and Valmiki. 39. Palliyan 40. Paniyan 41. Pardhi, Advichincher, Phase Pardhi 42. Patelia 43. Rathawa 44. Sholaga 45. Soligaru 46. Toda 47. Varli 48. Vitolia, kotwalia, barodia 49. Yerava 50. Siddi (in Uttar Kannada district)

source: Ministry of Tribal Affairs



source: Census 2011 (<http://www.censusindia.gov.in/>)

Figure 3.3.4-4 Scheduled Tribes in Karnataka State

9) Security

In terms of the MOFA's "Overseas Travel Safety Information", Karnataka state is Level 1 (Exercise caution).

(2) Relevant authorities

Followings are the Relevant Authorities in Karnataka State.

Table 3.3.4-5 Relevant Authorities in Karnataka State

Name	Address	Role
Karnataka State Pollution Control Board (KSPCB)	Karnataka State Pollution Control Board "Parisara Bhavan", #49,4th & 5th Floor, Church Street, Bangalore-560001	Pollution
Department of Ecology & Environment (DEE)	Room No. 708, Gate 2, Multi Storied Building, Dr. Ambedkar Veedhi Bangalore - 560 001	Environment Clearance
Karnataka Forest Department	18th Cross, Malleswaram, Bengaluru	Forest Clearance, Wildlife Clearance
Regional Offices, Ministry of Environment and Forest, Climate Change	Regional Office (SZ), Kendriya Sadan, 4th Floor, E&F Wings, 17th Main Road, Koramangala II Block, Bangalore - 560034	Forest Clearance, Wildlife Clearance
Environment Management Policy Research Institute (EMPRI)	"Hasiru Bhavana", Doresanipalya Forest Campus Vinayakanagara Circle, J.P. Nagar 5th Phase Bangalore 560 078	Environment
Water Resources Department	Vikasa Soudha, Dr. B. R. Ambedkar Road Bangalore-560001	Water
Commissionerate of Social Welfare Department	5th Floor, MS Building Dr. Ambedkar Veedhi. Bangalore 560001	SC/ST
Rural Development and Panchayat Raj Department	3rd Gate, 3rd Floor MS Building Bangalore-560001	Rural Development

(3) Environmental and Social issues

According to the pollution assessment is based on the bio-chemical oxygen demand (BOD) by Central Pollution Control Board (CPCB, 2014-15), 15 out of 302 polluted river stretches in India locate in Karnataka State, which is the worst 6 state in India. The rivers are Arkavathi, Bhadra, Bhima, Cauvery, Ghatprabha, Kabini, Kagina, Kali, Krishna, Lakshmantirtha, Malprbha, Manjira, Shimsha, Tungabhadra, and Tungha.

State of Environment Report Karnataka 2011(Department of Forest, Ecology and Environment Government of Karnataka) points out various Environmental issues. Followings are a part of the issues.

1) Forest change and mining

A recent macro level environmental impact assessment (EIA) of Bellary conducted on the order of the Supreme Court found that between 2000 and 2011, 8.9 km² of forest area has been converted while mining impacted an area of 43.4 km², spreading significantly beyond lease boundaries. As per Karnataka Forest Department, 82 leases, covering a total extent of 6,776 ha exist in forest areas of Bellary, Sandur and Hospet. Mining is in progress in 66 mine leases while another 16 cases are under consideration. 9.9% of forest cover has already been lost due to existing mines here. A comparison of floral diversity shows that in Sandur's disturbed areas 168 species were found while undisturbed areas in the same region provided habitat for 186 species. In Hospet the contrast was even starker: 84 species were identified in disturbed areas against 106 in undisturbed areas.

2) Encroachment

The loss of forests due to encroachments has a long history. Even before the birth of the forest administration, there was a system of shifting cultivation practiced mainly by tribals. With a view to regulate the loss of forest cover, certain administrative measures were taken such as leases (one-year, periodic), clearance of forest strips around cultivated lands for crop protection from wild animals, grants for fruit cultivation, permits for coffee and cardamom cultivation etc. Many of them later became forest encroachments, either due to nonrenewal of leases or breach of conditions of the lease or conditions imposed by the Forest Conservation Act. Around 17,500 ha of forestland are encroached.

3) INTER-STATE WATER DISPUTES

Karnataka has reached a stage where it cannot significantly enhance the utilisation of rivers as inter-state water disputes are dragging developmental activities. Sharing of water from the Cauvery river among the riparian states has evolved into a long-standing contentious issue which by itself is indicative of the growing scarcity of water and the socio-economic and political ramifications of water shortages. The Cauvery Water Disputes Tribunal in its judgment in 2007 allocated a certain share of water to each party on the basis of 50% dependability and 270 TMC/a (7.7 billion m³/a) to Karnataka. This limits the further augmentation potential for the state.

Sharing of water of the Krishna river between Maharashtra, Karnataka and Andhra Pradesh has been a contentious issue for the last 43 years. In 2010, the Krishna Water Dispute Tribunal announced a watersharing formula valid until 2050. It allocated a total of 2,578 TMC/a (73.0 billion m³/a) to all three states of which Karnataka is entitled to 911 TMC/a (25.8 billion m³/a). The state is also permitted to stock additional water in the Almatti dam by raising its height by five metres to 524 metres.

3.3.5 Kerala State (KR)

(1) Environment

1) Population

As per details from Census 2011 (<http://www.censusindia.gov.in/>), Kerala has population of 3.34 Crores, an increase from figure of 3.18 Crore in 2001 census. Total population of Kerala as per 2011 census is 33,406,061. The total population growth in this decade was 4.91 percent while in previous decade it was 9.42 percent. The population of Kerala forms 2.76 percent of India in 2011. In 2001, the figure was 3.10 percent.

2) Greenhouse Gas emission and emission source

According to T.V. Ramachandra (2012)⁸ CH₄ emission of Kerala is 150.8 Gg (19th rank and 0.9% of India), CO emission is 610.8 Gg (13th rank and 2.7% of India), and CO₂ emission is 26,046.5 Gg (15th rank and 2.7% in India). Number of registered motor vehicles is 2,792,074 (11th rank and 3.8% of India). Cement production is 288.6 kt (18th rank, 0.2% of India) and Steel production is 679.7 kt (13th rank and 1.5% of India).

3) Critical Polluted Areas

One areas are identified as Critical Polluted Areas in Kerala State. The Comprehensive Environmental Pollution Index (CEPI) in 2013 is 57.94 which is decreasing from 2009.

Table 3.3.5-1 Comprehensive Environmental Pollution Index (CEPI) in Kerala State

Industrial Cluster/Area	Potential Impact Zones	CEPI SCORE			Status
		2009	2011	2013	
Greater Cochin	Eloor-Edayar Industrial Belt	75.08	57.39	57.94	An-Wn-Ln

note: Ac = Air critical ; As = Air severe ; An = Air normal

Wc = Water critical ; Ws = Water severe ; Wn = Water normal

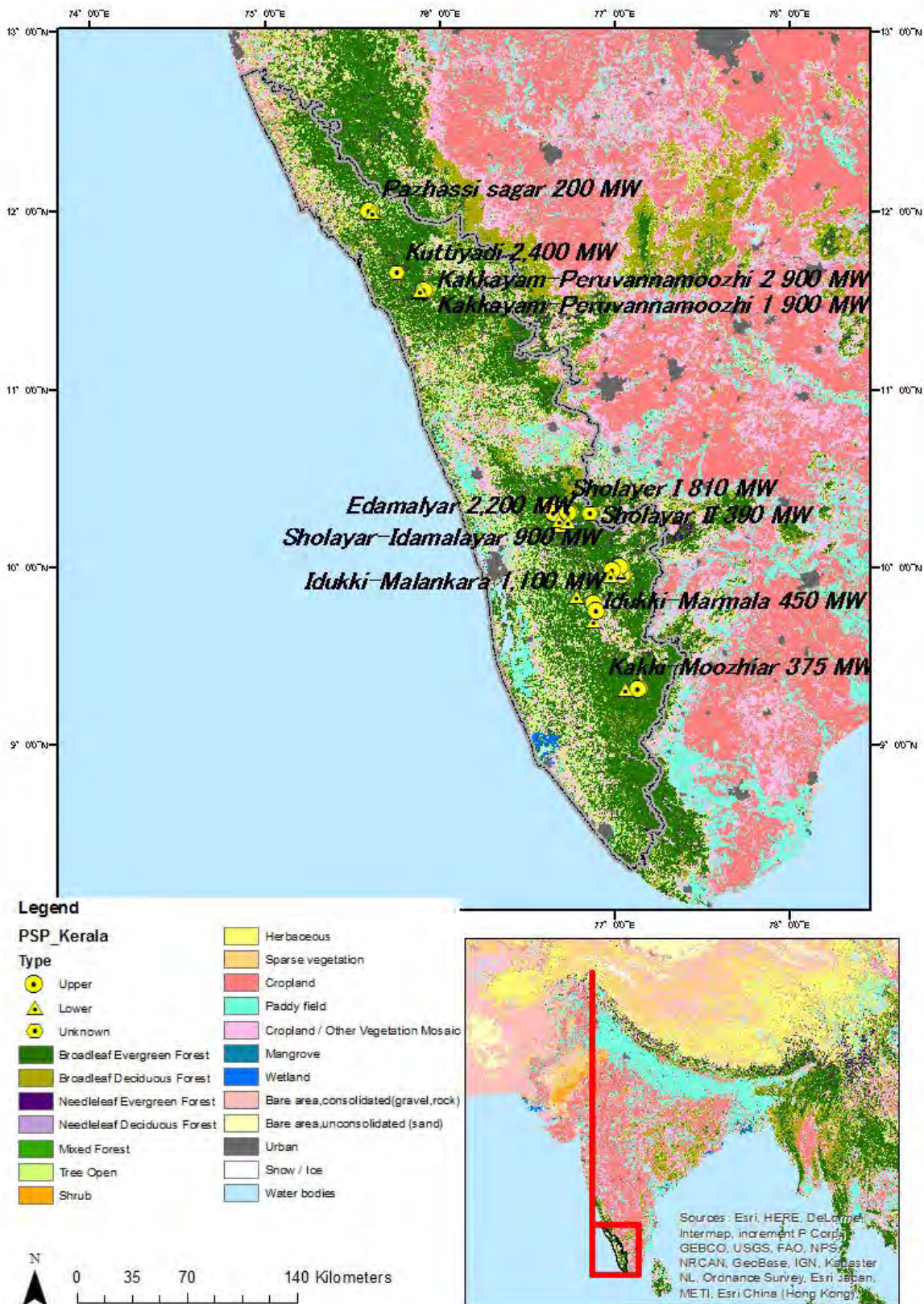
Lc = Land critical ; Ls = Land severe ; Ln = Land normal

source: The Central Pollution Control Board (CPCB) (<http://cpcb.nic.in/>)

4) Land use

Base on the **GLCNMO** version 3 (2013) 19.8 % the land cover of Karnataka State is Agricultural land, 76.5 % is Forest, and 1.5% is Urban area. Forests are well preserved along Western Ghats.

