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Analysis of System Stability in Developing and Emerging Countries

Country Chapter: India

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1 Background

India has huge potential of renewable energy resources such as wind, solar, hydro etc. Most of the renewable installations are in the renewable potential rich states of Tamil Nadu, Karnataka, Andhra Pradesh, Gujarat, Maharashtra, Rajasthan Himachal Pradesh and Jammu & Kashmir. These states contribute more than 80 to 90% to the total installed renewable capacity in the country. Various policy initiatives and fiscal incentives have awakened interest in developing renewable generation plants. [1]

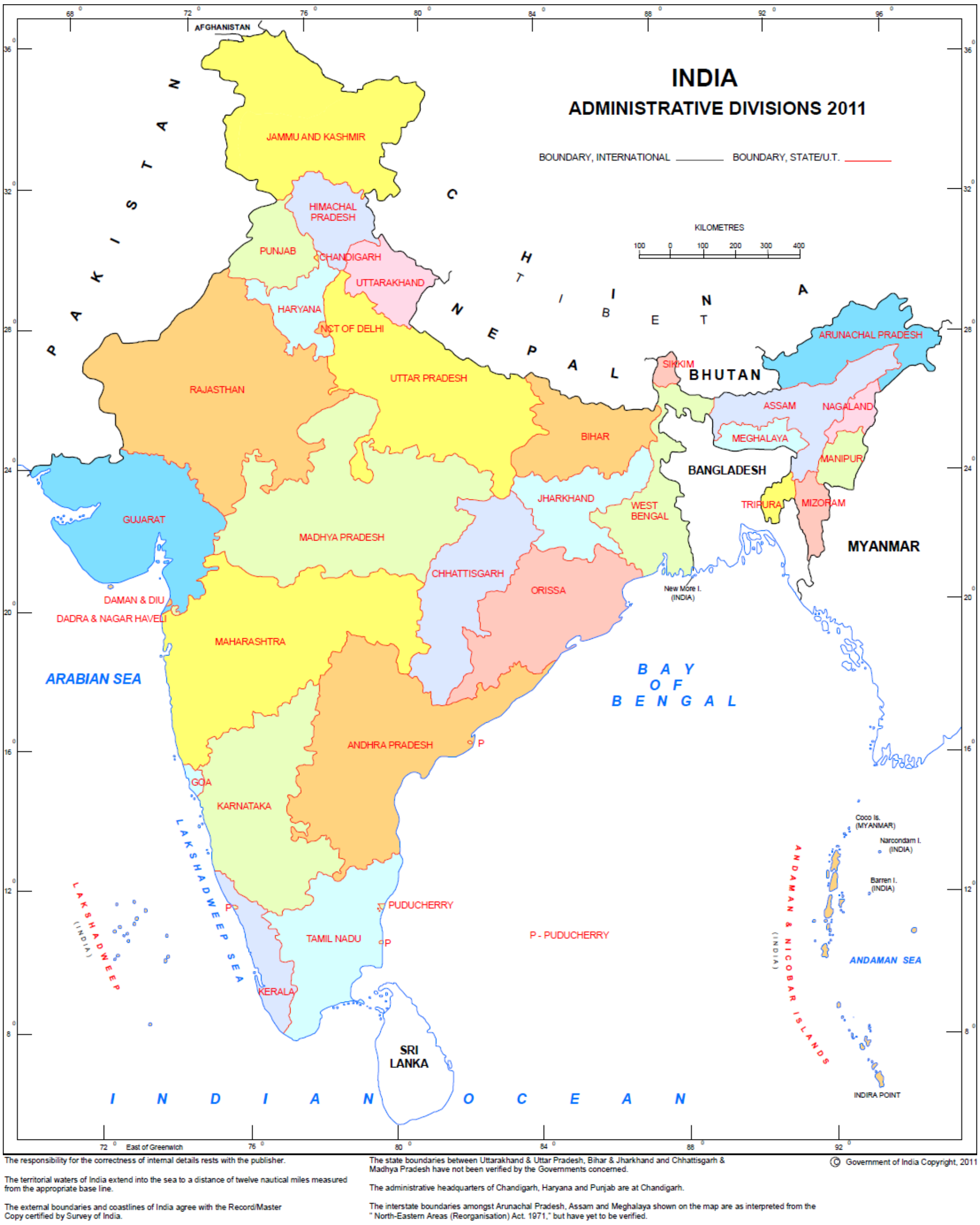

Figure 1 - Administrative Divisions 2011 [2]

2 The Indian Power Sector

Due to the large area of India and its population of approximately 1.2 billion inhabitants, the Indian power sector has a rather complex structure of actors as shown in *Table 1*.

Table 1 – Actors of the Indian Power Sector [3]

<table>
<tr><th></th><th colspan="2">Central Government</th><th>State</th><th>Private</th></tr>
<tr><th>Policy</th><td colspan="2">MoP, MNRE</td><td>State governments</td><td>-</td></tr>
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<tr><th>Execution</th><td>Regional load dispatch centers</td><td>State load dispatch centers</td><td></td></tr>
<tr><th>Distribution</th><td colspan="2">-</td><td>State distribution utilities</td><td>Small number of private service providers</td></tr>
<tr><th>Trade</th><td colspan="2">PTC India Ltd.
Licensee</td><td>Licensee</td><td>Licensee</td></tr>
<tr><th>Law</th><td colspan="2"></td><td colspan="2">Appeal tribunal</td></tr>
</table>

The functions and responsibilities of these actors are described in the following sections.

2.1 Ministry of Power (MoP)

The Ministry of Power is primarily responsible for the development of electrical energy sector in the country. The Ministry is responsible for perspective planning, policy formulation, processing of projects for investment decisions, monitoring of the implementation of power projects, training and capacity development and the administration and enactment of legislation in regard to thermal and hydro power generation, transmission and distribution. [4]

2.2 Ministry of New & Renewable Energy (MNRE)

The broad aim of the Ministry is to develop and deploy new and renewable energy projects for supplementing the energy requirements of the country. Also it has to facilitate research, design, development, production and deployment of new and renewable energy systems/devices for transportation, portable and stationary applications in rural, urban, industrial and commercial sectors.

2.3 Statutory Bodies

2.3.1 Central Electricity Authority (CEA)

CEA is an "Attached Office" of the Ministry of Power. The CEA is responsible for the technical coordination and supervision of programs and is also entrusted with a number of statutory functions. [5]

2.3.2 Regulatory Commissions

Central Electricity Regulatory Commission (CERC):

The main functions of CERC are the following:

- to regulate the tariff of generating companies owned or controlled by the Central Government;
- to regulate the tariff of generating companies other than those owned or controlled by the Central Government, if such companies generate and sell electricity in more than one state;
- to regulate the inter-state transmission of energy including tariff of the transmission utilities;
- to grant licences for inter-state transmission and trading;
- to advise the Central Government in formulation of National Electricity Policy and Tariff Policy [5];

State Electricity Regulatory Commission (SERC):

The concept of SERC as a statutory body is to be responsible for determination of tariff and grant of licence at intra-state level. Main responsibilities of SERC are:

- to determine the tariff for generation, supply, transmission and wheeling of electricity, whole sale, bulk or retail sale within the state;
- to issue licences for intra-state transmission, distribution and trading;
- to promote co-generation and generation of electricity from renewable energy sources etc. [5]

SERC have specified a Renewable Purchase Obligation (RPO) and a feed-in tariff (preferential tariff) among other terms and conditions to promote generation of electricity from renewables. [1]

2.3.3 Transmission Utilities

Central Transmission Utility (CTU):

The functions of the CTU are to undertake the transmission of energy through the inter-state transmission system and to execute all functions of planning and coordination of all issues relating to the inter-state transmission system with State Transmission Utilities, Central Government, State Governments, generating companies etc. Power Grid Corporation of India Limited will be Central Transmission Utility. [5]

State Transmission Utility (STU):

The functions of the State Transmission Utility are to undertake the transmission of energy through the intra-state transmission system and deal with all functions of planning and coordination relating to the intra-state transmission system with the Central Transmission Utility, State Governments, generating companies etc. [5].