⁸ Decentralised carbon footprint analysis for opting climate change mitigation strategies in India (2012, T.V. Ramachandra)



source: GLCNMO version 3 (2013) (<https://globalmaps.github.io/glcnm.html>)

Figure 3.3.5-1 Land Use in Kerala State

5) Forest

According to State of Forest Report 2015 (Forest Survey of India) the forest cover in Kerala is 19,239 km² (49.50 %) which includes Very Dense Forest 1,523 km², Moderately Dense Forest 9,301 km² and Open Forest 8,415 km². The forest is 1317 km² increasing by 2013.

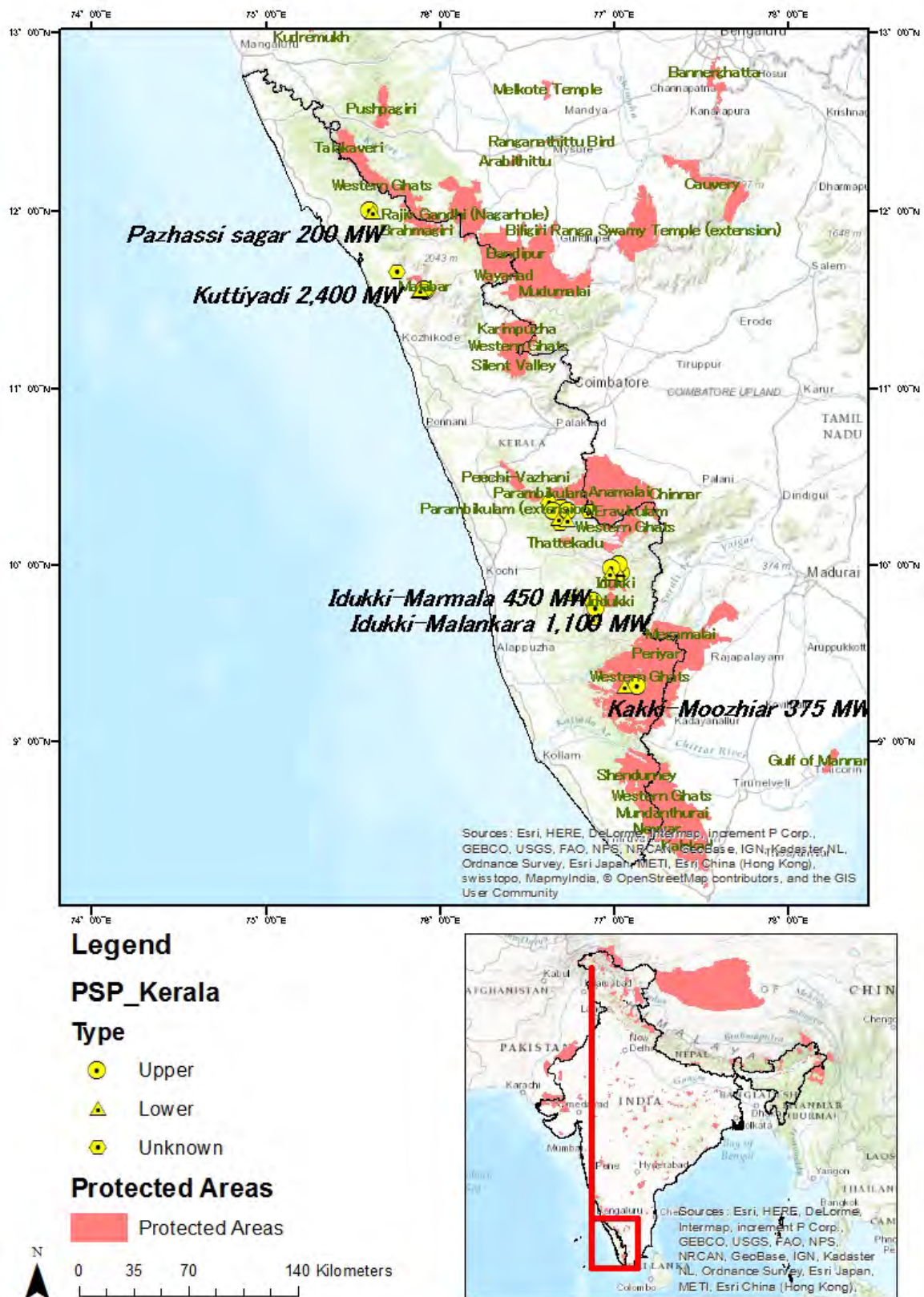
6) Protected area

There are 30 protected areas including 6 National Park, 1 Community Reserves, 4 Elephant Reserves, 2 Tiger Reserves, and 17 Wildlife reserves in Kerala State. The exact boundaries of the protected areas are not clear.

Table 3.3.5-2 Protected Areas in Kerala State

Type	Name	Year	Area (km ²)	District
COMMUNITY RESERVES	Kadalundi	2007	1.50	Malappuram
Elephant Reserves	22. Wayanad ER	2.4.02		
	25. Nilambur ER	2.4.02		
	28. Anamudi ER	2.4.02		
	29. Periyar ER	2.4.02		
National Park	Anamudi Shola NP	2003	7.50	Idukki
	Eravikulam NP	1978	97.00	Idukki
	Mathikettan Shola NP	2003	12.82	Idukki
	Pambadum Shola NP	2003	1.32	Idukki
	Periyar NP	1982	350.00	Idukki & Quilon
	Silent Valley NP	1984	89.52	Palakkad
Tiger Reserves	Periyar		925.00	
	Parambikulam		643.66	
Wildlife Sanctuaries	Aralam WLS	1984	55.00	Kannur
	Chimmony WLS	1984	85.00	Thrissur
	Chinnar WLS	1984	90.44	Idukki
	Chulannur Peafowl WLS	2007	3.42	Thrissur & Palakkad
	Idukki WLS	1976	70.00	Idukki
	Kottiyoor WLS	2011	30.38	Kannur
	Kurinjimala WLS	2006	32.00	Idukki
	Malabar WLS	2010	74.22	Kozhikode
	Mangalavanam Bird WLS	2004	0.03	Ernakulam
	Neyyar WLS	1958	128.00	Thiruvananthapuram
	Parambikulam WLS	1973	285.00	Palakkad
	Peechi-Vazhani WLS	1958	125.00	Thrissur
	Peppara WLS	1983	53.00	Thiruvananthapuram
	Periyar WLS	1950	427.00	Idukki
	Shendurney WLS	1984	100.32	Ouilon
	Thattekad Bird WLS	1983	25.00	Idukki
	Wayanad WLS	1973	344.44	Wayanad

source: ENVIS Centre on Wildlife & Protected Areas (<http://www.wiienvis.nic.in>)



source: Protected Planet (<https://www.protectedplanet.net/>)

Figure 3.3.5-2 Protected Areas in Kerala State

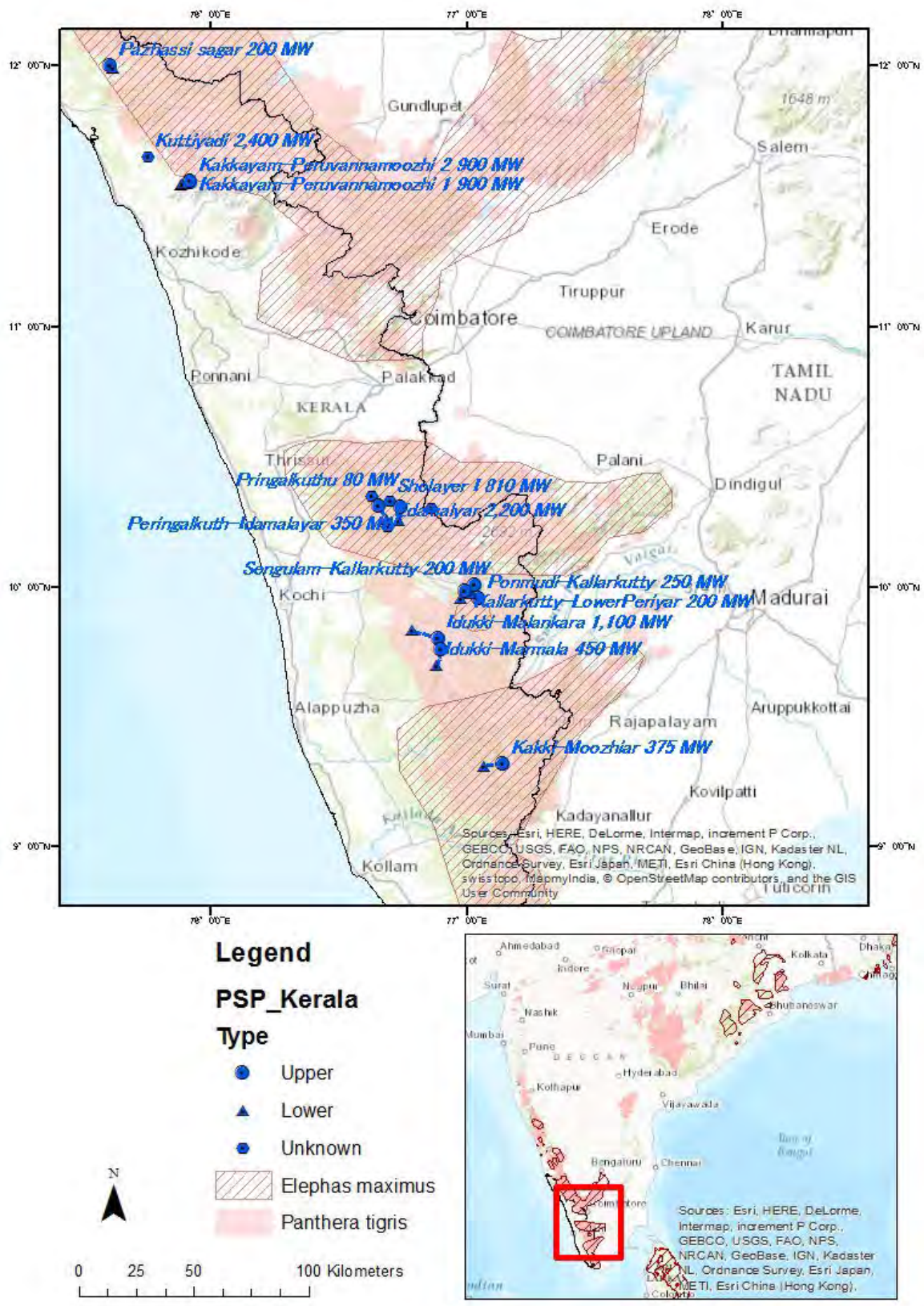
7) Protected species

IUCN red list mammals which has distribution areas in Kerala State are 36 species including Critically endangered (CR) 1, Endangered (EN) 13, Vulnerable (VU) 13, and Near threatened (NT) 6. Distribution areas of *Elephas maximus* (EN) and *Panthera tigris* (EN) are shown in the following figure.