2.3.4 Dispatch Centers

National Load Despatch Centre (NLDC):

The functions of the National Load Despatch Centre are to undertake the optimum scheduling and despatch of electricity among the Regional Load Despatch Centres. The constitution and functions of NLDC are yet to be prescribed by the Central Government [5].

Regional Load Despatch Centres (RLDC):

The RLDCs are responsible, inter-alia, for dispatch of electricity within the regions, monitoring grid operations, etc. The directions given by the RLDC for ensuring grid stability etc. are to be compiled with by the licensees, generating companies, generating stations, sub-stations and any other person or organisation related to the operation of the power system [5].

State Load Despatch Centres (SLDC):

As does the RLDC at a regional level, the SLDCs have to ensure integrated operations of the power system at state level [5].

2.4 Public Sector Undertakings

Besides the statutory bodies, there are several public sector organisations. The most relevant actors relating to system security and system stability are listed below:

2.4.1 Power Grid Corporation of India Ltd.

Apart from providing the transmission system for the evacuation of central sector power, Power Grid is responsible for establishing and operating regional and national power grids, in order to facilitate transfer of power within and across the regions with reliability, security and economy on sound commercial principles [6].

2.4.2 NTPC Limited

NTPC is the largest power generating company in India. It was incorporated on November 7th, 1975 with the objective of building large size thermal power stations, along with associated transmission systems, to accelerate the integrated development of the power sector in India. It is now an integrated power company with presence across the entire energy value chain through diversification and backward & forward integration [6].

2.4.3 NHPC Limited

NHPC Limited has an objective to plan, promote and organise an integrated and efficient development of hydroelectric power in all aspects and to include development of power in all its aspects through conventional and non-conventional sources in India and abroad [6].

2.4.4 North Eastern electric Power Corporation Limited (NEEPCO)

North Eastern Electric Power Corporation Ltd. (NEEPCO) was constituted in 1976 under the Company's Act 1956 with the objective of developing the large power potential of the North Eastern Region of the country through planned development of the North Eastern Region [6].

3 The Indian Power System

3.1 Present Situation

Currently, the total installed capacity of India is about 223.3 GW (March 2013). The capacity from conventional sources namely coal, gas, diesel, nuclear and large hydro amounts to about 88% of the total installed capacity. The contribution of non-conventional renewable sources is about 12% (27,542 MW).

Table 2: - Installed capacity per source and region (March 2013) in MW [7]

Region	Thermal				Nuclear	Big Hydro	RES*	TOTAL
	Coal	gas	diesel	total				
Northern	32,414	4,781	36,495	37,208	1,620	15,468	5,589	**59,885**
Western	49,257	8,988	17	58,263	1,840	7,448	8,987	**76,537**
Southern	25,033	4,963	939	30,935	1,320	11,353	12,252	**55,859**
Eastern	23,458	190	17	23,665	0	3,981	455	**28,101**
N. Eastern	60	1,188	143	1,390	0	1,242	253	**2,885**
Islands	0	0	70	70	0	0	416	**76**
All India	130,221	20,110	1,200	**151,530**	**4,780**	**39,491**	**27,542**	**223,344**

*Renewable Energy Sources (RES) includes Small Hydro Power (SHP), Biomass Power (BP), Urban & Industrial waste Power (U&I), Wind Energy and Solar Power.

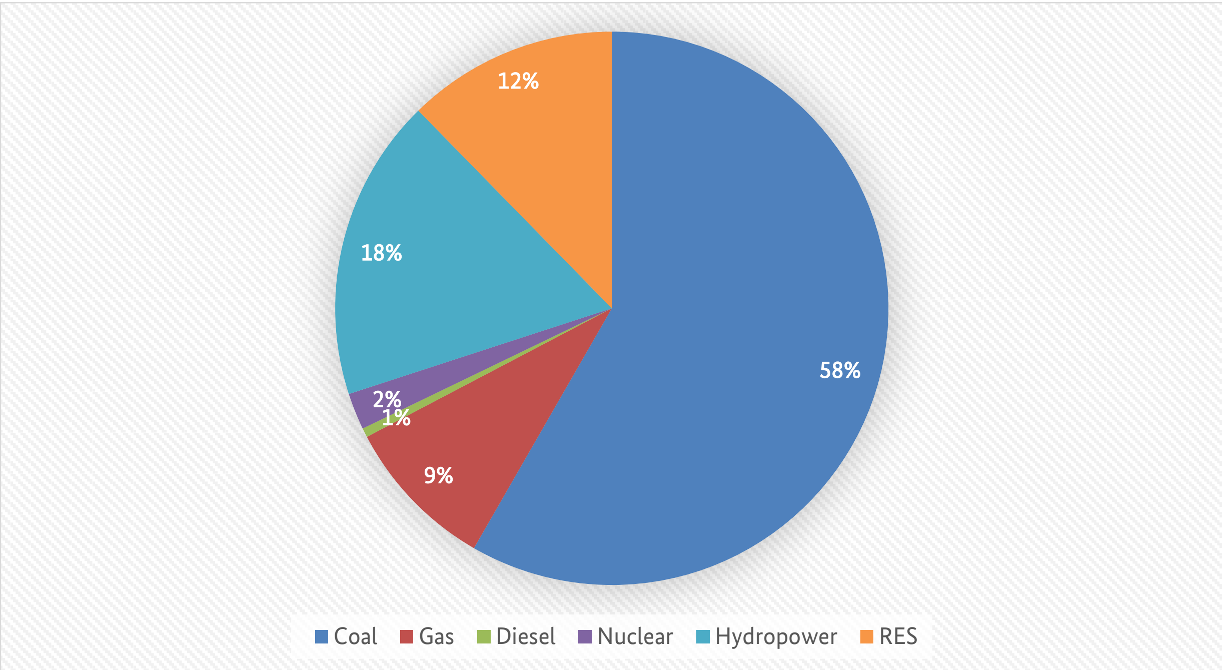

Figure 2 - Installed Capacity per source (March 2013) [7]

India has been continuously progressing in conventional as well as renewable capacity addition. Since the 9^{th} Plan period, the share of renewable capacity has increased from 2% to 12% until today.

The contribution of RES to the generation of electrical energy has increased over the past years and is nowadays about 4% [1].

3.2 System Overview

The Indian power grid is an inter-connected 50Hz network. At the end of the implementation period of the 11^{th} Plan (2012) the overall length of the transmission lines reaches almost 270 000 circuit kilometres (see Table 3).

The main transmission levels are 765kV, 400kV and 220kV. Lines having a rated voltage of 1000kV are currently under planning.

Besides the very extensive AC transmission grid, there are several HVDC lines running in parallel to the AC grid that allow very high power transfers, while stabilizing the power transfers on long AC transmission lines. The capacity of all HVDC terminals is expected to reach 13 500MW by the end of the 11^{th} Plan period (see Table 4).

Table 3 - Transmission Lines [circuit kilometers] [8]

Transmission Lines (AC and HVDC)	Expected end of 11th Plan (2012)
HVDC Bipole lines	9,452
765 kV	4,164
400 kV	114,979
220 kV	140,976
Total Transmission Line, ckm	**269,571**

Table 4 - Transformation capacities [MW/MVA] [8]

Substations (AC and HVDC)	Expected at the end of 11th Plan
Total- HVDC Terminal Capacity, MW	13,500
Total- AC Substation capacity, MVA	372,894

3.3 Transmission Network Development

Since the beginning of the 90[ies], the Indian transmission grid developed from a system of five non-synchronous areas into a synchronized interconnected power system having numerous AC and DC tie lines (see Figure 3 Figure 4).

The operation of such a large interconnected system with very wide distances is very challenging because of various stability aspects that have to be considered.

More than 80% of the renewable generation capacity is in the states of Tamil Nadu, Maharashtra, Karnataka, Gujarat and Rajasthan. As most of the renewable energy generation is of rather small capacity, ranging from a few MW to 25 MW or 50 MW, their integration into the grid is usually done at distribution or subtransmission level, such as 11kV, 22 kV, 33kV or 66 kV [8] and not at main transmission levels.

Hence, main issues relating to the grid integration of renewables are probably within distribution grids. The impact of renewables on the main transmission system is probably still relatively low, which means that the impact of renewables on system security is certainly not yet a key topic.