Table 3.3.5-3 IUCN red list species which has known habitat in Kerala State

Category	Scientific name
CR	<i>Viverra civettina</i>
EN	<i>Cuon alpinus</i> <i>Elephas maximus</i> <i>Feroculus feroculus</i> <i>Latidens salimalii</i> <i>Macaca silenus</i> <i>Manis crassicaudata</i> <i>Mus famulus</i> <i>Nilgiritragus hylocrius</i> <i>Panthera tigris</i> <i>Prionailurus viverrinus</i> <i>Rattus ranjinae</i> <i>Suncus dayi</i> <i>Vandeleuria nilagirica</i>
VU	<i>Aonyx cinereus</i> <i>Bos gaurus</i> <i>Funambulus sublineatus</i> <i>Lutrogale perspicillata</i> <i>Martes gwatkinsii</i> <i>Melursus ursinus</i> <i>Platacanthomys lasiurus</i> <i>Prionailurus rubiginosus</i> <i>Rusa unicolor</i> <i>Semnopithecus hypoleucos</i> <i>Suncus montanus</i> <i>Tetracerus quadricornis</i> <i>Trachypithecus johnii</i>
NT	<i>Antilope cervicapra</i> <i>Lutra lutra</i> <i>Panthera pardus</i> <i>Petinomys fuscocapillus</i> <i>Ratufa macroura</i> <i>Semnopithecus priam</i>

source: IUCN (<http://www.iucnredlist.org/>)



source: IUCN (<http://www.iucnredlist.org/>)

Figure 3.3.5-3 Elephant and Tiger habitat in Kerala State

8) Tribes

Based on the Scheduled Castes and Scheduled Tribes Orders (Amendment) Act (1976) 43 Scheduled Tribes are listed in Kerala. According to Census 2011 (<http://www.censusindia.gov.in/>), 484,839 peoples (1.45%) are scheduled Tribe. The districts which tribe rate are relatively higher are Wayanad 18.53% and Idukki 5.03%.

9) Security

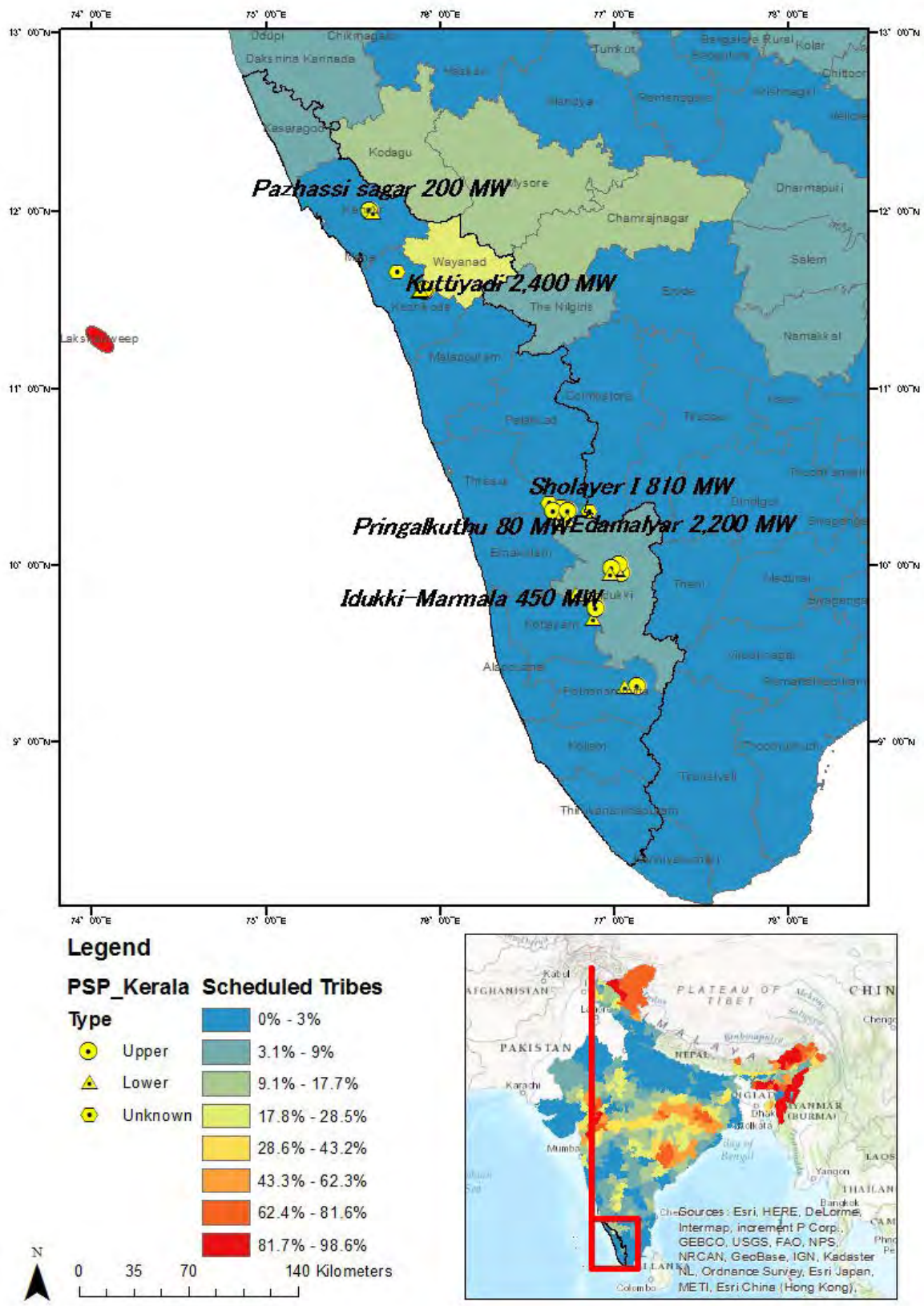
In terms of the MOFA's "Overseas Travel Safety Information", Kerala state is Level 1 (Exercise caution).

(2) Relevant authorities

Relevant authorities in Kerala State is as follows.

Table 3.3.5-4 Relevant Authorities in Kerala State

Name	Address	Role
Kerala State Pollution Control Board	Pattom P.O., Thiruvananthapuram - 695 004	Pollution
Kerala Forest and Wildlife Department	Parijatham Forest Complex, Palace Rd, Chembukkav, Thrissur, Kerala 680020	Forest Clearance, Wildlife Clearance
Regional Offices, Ministry of Environment and Forest, Climate Change	Regional Office (SZ), Kendriya Sadan, 4th Floor, E&F Wings, 17th Main Road, Koramangala II Block, Bangalore - 560034	Forest Clearance
Directorate of Environment & Climate Change	Pallimukku - Kannammoola Rd, Velakudi, Thiruvananthapuram, Kerala 695024	Environment Clearance
Water Resources Department	1st Floor North Block Secretariat Thiruvananthapuram	Water Resource
Scheduled Tribes Development Department	Ground Floor, South Block Government Secretariat Thiruvananthapuram	ST
Scheduled Castes Development Department	Ground Floor North Block Secretariat Thiruvananthapuram	SC



source: Census 2011 (<http://www.censusindia.gov.in/>)

Figure 3.3.5-4 Scheduled Tribes in Kerala State

(3) Environmental and Social issues

According to the pollution assessment is based on the bio-chemical oxygen demand (BOD) by Central Pollution Control Board (CPCB, 2014-15), 13 out of 302 polluted river stretches in India locate in Kerala State, which is the worst 7th state in India. The rivers are Chitrapuzha, Kadambayar, Kallai, Karamana, Keecheri, Kuppam, Manimala, Neeleswaram, Periyar, Pullur, Puzhackal, Thirur, and Uppala.

Based on “State of the Environment Report (2007, Kerala State Council for Science, Technology and Environment)” the major environmental issues confronting land environment are Landuse change, Mining, Soil erosion, and Soil quality deterioration. The causes of the landuse change are change in cropping pattern, quarrying, slope modification, soil excavation, conversion of paddy lands and swampy areas and filling of wetlands etc. The major mining activity in the State is confined to the beach placers and china clay deposits. The unorganized mining, especially with respect to tile and brick clay, alluvial sands, crystalline rocks, soils etc, is posing serious threats.

The major issues facing the wetlands of Kerala are mainly related to pollution, eutrophication, encroachment, reclamation, mining and biodiversity loss. The major pressures identified are from (i) industrial effluents (ii) retting of coconut husk (iii) leachates from agricultural fields (iv) waste disposal (v) petroleum hydrocarbons (vi) landuse changes (vii) hydraulic interventions (viii) overexploitation of resources and (ix) weed infestation.

3.3.6 Tamil Nadu State (TN)

(1) Environment

1) Population

As per details from Census 2011 (<http://www.censusindia.gov.in/>), Tamil Nadu has population of 7.21 Crores, an increase from figure of 6.24 Crore in 2001 census. Total population of Tamil Nadu as per 2011 census is 72,147,030. The total population growth in this decade was 15.61 percent while in previous decade it was 11.19 percent. The population of Tamil Nadu forms 5.96 percent of India in 2011. In 2001, the figure was 6.07 percent.