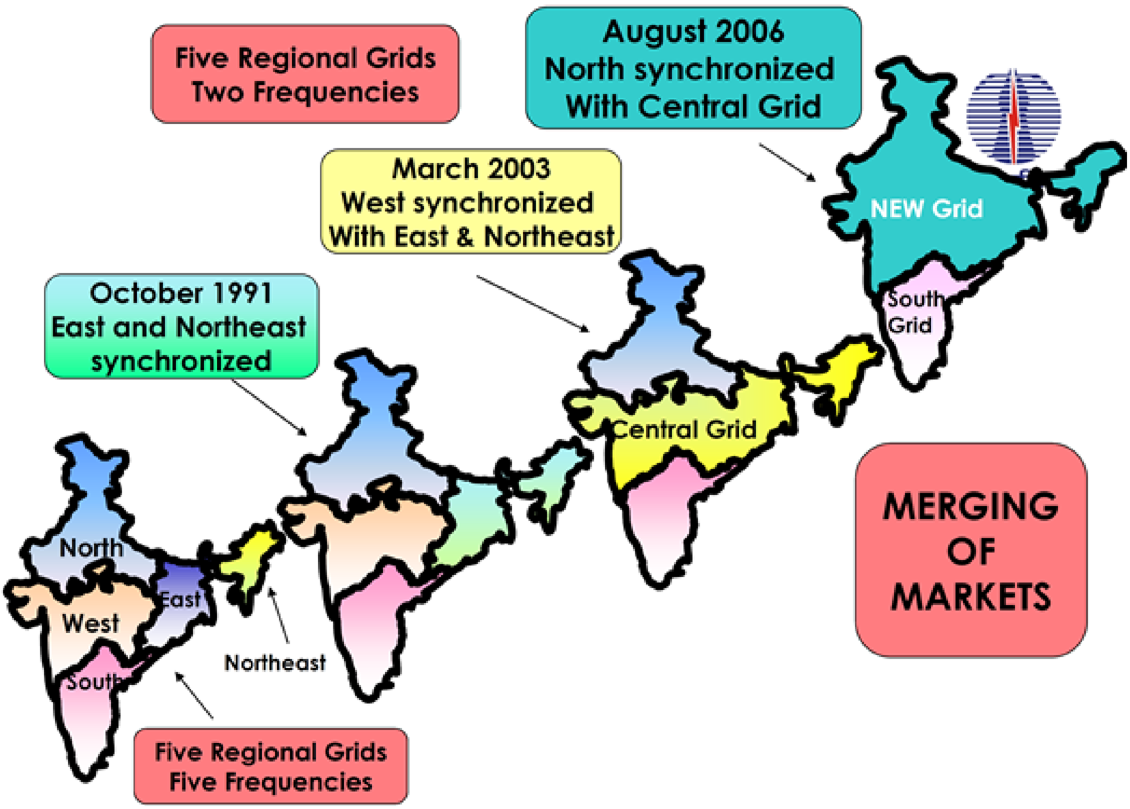

Figure 3: Synchronous Connections

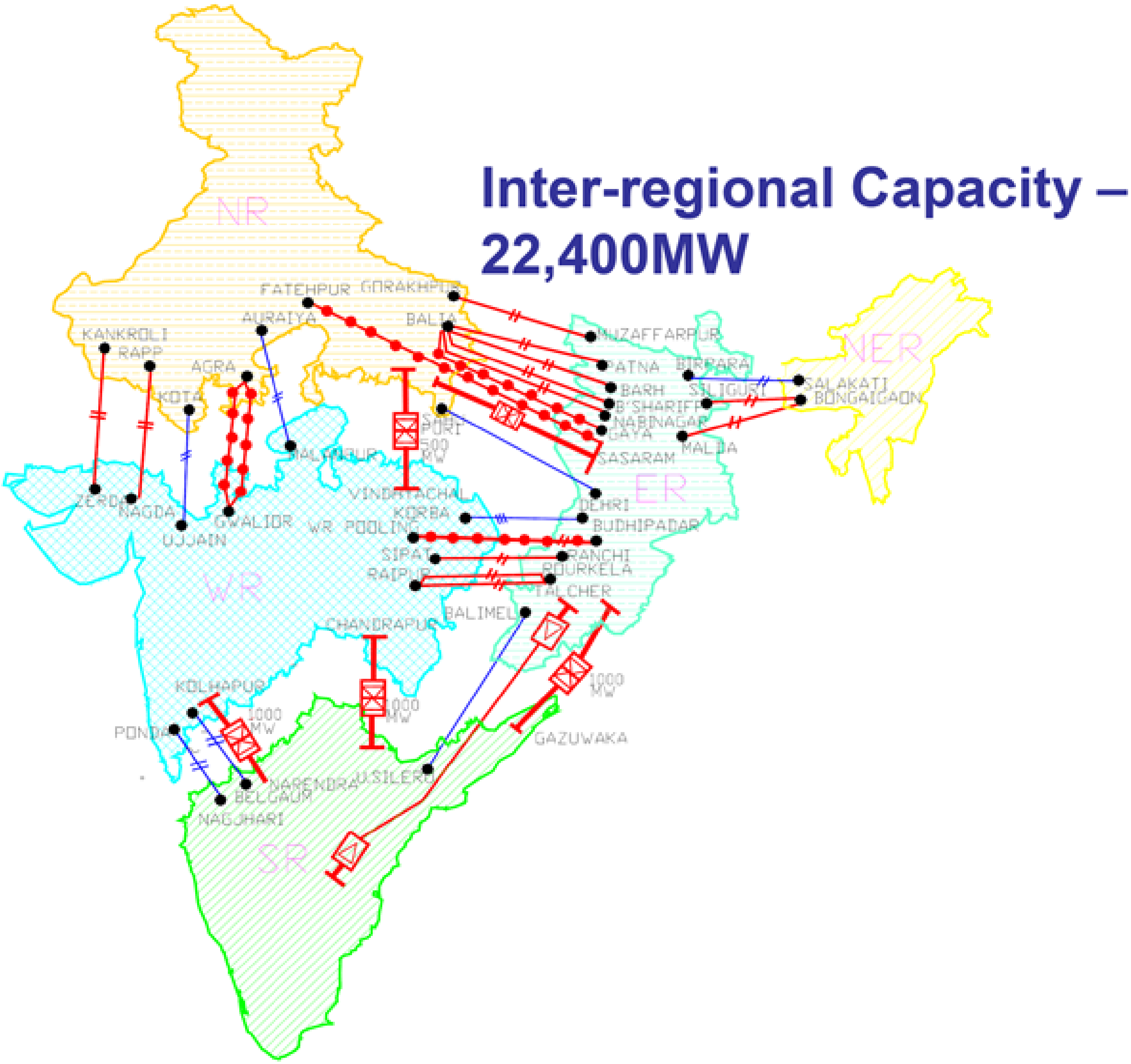

Figure 4: Regional interconnections [9]

3.4 Operational Aspects

Conventional generation plants such as coal fired, nuclear and run-off river are generally operated as base load plants, whereas gas fired units and hydro power plants with reservoir type storage are used as peak load units [1].

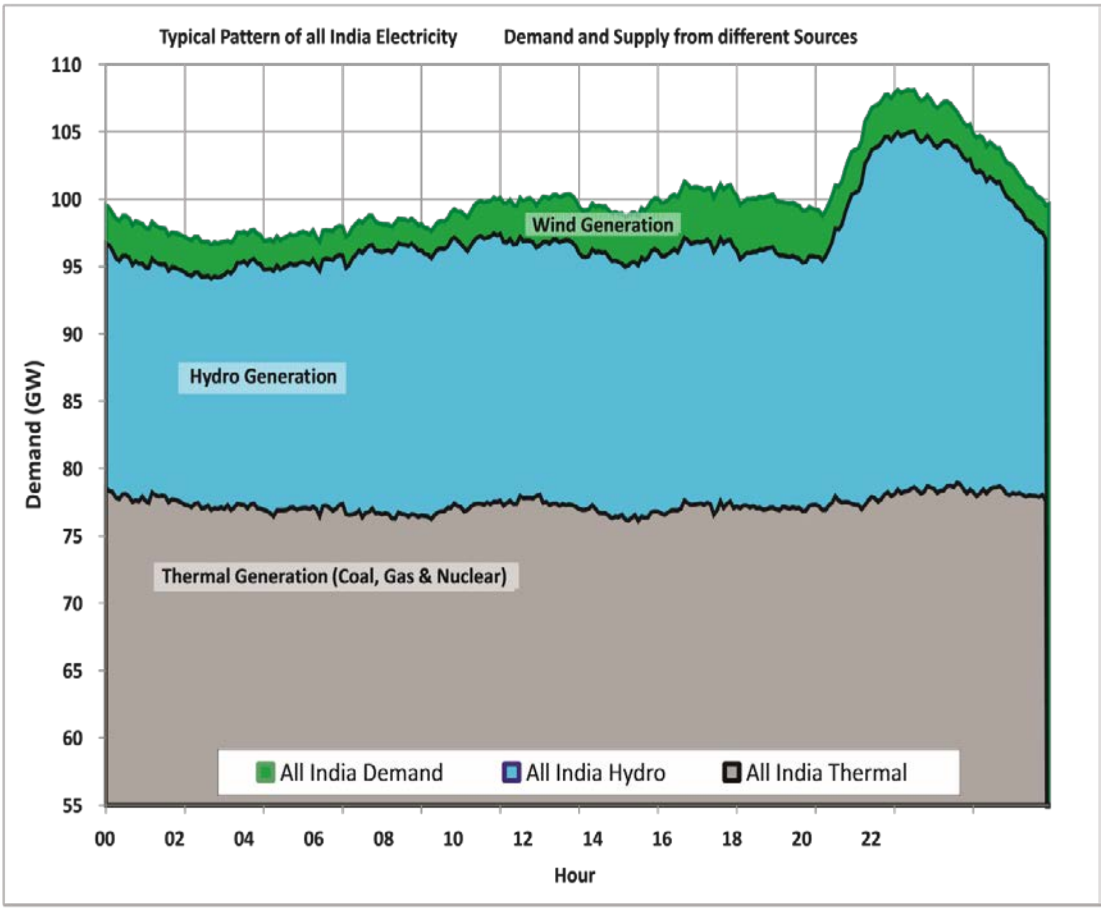

Figure 5- Typical demand profile and supply-mix on all India basis (July 2011) [1]

The Demand load profile in India shows that the peak occurs during evening hours whereas during the day a fairly flat load profile can be observed. Ramp rates during evening peak can be as high as 200MW/minute (e.g. on festival days like Diwali [1])

Figure 6 - Daily load profile [1]

Wind profiles show that wind generation usually peaks during late afternoon hours showing relatively high wind generation pattern during peak load hour. Generally, wind generation starts increasing during morning hours and getting low during the night. Hence, there is a reasonable correlation between wind generation and demand [1].

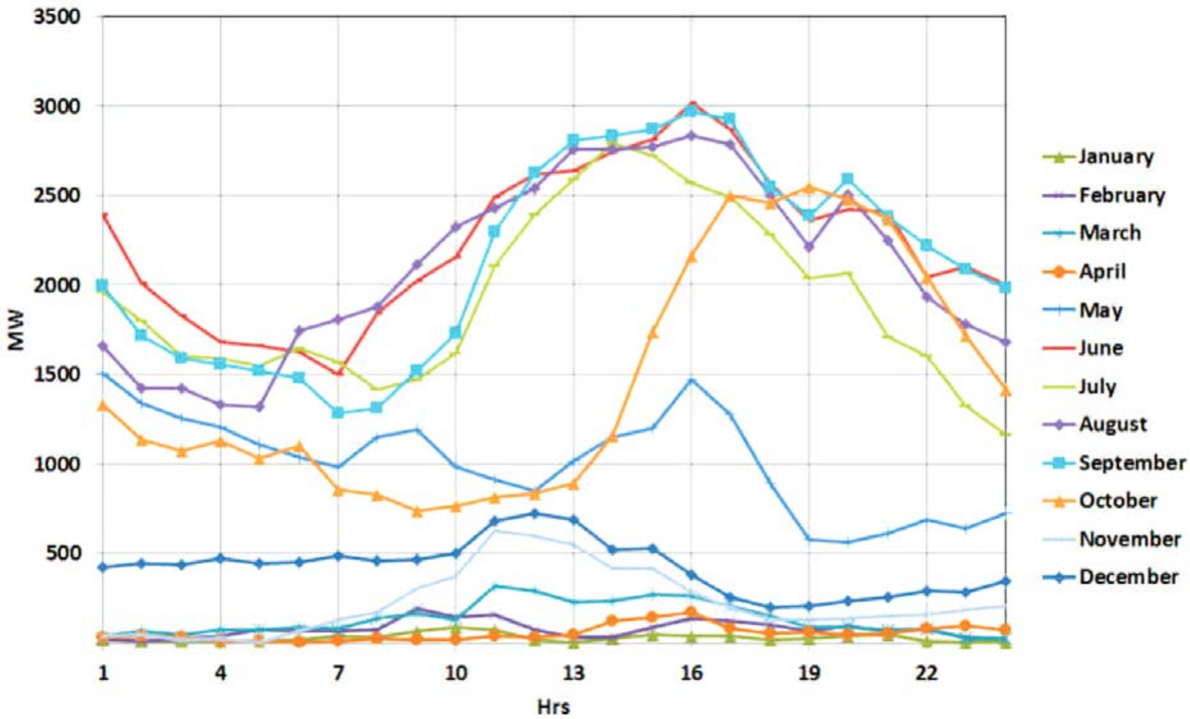

Figure 7 - Tamil Nadu typical daily wind generation pattern month wise [1]

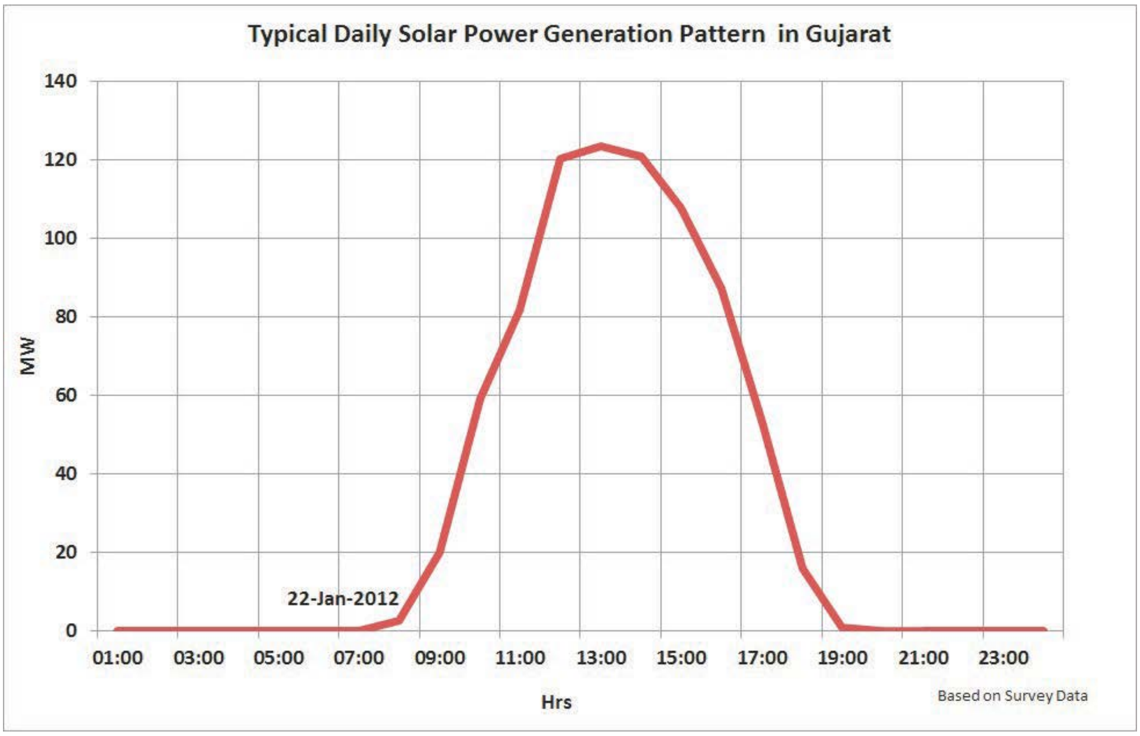

Figure 8 - Daily solar generation profile (sunny day)

Because of the very strong evening peak in the demand curve, the correlation between solar generation and load is rather negative (see Figure 8), which means that solar generation (without storage) could only have a low contribution to the equivalent firm capacity of the Indian system (low capacity credit).

4 Renewable Energy Resources

India has large renewable energy resources, amongst which solar and wind are having the largest potential. The potential of solar generation in India is around 20-30 MW/km² (in total > 100 GW). As per C-WET (Chennai), the overall estimated wind potential is about 103 GW at 80 m hub height. It can be observed that high wind and solar resources are mainly confined in southern, western States viz. Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra, Gujarat, Rajasthan & Jammu & Kashmir. [1]

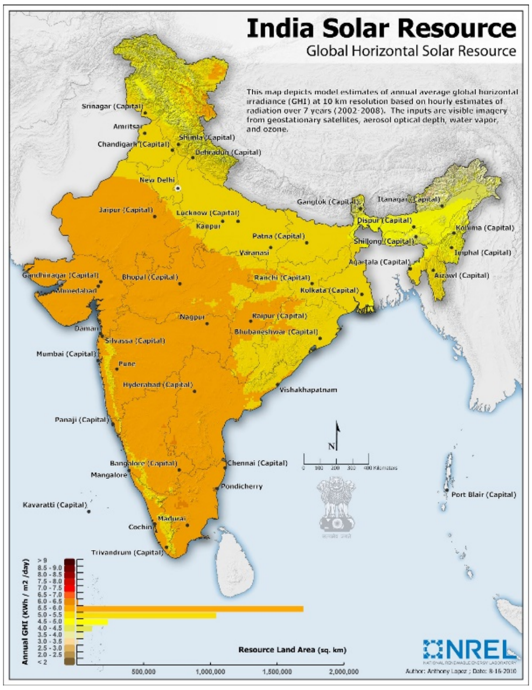

Figure 9 - Global Horizontal Solar Resource

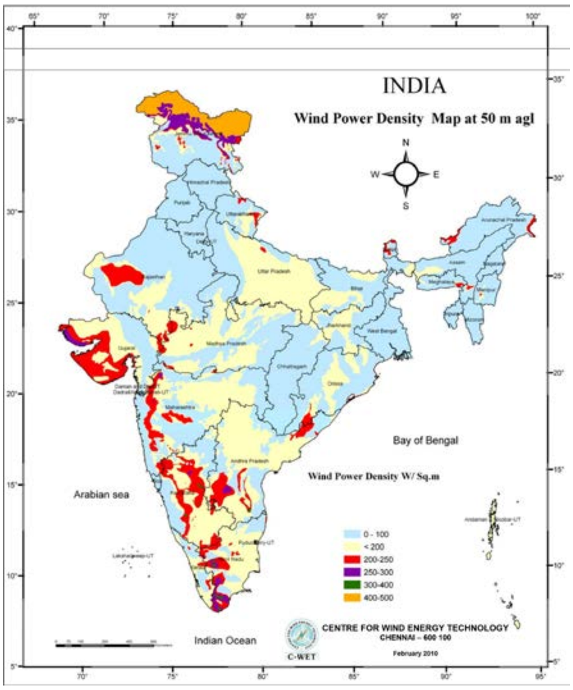

Figure 10 - Wind Power Density Map

It has been estimated that the potential of Biomass/Bagasse power using agro waste & agro-industrial residues is around 17 GW and 5 GW respectively. In addition, estimated potential of power generation from micro/mini/small hydropower plants is about 15 GW from 5718 identified sites. The estimated potential of renewable generation capacity of various sources is shown in Figure 11 [1].