2) Greenhouse Gas emission and emission source

According to T.V. Ramachandra (2012)⁹ CH₄ emission of Tamil Nadu is 750.5 Gg (10th rank and 4.4% of India), CO emission is 1,919.0 Gg (5th rank and 8.5% of India), and CO₂ emission is 71,107.4 Gg (5th rank and 7.4% in India). Number of registered motor vehicles is 8,575,241 (2nd rank and 11.8% of India). Cement production is 15,649.70 kt (3rd rank, 12.0% of India) and Steel production is 1081.8 kt (11th rank and 2.4% of India).

⁹ Decentralised carbon footprint analysis for opting climate change mitigation strategies in India (2012, T.V. Ramachandra)

3) Critical Polluted Areas

Four areas are identified as Critical Polluted Areas in Tamil Nadu State. The Comprehensive Environmental Pollution Index (CEPI) in 2013 is 53.14 to 79.67 which is decreasing from 2009.

Table 3.3.6-1 Comprehensive Environmental Pollution Index (CEPI) in Tamil Nadu State

Industrial Cluster/Area	Potential Impact Zones	CEPI SCORE			Status
		2009	2011	2013	
Vellore	Ranipet, SIPCOT Industrial Complex	81.79	84.73	79.67	As-Wc-Ln
Cuddalore	SIPCOT Industrial Complex, Phase I & II	77.45	78.41	70.12	An-Ws-Lc
Manali	Manali Industrial Area	85.04	88.88	77.26	As-Wc-Ln
Coimbatore	SIDCO, Kurichi Industrial Clusters	72.38	54.16	53.14	An-Wn-Ln

note: Ac = Air critical ; As = Air severe ; An = Air normal
 Wc = Water critical ; Ws = Water severe ; Wn = Water normal
 Lc = Land critical ; Ls = Land severe ; Ln = Land normal

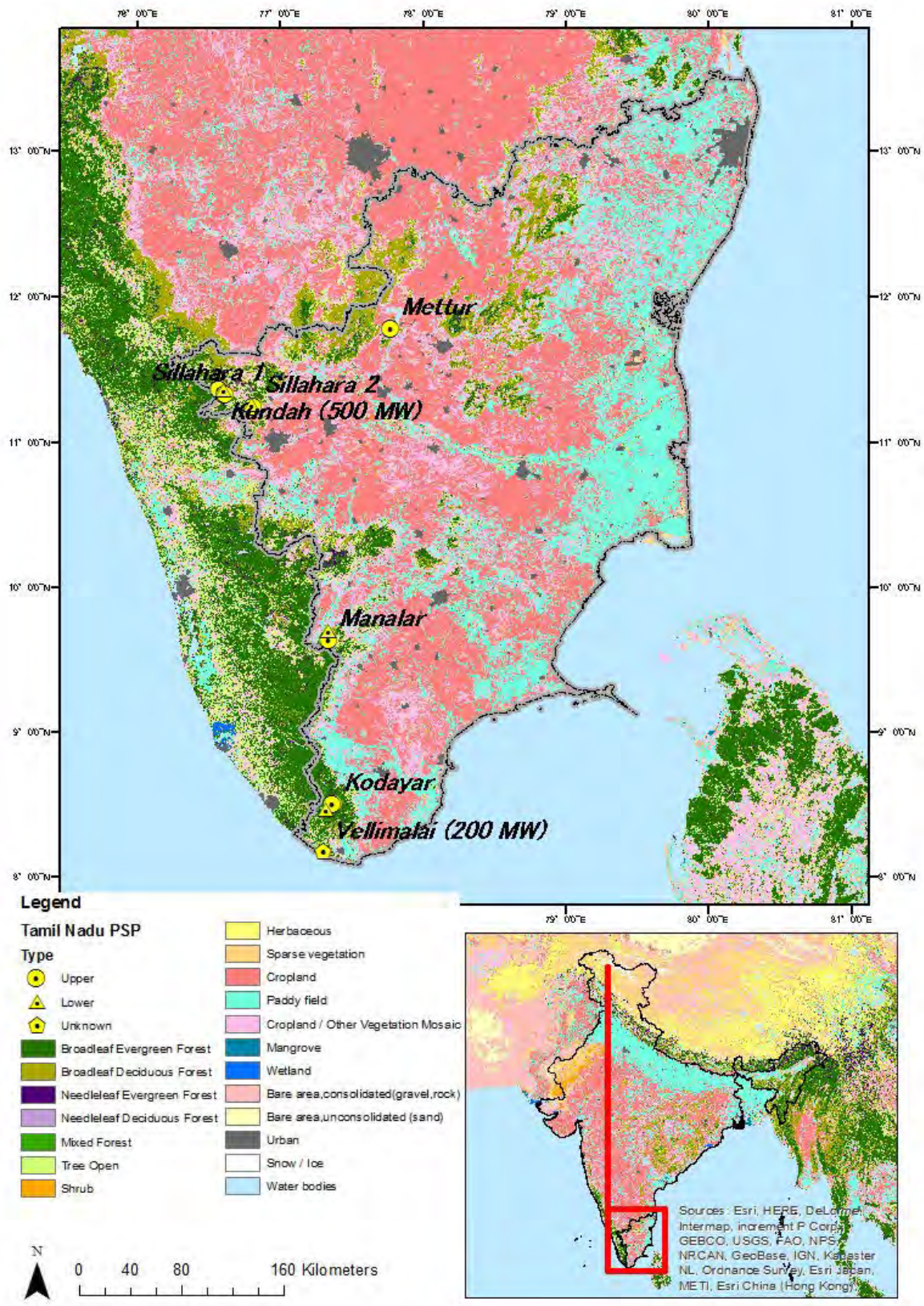
source: The Central Pollution Control Board (CPCB) (<http://cpcb.nic.in/>)

4) Land use

Base on the **GLCNMO** version 3 (2013) 82.2 % the land cover of Tamil Nadu State is Agricultural land, 14.2 % is Forest, and 2.4% is Urban area. Forest areas are remaining along Western Ghats.

5) Forest

According to State of Forest Report 2015 (Forest Survey of India) the forest cover in Tamil Nadu is 26,345 km² (20.26 %) which includes Very Dense Forest 2,993 km², Moderately Dense Forest 10,469 km² and Open Forest 12,883 km². The forest is 2501 km² increasing by 2013.



source: GLCNMO version 3 (2013) (<https://globalmaps.github.io/glcnm.html>)

Figure 3.3.6-1 Land Use in Tamil Nadu State

6) Protected area

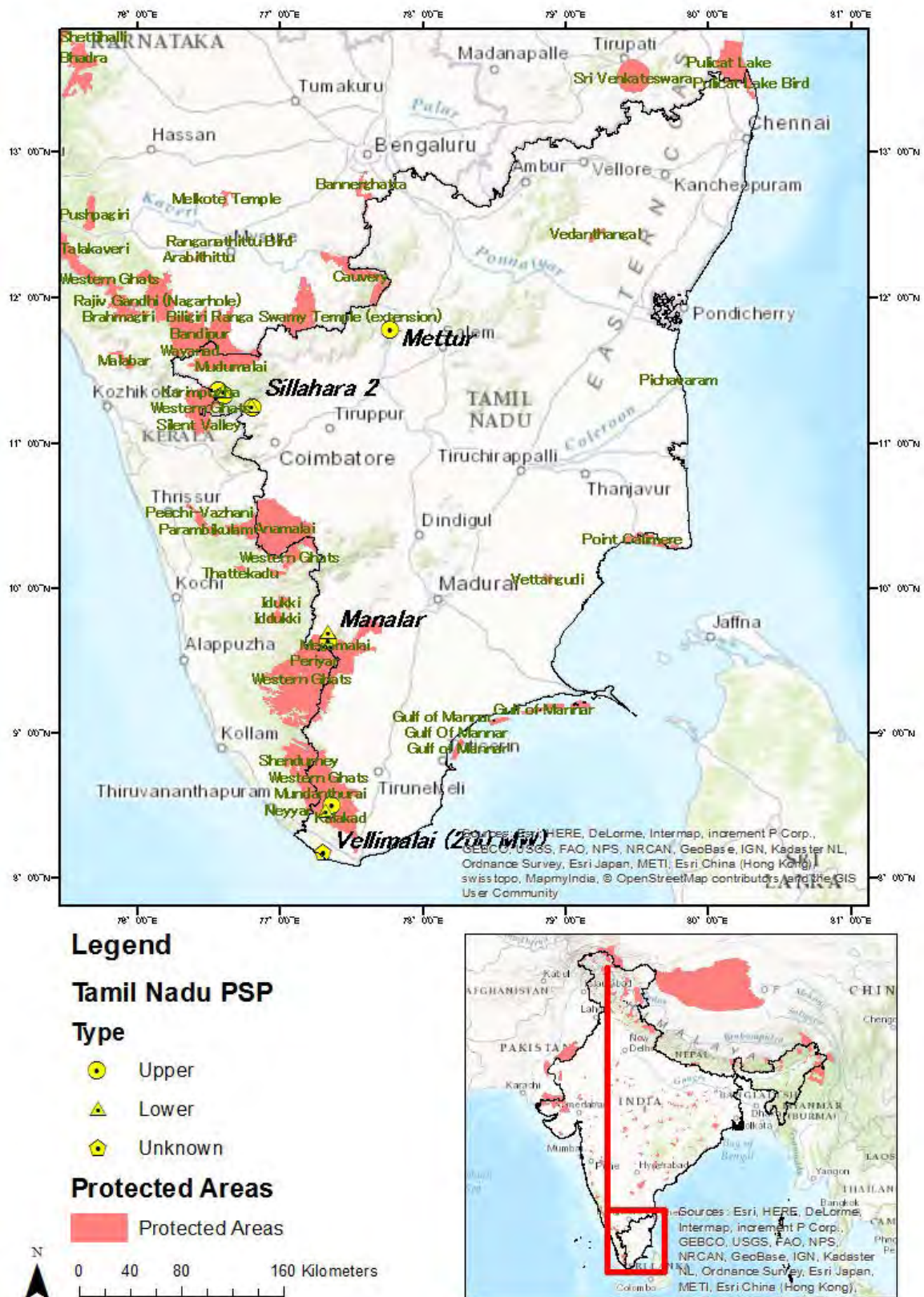
There are 44 protected areas including 5 National Park, 29 Wildlife reserves, and 2 Conservation Reserves, 4 Elephant Reserves, and 4 Tiger Reserves in Tamil Nadu State. The exact boundaries of the protected areas are not clear.