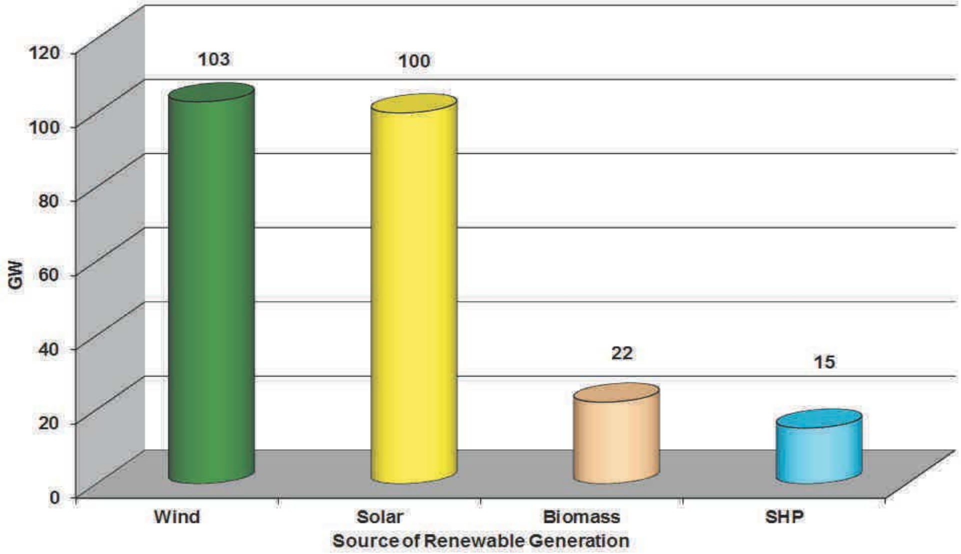

Figure 11 - Potential (installed capacity) per renewable energy source in GW

4.1 Present Situation

Since 2008 there has been a considerable growth of the use of renewable energies in India. As on March 31st, 2013 the installed RES capacity in India was around 28 GW.

Compared to wind, the installed solar capacity is still relatively low. In March 2013, the installed solar capacity was close to 1.7 GW only. [9]

Table 5 - Installed capacity per RE source in MW [9]

Source	**Installed capacity (31.03.2013)**
Wind Power	19,051.45
Small Hydro Power	3,632.25
Biomass Power	1,264.80
Bagasse Cogeneration	2,337.43
Waste to Power (Urban)	96.08
Solar Power (SPV)	1,686.44
Total	**28,068.45**

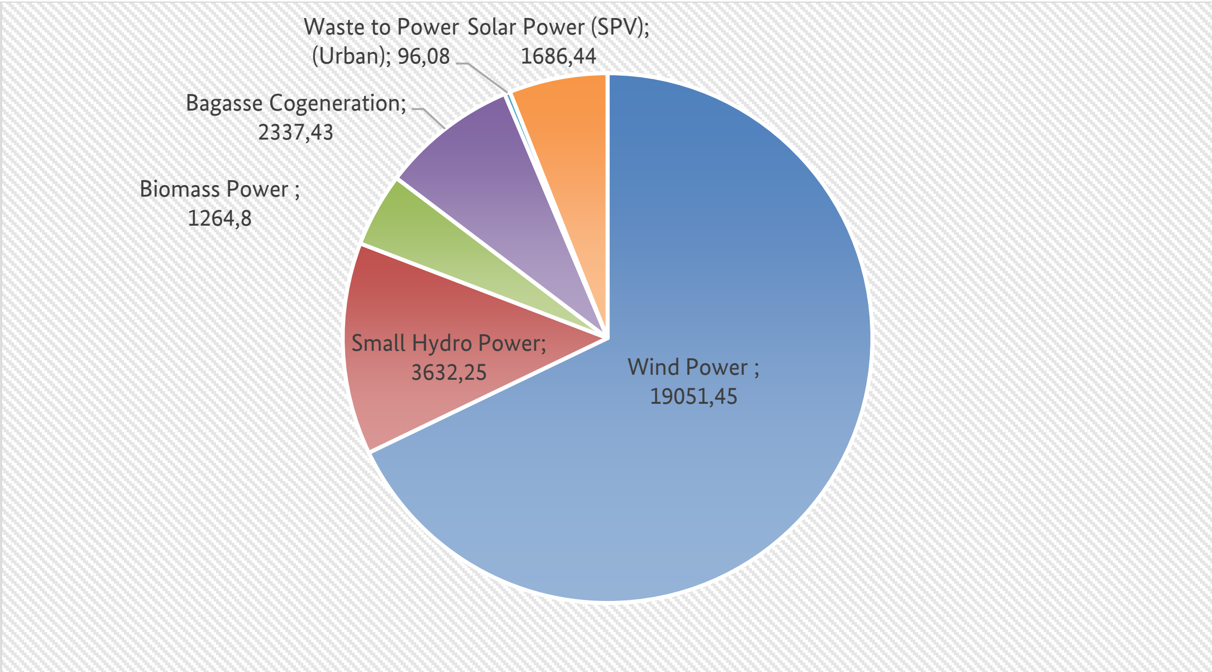

Figure 12 - Installed RES capacity (MW) [9]

4.2 Incentives

4.2.1 Grant of Connectivity, Long term Access and MTOA[1] of RE plant in ISTS[2]

As per CERC (Grant of Connectivity, Long term Access and Medium term Open access in ISTS) regulation of 2010, a generator or a group of generators using renewable sources of energy including hydro with aggregate installed capacity of more than 50 MW can apply to the CTU for direct connection with the interstate transmission system.