Table 3.3.6-2 Protected Areas in Tamil Nadu State

Type	Name	Year	Area (km ²)	District
Conservation Reserves	Tiruppadaimarathur		0.03	Tirunelveli
	Suchindrum-Theroor-Managudi		4.85	Kanyakumari
Elephant Reserves	23. Nilgiri ER	19.9.03		
	26. Coimbatore ER	19.9.03		
	27. Anamalai ER	19.9.03		
	30. Srivilliputhur ER	19.9.03		
National Park	Guindy NP	1976	2.82	Chennai
	Gulf of Mannar Marine NP	1980	6.23	Ramanathpuram & Tuticorin
	Indira Gandhi (Annamalai) NP	1989	117.10	Coimbatore
	Mudumalai NP	1990	103.23	Nilgiris
	Mukurthi NP	1990	78.46	Nilgiris
Tiger Reserves	Kalakad-Mundanthurai		1,601.54	
	Mudumalai		688.59	
	Sathyamangalam		1,408.40	
	Anamalai		1,479.87	
Wildlife Sanctuaries	Cauvery North WLS	2014	504.33	Kishnagiri & Dharmapuri
	Chitrangudi Bird WLS	1989	0.48	Ramanathpuram
	Gangaikondam Spotted Dear WLS	2013	2.88	Tirunelveli
	Indira Gandhi (Annamalai) WLS	1976	841.49	Coimbatore
	Kalakad WLS	1976	223.58	Tirunelveli
	Kanjirankulam Bird WLS	1989	1.04	Ramanathpuram
	Kanyakumari WLS	2002	457.78	Kanyakumari
	Karaivetti Bird WLS	1999	4.54	Perambalur
	Karikilli Birds WLS	1989	0.61	Kanchipuram
	Kodaikanal WLS	2013	608.95	Dindigul & Theni
	Koonthankulam-Kadankulam WLS	1994	1.29	Tirunelveli
	Megamalai	2016	269.11	Theni
	Melaselvanoor-Keelaselvanoor WLS	1998	5.93	Ramanathpuram
	Mudumalai WLS	1942	217.76	Nilgiris
	Mundanthurai WLS	1977	567.38	Tirunelveli
	Nellai WLS	2015	356.73	Tirunelveli
	Oussudu Lake Bird Sanctuary	2015	3.32	Villupuram
	Point Calimere WLS	1967	17.26	Nagapattinam
	Pulicat Lake Bird WLS	1980	153.67	Tiruvellore

Sathyamangalam WS	2008, 2011	1,411.61	Erode
Srivilliputhur Grizzled Squirrel WLS	1988	485.20	Virudhunagar
Theerthangal	2016	0.29	Ramanathpuram
Sakkarakottai	2016	2.30	Ramanathpuram
Udayamarthandapuram Lake WLS	1991	0.45	Thiruvarur
Vaduvor Birds WLS	1991	1.28	Thiruvarur
Vedanthangal Lake Birds WLS	1936	0.30	Chengalpet
Vellanadu Blackbuck WLS	1987	16.41	Tuticorin
Vellode Birds WLS	1997	0.77	Erode
Vettangudi Birds WLS	1977	0.38	Sivagangai

source: ENVIS Centre on Wildlife & Protected Areas (<http://www.wiienvis.nic.in>)



source: Protected Planet (<https://www.protectedplanet.net/>)

Figure 3.3.6-2 Protected Areas in Tamil Nadu State

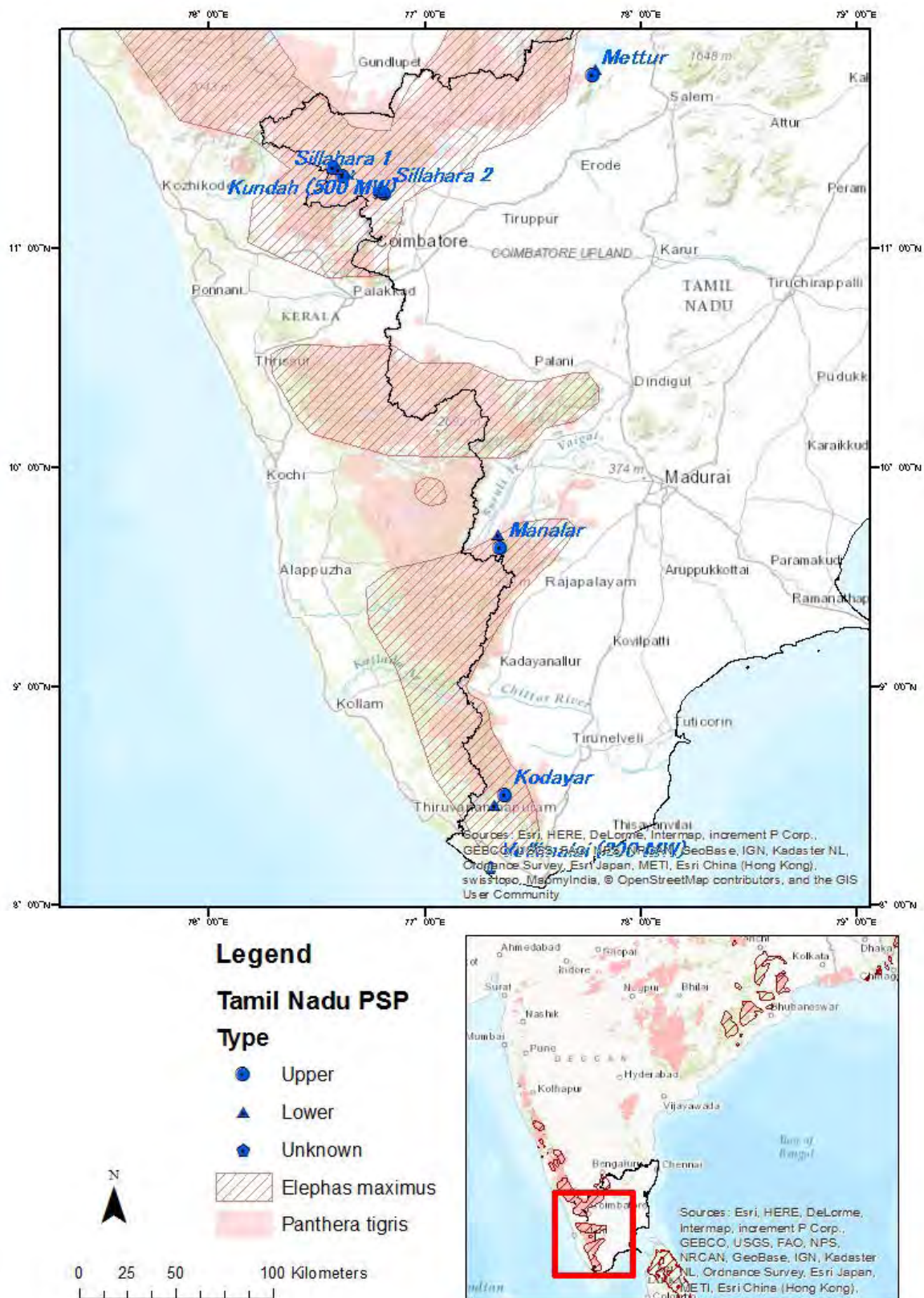
7) Protected species

IUCN red list mammals which has distribution areas in Tamil Nadu State are 34 species including Critically endangered (CR) 1, Endangered (EN) 13, Vulnerable (VU) 13, and Near threatened (NT) 7. Distribution areas of *Elephas maximus* (EN) and *Panthera tigris* (EN) are shown in the following figure.

Table 3.3.6-3 IUCN red list species which has known habitat in Tamil Nadu State

Category	Scientific name
CR	<i>Cremonomys elvira</i>
EN	<i>Cuon alpinus</i> <i>Elephas maximus</i> <i>Feroculus feroculus</i> <i>Hipposideros hypophyllus</i> <i>Latidens salimalii</i> <i>Macaca silenus</i> <i>Manis crassicaudata</i> <i>Mus famulus</i> <i>Nilgiritragus hylocrius</i> <i>Panthera tigris</i> <i>Prionailurus viverrinus</i> <i>Suncus dayi</i> <i>Vandeleuria nilagirica</i>
VU	<i>Aonyx cinereus</i> <i>Bos gaurus</i> <i>Funambulus sublineatus</i> <i>Lutrogale perspicillata</i> <i>Martes gwatkinsii</i> <i>Melursus ursinus</i> <i>Platacanthomys lasiurus</i> <i>Prionailurus rubiginosus</i> <i>Rattus satarae</i> <i>Rusa unicolor</i> <i>Semnopithecus hypoleucos</i> <i>Suncus montanus</i> <i>Trachypithecus johnii</i>
NT	<i>Antilope cervicapra</i> <i>Hyaena hyaena</i> <i>Lutra lutra</i> <i>Panthera pardus</i> <i>Petinomys fuscocapillus</i> <i>Ratufa macroura</i> <i>Semnopithecus priam</i>

source: IUCN (<http://www.iucnredlist.org/>)



source: IUCN (<http://www.iucnredlist.org>)

Figure 3.3.6-3 Elephant and Tiger habitat in Tamil Nadu State

8) Tribes

Based on the Scheduled Castes and Scheduled Tribes Orders (Amendment) Act (1976) 36 Scheduled Tribes are listed in Tamil Nadu. According to Census 2011 (<http://www.censusindia.gov.in/>), 794,697 peoples (1.10%) are scheduled Tribe. The districts which tribe rate are relatively higher are The Nilgiris 4.46%, Dharmapuri 4.18% and Salem 3.43%.

9) Security

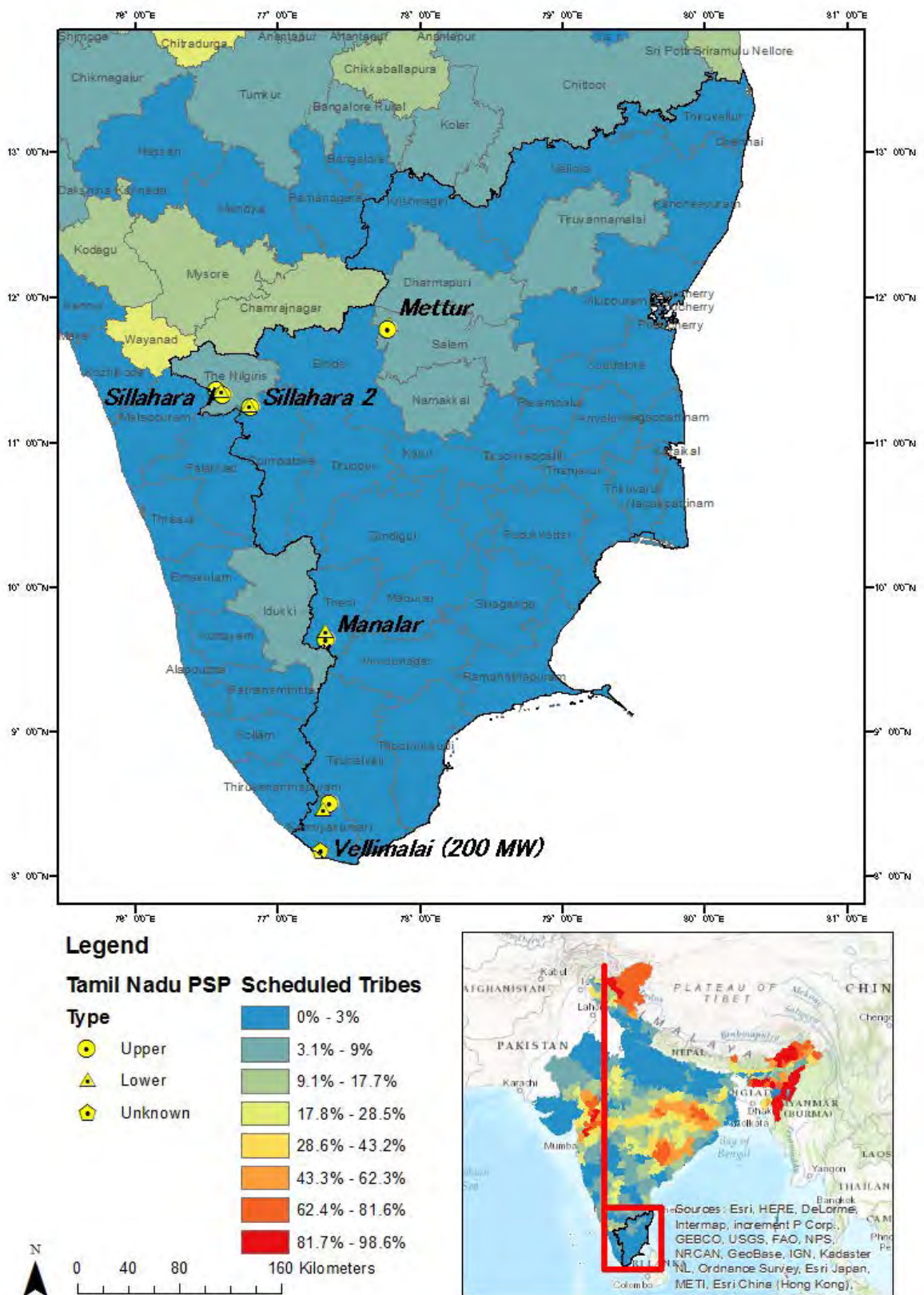
In terms of the MOFA's "Overseas Travel Safety Information", Tamil Nadu state is Level 1 (Exercise caution).

(2) Relevant authorities

Followings are the relevant authorities in Tamil Nadu State.

Table 3.3.6-4 Relevant Authorities in Tamil Nadu State

Name	Address	Role
Regional Offices, Ministry of Environment and Forest, Climate Change	Ist and IInd Floor, Handloom Export Promotion Council,34, Cathedral Garden Road, Nungambakkam, Chennai - 34	Forest Clearance, Wildlife Clearance, Environment Clearance
TAMIL NADU POLLUTION CONTROL BOARD	Tamil Nadu Pollution Control Board, 76, Mount Salai, Guindy, Chennai - 600 032	Pollution
Tamil Nadu Forest Department	122, Chinnakada Theru, Pavazhakundur, Tiruvannamalai, Tamil Nadu 606601	Forest Clearance, Wildlife Clearance
Department of Environment	No.1, Jeenis Road, Panagal Building, Ground Floor, Saidapet, Chennai-600 015	Environment Clearance
Water Resources Organisation Public Works Department (PWD)	Public Works Department Chepauk, Chennai 600 005	Water Resources
Adi Dravidar and Tribal Welfare Department	Namakkal Kavignar Maaligai, Fort St. George, Chennai 600 009	SC/ST
Rural Development and Panchayat Raj Department	Namakkal Kavignar Maaligai, Fort St. George, Chennai 600 009	Rural Development



source: Census 2011 (<http://www.censusindia.gov.in/>)

Figure 3.3.6-4 Scheduled Tribes in Tamil Nadu State

(3) Environmental and Social issues

Some Environmental issues are reported in STATE OF ENVIRONMENT REPORT OF TAMIL NADU (2002). Followings are the excerpt from the report.

1) FORESTS AND WILDLIFE

In Tamil Nadu we have only 17.5% of the area under forest cover a sizeable area is under degraded of which condition. Tamil Nadu is extremely rich in bio diversity but adequate attention has not been paid in the past to assess it effectively; as a result many species have become endangered.

2) WATER RESOURCES

Tamil Nadu has number of seasonal rivers; the, surface water resources are almost fully harnessed by impounding the available water in 61 major reservoirs and also in 39,202 big and small tanks.

According to the pollution assessment is based on the bio-chemical oxygen demand (BOD) by Central Pollution Control Board (CPCB, 2014-15), 7 out of 302 polluted river stretches in India locate in Tamil Nadu State, which is the worst 17th state in India. The rivers are Bhavani, Cauvery, Palar, Sarabanga, Tambirapani, Thirumanimuthar, and Vasista.

3) INDUSTRIALISATION

The major contributors to industrial pollution are leather tanning units, textile processing units, Chemical and petro chemical industries, cement industries and thermal power plants. About 80 percent of 2,500 leather processing units in the country are located in Tamil Nadu. The units discharge about 24 million cubic liters of wastewater about 40,000 tonnes of hazardous solid waste every year.

3.3.7 West Bengal State (WB)

(1) Environment

1) Population

As per details from Census 2011 (<http://www.censusindia.gov.in/>), West Bengal has population of 9.13 Crores, an increase from figure of 8.02 Crore in 2001 census. Total population of West Bengal as per 2011 census is 91,276,115. The total population growth in this decade was 13.84 percent while in previous decade it was 17.84 percent. The population of West Bengal forms 7.54 percent of India in 2011. In 2001, the figure was 7.79 percent.

2) Greenhouse Gas emission and emission source

According to T.V. Ramachandra (2012)¹⁰ CH₄ emission of West Bengal is 1,461.0 Gg (2nd rank and 8.6% of India), CO emission is 2,072.6 Gg (4th rank and 9.2% of India), and CO₂ emission is

¹⁰ Decentralised carbon footprint analysis for opting climate change mitigation strategies in India (2012, T.V. Ramachandra)

69,709.9 Gg (6th rank and 7.2% in India). Number of registered motor vehicles is 2,547,963 (12th rank and 3.5% of India). Cement production is 3028.7 kt (11th rank, 2.3% of India) and Steel production is 3142.9 kt (5th rank and 6.9% of India).

3) Critical Polluted Areas

Three areas are identified as Critical Polluted Areas in West Bengal State. The Comprehensive Environmental Pollution Index (CEPI) in 2013 is 56.01 to 61.58 which is decreasing from 2009.

Table 3.3.7-1 Comprehensive Environmental Pollution Index (CEPI) in West Bengal State

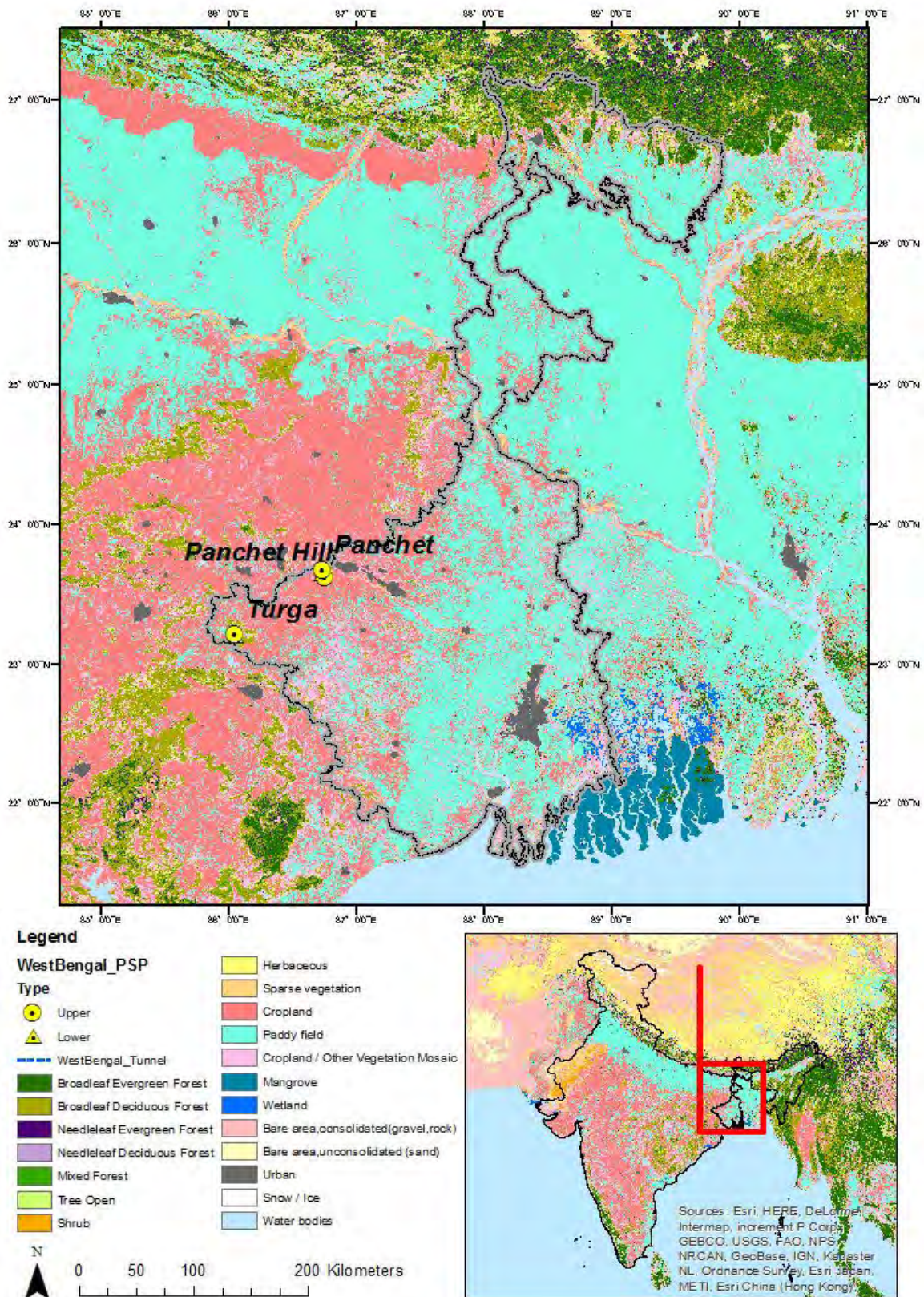
Industrial Cluster/Area	Potential Impact Zones	CEPI SCORE			Status
		2009	2011	2013	
Asansol	Burnpur area surrounding IISCO	70.2	70.96	56.01	An-Wn-Ln
Haldia	5 km wide Strip of Industrial area on the southern side of the confluence point of Hooghly River with Sea.	83.48	79.71	61.58	An-Ws-Ln
Howrah	a) Liluah-Bamangachhi Region, Howrah b) Jalan Industrial Complex-1, Howrah	74.84	76.88	61.11	An-Ws-Ln