In case of renewable generation plants having a capacity of more than 250 MW, it shall not be required to construct a dedicated transmission line to the point of connection and they shall be taken into account for coordinated transmission planning by the CTU and CEA. [1]

[1] Medium-Term Open Access
[2] Inter-State Transmission

4.2.2 Sharing of Transmission Charges

In case of solar plants, which are to be commissioned by 2014, as per CERC (Sharing of inter-state transmission charges and losses) Regulations 2010, ISTS charges/losses are exempted. [1]

4.2.3 Renewable Energy Certificate

CERC has introduced Renewable Energy Certificate (REC) mechanism which is a market based instrument to promote renewable sources of energy. This mechanism encourages setting up of large RE generation capacities at resource-rich locations. Through this instrument, obligated entities, viz. DISCOM, Open Access Users and Captive Power Consumers can fulfil their renewable purchase obligation (RPO). The concept is based on 'un-bundling' the green power into two parts, one is 'electricity' another is 'green/environmental attribute' which gets converted to renewable energy certificate (REC). [1]

4.2.4 Development of Renewable Regulatory Fund

As per CERC (Indian Electricity Grid Code) Regulations, 2010, wind generators shall be responsible for forecasting their generation up to an accuracy of 70%. For actual generation within ±30% of the schedule, no UI[3] charge would be payable/receivable by the Generator. UI charges for within this variation, i.e. within ±30% would be applicable to the host state. In case of solar generation no UI charge shall be payable/receivable by the generator. The host State shall bear the UI charges for any deviation in actual generation from the schedule [1].

4.2.5 Projected Renewable Purchase Obligation (RPO)

In line with the Electricity Act 2003 and National Electricity Policy, SERC have specified a trajectory on Renewable Purchase Obligation (RPO) by each state in 12th Plan. The RPO target is 7-15% depending on the availability of renewable capacity in the state, demand/energy consumption projection etc. [1]

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[3] Unscheduled Interchange

5 Expansion Plans

For Generation Planning Studies, in the base case, demand corresponding to actual requirements in 2009-10 and thereafter a 9% GDP growth rate and 0.9 & 0.8 elasticity during 12th & 13th Plans respectively, has been considered to assess capacity addition requirements for the 12th and 13th Plan periods. Thereafter, reduction in Peak Demand and Energy Requirement, on account of BEE's Energy Efficiency Measures and DSM programmes, has also been accounted for, while arriving at the final Peak Demand & Energy Requirement for generation planning studies. A load factor of about 78% was considered while estimating the peak demand for 2016-17 and 76% for 2021-22. [8]

Table 6 - Demand adopted for generation planning studies [8]

	Energy Requirement (GWh)	Peak Load (MW)
	9% GDP Growth rate (0.9 / 0.8 Elasticity in 12th / 13th Plan)	9% GDP Growth rate (0.9 / 0.8 Elasticity in 12th / 13th Plan)
2016-17 (12th Plan end)	1,403	197,686
2021-22 (13th Plan end)	1,993	289,667

5.1 Capacity expansion planning

Base Case

According to [8], capacity addition requirements during the 12th Plan sum up to around 76GW. In accordance with the Low Carbon Growth Strategy, it has been accorded to give priority to renewable energy sources, hydro and nuclear generation capacity. Accordingly, a feasible hydro capacity addition of 9.2GW and a nuclear capacity addition of 2.8GW have been taken as must-run during the 12th Plan period. Gas based capacity of around 1.1GW only has been considered by these studies coming from assured, local resources. Besides this, 1.2GW import from Bhutan has also been considered. The balance capacity addition to meet peak demand would be from coal based capacity which is 62.6GW.

High Gas Scenario

In the High Gas Scenario an additional gas based capacity of 12GW, which is under construction has been considered in addition to the 1.1GW of the base case scenario [8].

High Gas + High Renewable Scenario

As per revised programme of MNRE, a total renewable capacity addition of 30GW during the 12th Plan period has been considered instead of 18.5GW in the base case Scenario [8].

Table 7 - Planned capacity addition according [8] (0.9 Elasticity)

Type of Capacity	Capacity addition required during 12th Plan with Demand corresponding to 9% GDP GR & 0.9 Elasticity		
	Base Case Scenario	High Gas Scenario	High Gas + Higher Renewables Scenario
Thermal (MW)	63,781	63,686	60,486
- Coal (MW)	62,695	50,600	47,400
- Gas (MW)	1,086	13,086	13,086
Hydro (MW)	9,204	9,204	9,204
Nuclear (MW)	2,800	2,800	2,800
Subtotal (MW)	**75,785**	**75,690**	**72,490**
Renewables (MW)	18,500	18,500	30,000
Imports (MW)	1,200	1,200	1,200
Total with Renewables and Imports (MW)	**95,485**	**95,390**	**1,03,690**
Coal Requirement (MT)	842	772	764

Table 8 - Planned capacity addition according [8] (1 Elasticity)

Type of Capacity	Capacity addition required during 12th Plan with Demand corresponding to 9% GDP GR & 1.0 Elasticity		
	Corresponding to Base Case Scenario with 1.0 Elasticity	High Gas	High Gas + Higher Renewables
Thermal (MW)	84,486	85,286	82,086
- Coal (MW)	83,400	72,200	69,000
- Gas (MW)	1,086	13,086	13,086
Hydro (MW)	9,204	9,204	9,204
Nuclear (MW)	2,800	2,800	2,800
Subtotal (MW)	**96,490**	**97,290**	**94,090**
Renewables (MW)	18,500	18,500	30,000
Imports (MW)	1,200	1,200	1,200
Total with Renewables and Imports (MW)	**116,190**	**116,990**	**125,290**
Coal Requirement (MT)	905	844	837

5.2 Grid expansion planning

During the 12th Plan period, a total of about 109,000 circuit kilometres (ckm) of transmission lines, 270,000 MVA of AC transformation capacity and 13,000 MW of HVDC converter stations are estimated to be added.

Table 9 - Transmission Lines [ckm] [8]

Transmission Lines (AC and HVDC)	Expected end of 11th Plan	Expected addition during 12th Plan	Expected by end of 12th Plan
HVDC Bipole lines	9,452	**9,440**	18,892
765 kV	4,164	**27,000**	31,164
400 kV	114,979	**38,000**	152,979
220 kV	140,976	**35,000**	175,976
Total Transmission Line	**269,571**	**109,440**	**379,011**

Table 10 –Substation [8]

Substations (AC and HVDC)	Expected at the end of 11th Plan	Expected addition during 12th Plan	Expected by end of 12th Plan
HVDC Terminal Capacity, MW	13,500	13,000	26,500
AC Substation capacity, MVA	372,894	270,000	642,894