note: Ac = Air critical ; As = Air severe ; An = Air normal
Wc = Water critical ; Ws = Water severe ; Wn = Water normal
Lc = Land critical ; Ls = Land severe ; Ln = Land normal

source: The Central Pollution Control Board (CPCB) (<http://cpcb.nic.in/>)

4) Land use

Base on the **GLCNMO** version 3 (2013) 87.1 % the land cover of West Bengal State is Agricultural land, 7.6 % is Forest, and 2.3% is Urban area. Forest areas are remaining along the Darjeeling Himalayan hill region.



source: GLCNMO version 3 (2013) (<https://globalmaps.github.io/glcnm.html>)

Figure 3.3.7-1 Land Use in West Bengal State

5) Forest

According to State of Forest Report 2015 (Forest Survey of India) the forest cover in West Bengal is 16,828 km² (18.96 %) which includes Very Dense Forest 2,948 km², Moderately Dense Forest 4,172 km² and Open Forest 9,708 km². The forest is 2501 km² increasing by 2013.

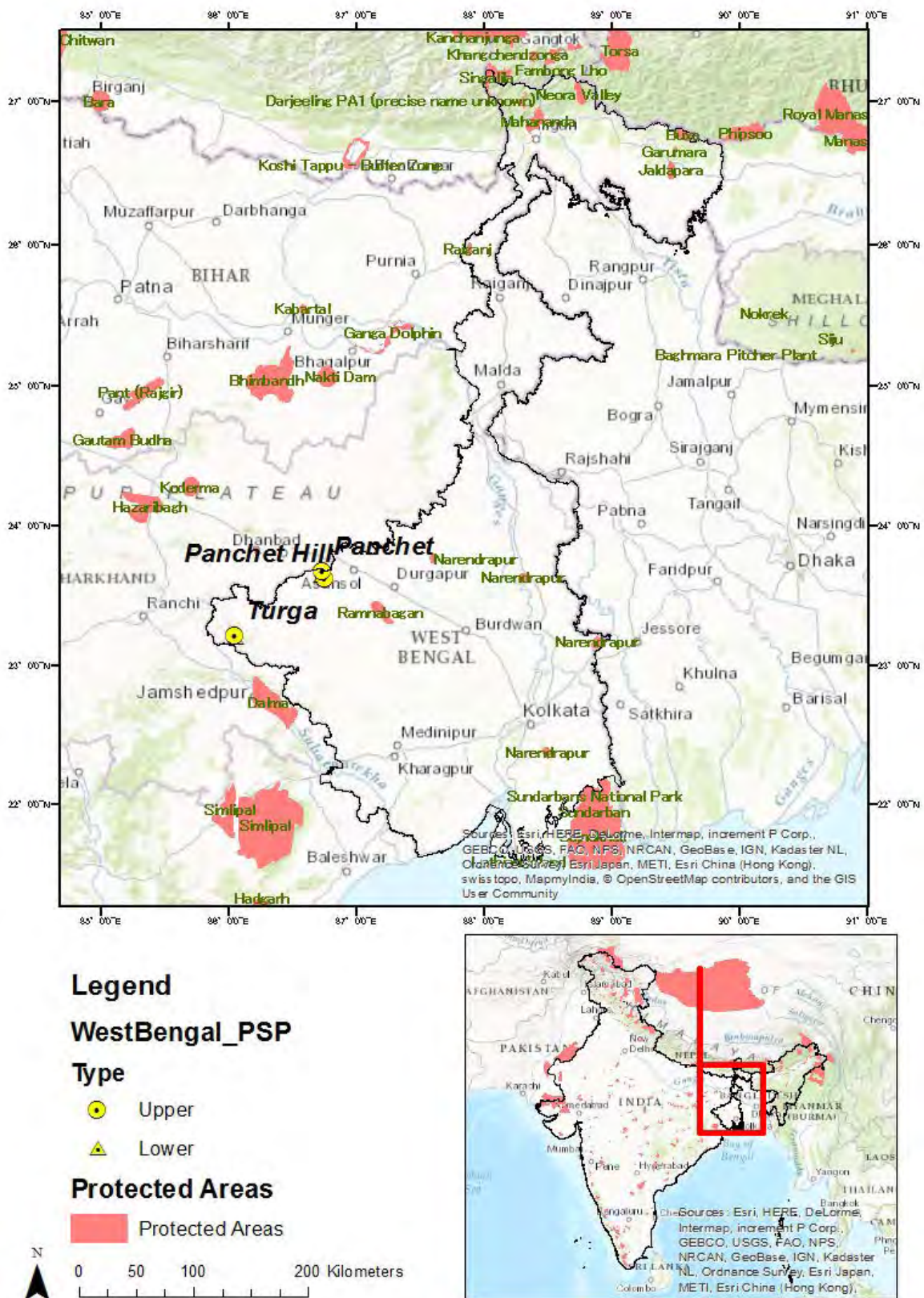
6) Protected area

There are 25 protected areas including 6 National Park, 15 Wildlife Sanctuaries, 2 Elephant Reserves, and 2 Tiger reserves in West Bengal State. The exact boundaries of the protected areas are not clear.

Table 3.3.7-2 Protected Areas in West Bengal State

Type	Name	Year	Area (km ²)	District
Elephant Reserves	1. Mayurjharna ER	24.10.02		
	18. Eastern Dooars ER	28.8.02		
National Park	Buxa NP	1992	117.10	Jalpaiguri
	Gorumara NP	1992	79.45	Jalpaiguri
	Jaldapara NP	2014	216.51	Jalpaiguri
	Neora Valley NP	1986	159.89	Darjeeling
	Singalila NP	1986	78.60	Darjeeling
	Sunderban NP	1984	1,330.10	North & South 24-Paraganas
Tiger Reserves	Sunderbans		2,584.89	
	Buxa		757.90	
Wildlife Sanctuaries	Ballavpur WLS	1977	2.02	Birbhum
	Bethuadahari WLS	1980	0.67	Nadia
	Bibhuti Bhusan WLS	1980	0.64	North 24-Paraganas
	Buxa WLS	1986	267.92	Jalpaiguri
	Chapramari WLS	1976	9.60	Jalpaiguri
	Chintamani Kar Bird WLS	1982	0.07	South 24-Paraganas
	Haliday Island WLS	1976	5.95	South 24-Paraganas
	Jorepokhri Salamander WLS	1985	0.04	Darjeeling
	Lothian Island WLS	1976	38.00	South 24-Paraganas
	Mahananda WLS	1976	158.04	Darjeeling & Jalpaiguri
	Raiganj WLS	1985	1.30	North Dinajpur
	Ramnabagan WLS	1981	0.14	Burdwan
	Sajnakhali WLS	1976	362.40	South 24-Paraganas
	Senchal WLS	1976	38.88	Darjeeling
	West Sunderban WLS	2013	556.45	South 24-Paraganas

source: ENVIS Centre on Wildlife & Protected Areas (<http://www.wiienvis.nic.in>)



source: Protected Planet (<https://www.protectedplanet.net/>)

Figure 3.3.7-2 Protected Areas in West Bengal State

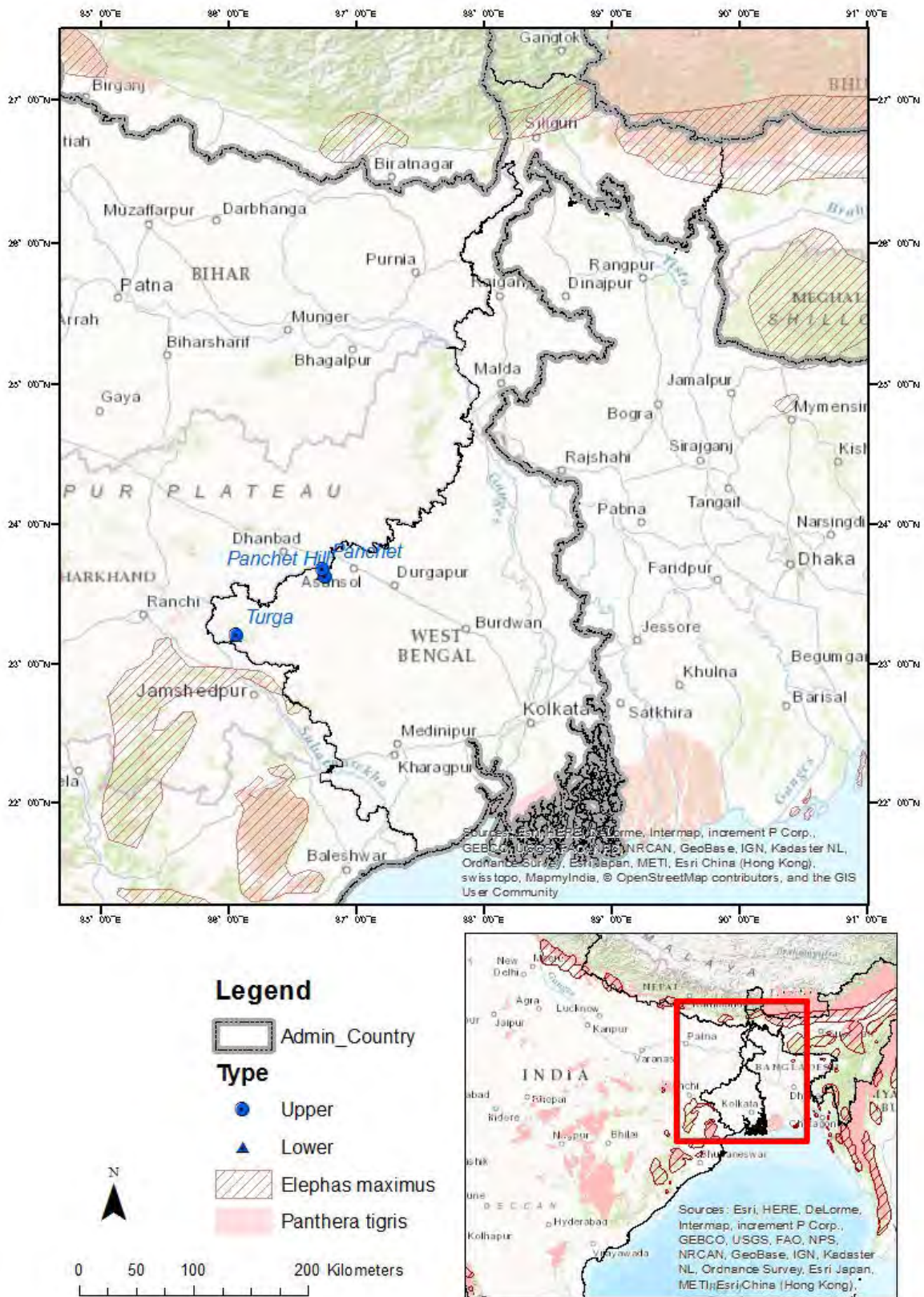
7) Protected species

IUCN red list mammals which has distribution areas in West Bengal State are 32 species including Critically endangered (CR) 1, Endangered (EN) 8, Vulnerable (VU) 11, and Near threatened (NT) 12. Distribution areas of *Elephas maximus* (EN) and *Panthera tigris* (EN) are shown in the following figure.

Table 3.3.7-3 IUCN red list species which has known habitat in West Bengal State

Category	Scientific name
CR	<i>Manis pentadactyla</i>
EN	<i>Ailurus fulgens</i> <i>Axis porcinus</i> <i>Caprolagus hispidus</i> <i>Cuon alpinus</i> <i>Elephas maximus</i> <i>Manis crassicaudata</i> <i>Moschus leucogaster</i> <i>Panthera tigris</i>
VU	<i>Aonyx cinereus</i> <i>Arctictis binturong</i> <i>Bos gaurus</i> <i>Lutrogale perspicillata</i> <i>Melursus ursinus</i> <i>Myotis sicarius</i> <i>Neofelis nebulosa</i> <i>Rhinoceros unicornis</i> <i>Rusa unicolor</i> <i>Tetracerus quadricornis</i> <i>Ursus thibetanus</i>
NT	<i>Capricornis thar</i> <i>Catopuma temminckii</i> <i>Hemitragus jemlahicus</i> <i>Lutra lutra</i> <i>Macaca assamensis</i> <i>Naemorhedus goral</i> <i>Panthera pardus</i> <i>Pardofelis marmorata</i> <i>Petaurista nobilis</i> <i>Ratufa bicolor</i> <i>Semnopithecus hector</i> <i>Viverra zibetha</i>

source: IUCN (<http://www.iucnredlist.org/>)



source: IUCN (<http://www.iucnredlist.org/>)

Figure 3.3.7-3 Elephant and Tiger habitat in West Bengal State

8) Tribes

Based on the Scheduled Castes and Scheduled Tribes Orders (Amendment) Act (1976) 36 Scheduled Tribes are listed in Tamil Nadu. According to Census 2011 (<http://www.censusindia.gov.in/>), 794,697 peoples (1.10%) are scheduled Tribe. The districts which tribe rate are relatively higher are The Nilgiris 4.46%, Dharmapuri 4.18%, and Salem 3.43%.

9) Security

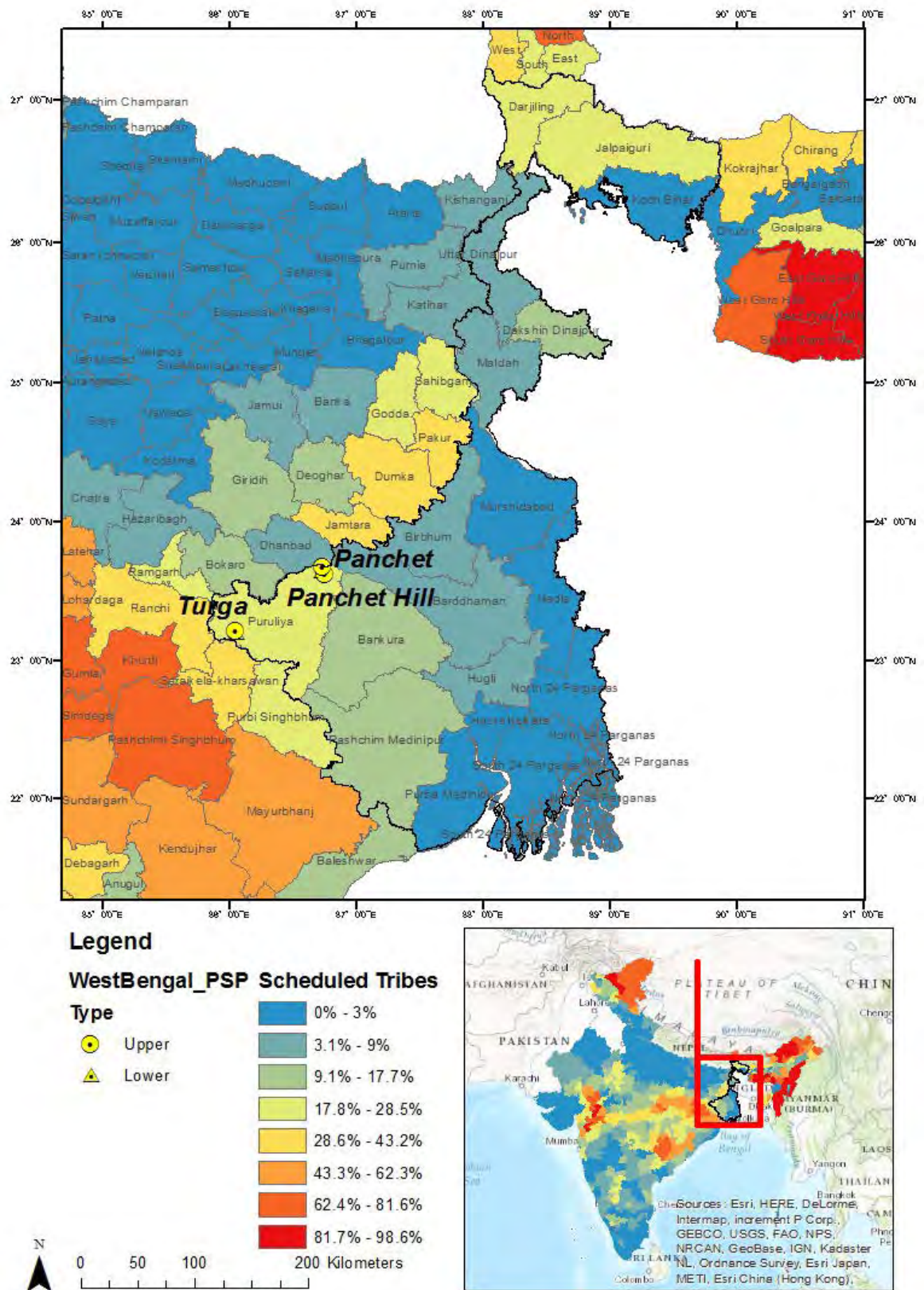
In terms of the MOFA's "Overseas Travel Safety Information", West Bengal state is Level 1 (Exercise caution).

(2) Relevant authorities

Followings are the relevant authorities in West Bengal State.

Table 3.3.7-4 Relevant Authorities in West Bengal State

Name	Address	Role
Regional Offices, Ministry of Environment and Forest, Climate Change	Regional Office (Eastern Zone), A/3, Chandrasekharpur, Bhubaneswar-751023	Forest Clearance, Wildlife Clearance
West Bengal Pollution Control Board	Paribesh Bhavan, 10A, Block-L.A., Sector 3, Salt Lake City, Kolkata, West Bengal 70009	Pollution Control
West Bengal Forest Department	Aranya Bhawan, Block LA-10A, Sector-III, Saltlake, Kolkata - 700 098	Forest Clearance, Wildlife Clearance
Environment Department	Poura Bhavan, 4th floor, FD-415/A, Sector-III, Bidhannagar, Kolkata-700106	Environment Clearance
STATE WATER INVESTIGATION DIRECTORATE	State Water Investigation Directorate Nirman Bhaban, 3rd Floor, Salt Lake City Kolkata-91	Water Resources
Backward Classes Welfare Department	B.D.O office Campus, Garhbeta, West Bengal 721127	SC/ST
Department of Panchayats & Rural Development	Joint Administrative Building, 7th floor, block HC Wing B, Plot no 7, Saltlake city, Sector-III Kolkata-700106	Rural Development



source: Census 2011 (<http://www.censusindia.gov.in/>)

Figure 3.3.7-4 Scheduled Tribes in West Bengal State

(3) Environmental and Social issues

According to the pollution assessment is based on the bio-chemical oxygen demand (BOD) by Central Pollution Control Board (CPCB, 2014-15), 17 out of 302 polluted river stretches in India locate in West Bengal State, which is the worst 5th state in India. The rivers are Barakar, Churni, Damodar, Dwarakeshwar, Dwarka, Ganga, Jalangi, Kaljani, Kanshi, Karola, Mahananda, Mathabhanga, Mayurkashi, Rupnarayan, Silabati, Teesta, and Vindhadhari.

54 major drains in West Bengal discharge into river Ganga. Sampling was conducted during lowest low tide. 48 Major drains were monitored in West Bengal and ten in Bihar. The total BOD load from these drains is estimated as 41303kg/day. The total Dissolved solids load of Paul Ghat near Belur Math(Howrah) was estimated as 1890.5 mg/ℓ highest amongst all the drains.