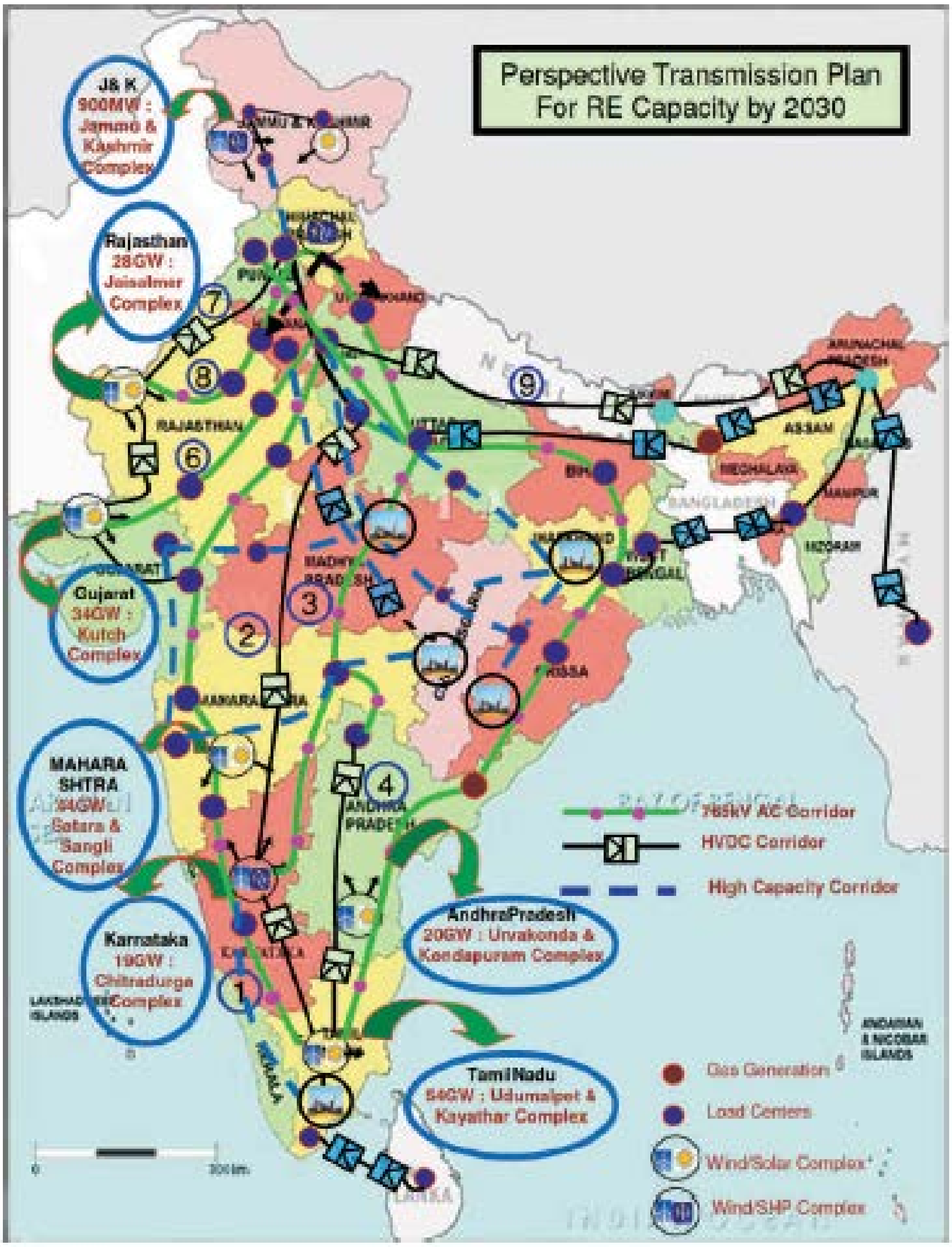

Figure 13 - High voltage transmission corridors for the integration of renewable energies until 2030

Numerous studies have been carried out for identifying required grid reinforcements for accommodating renewable generation until 2030. These ultra-high transmission corridors, partly based on 765kV AC-technology, partly based on HVDC technology are documented in [1].

As depicted in Figure 13, the plan considers a complete overlay grid structure for India for integrating the available renewable potential.

6 Backup - Planned capacity addition according to a Power Grid Report

Alternative plans for the addition of renewable generation sources in India can be found in the Power Grid Report [1].

Capacity addition through RES in the 12th Plan (until 2017) is about 42GW: 30.4 GW wind, 9.5 GW solar and 2.1 GW of Small Hydro. Under the Jawaharlal Nehru National Solar Mission (JNNSM) launched in 2010, the government intends to commission 20GW of grid-connected solar power by 2022. The following Tables show the generation capacity expansion planning according to the 12th Plan:

Table 11 - Wind / Solar Addition Plan in RE Rich States

State	Existing capacity [MW]		Addition in 12th Plan [MW]		Total capacity [MW]	
	Wind	*Solar*	*Wind*	*Solar*	*Wind*	*Solar*
Tamil Nadu	6,370	7	6,000	3,000	12,370	3,007
Karnataka	1,783	6	3,223	160	5,006	166
A.P	392	92	5,048	285	5,440	377
Gujarat	2,600	600	5,083	1,400	7,683	2,000
Maharashtra	2,460	17	9,016	905	11,476	922
Rajasthan	2,100	200	2,000	3,700	4,100	3,900
Jammu & Kashmir	-	2	12	102	12	104
Total	*15,705*	*924*	*30,382*	*9,552*	*46,087*	*10,476*

Table 12 - Small Hydro Addition Plan in RE Rich States

State	Existing capacity (MW)	Addition in 12th Plan (MW)	Total capacity (MW)
Karnataka	527	719	1,246
Himachal	443	996	1,439
J&K	118	362	480
Total	*1,088*	*2,077*	*3,165*

The annual capacity addition programme during the 12th Plan in each of the above states as informed by them is given in Table 13, Table 14 and Table 15.

Table 13 - Wind based capacity addition programme (MW)

State	2012-13	2013-14	2014-15	2015-16	2016-17
Tamil Nadu	1,200	1,200	1,200	1,200	1,200
Karnataka	620	600	700	780	523
A.P	1,503	1,435	257	1,202	651
Gujarat	2,633	300	1,150	500	500
Maharashtra	1,376	1,570	2,340	2,250	1,480
Rajasthan	400	400	400	400	400
Jammu & Kashmir	0	4	4	2	2
Total	**7,732**	**5,509**	**6,051**	**6,334**	**4,756**

Table 14 - Solar based capacity addition programme (MW)

State	2012-13	2013-14	2014-15	2015-16	2016-17
Tamil Nadu	200	500	600	800	900
Karnataka	40	40	40	40	0
A.P	15	0	120	100	50
Gujarat	350	350	300	300	100
Maharashtra	125	150	175	200	255
Rajasthan	500	1000	1000	900	300
Jammu & Kashmir	1	0	101	0	0
Total	**1231**	**2040**	**2336**	**2340**	**1605**

Table 15 - Small hydro based capacity addition programme (MW)

State	2012-13	2013-14	2014-15	2015-16	2016-17
Himachal Pradesh	105.45	219.65	165.15	307.45	198.02
Karnataka	161.21	108.5	152.8	150.8	145.3
J&K	26.5	35.95	39.0	108.0	152.35
Total	***293.16***	***364.1***	***356.95***	***566.25***	***495.67***

7 Potential Issues and Recommendations for System Impact Studies

7.1 Potential Issues and High Level Recommendation

The Indian power system is a large interconnected power system with long transmission lines, high power transfers and ambitious plans with regard to newly installed power plants.

Therefore most studies relating to the grid integration of renewables are planning studies with the aim at identifying required grid reinforcements for the integration of additional capacity and load.

Power Grid has already executed numerous studies related to renewable generation aiming at identifying required network upgrades for the integration of the planned renewable energy power plants [1]. These studies are mainly load flow and contingency analysis studies looking at worst case power transfers.

7.2 Objectives and Contents of Proposed Studies

7.2.1 Objectives

For a system that develops as dynamically as the Indian power system, planning studies, as already executed by Power Grid are required on a regular basis.

However, besides the identification of the required additional transmission lines, stability studies focused on all the various stability aspects are required for ensuring a secure and reliable system operation.

Due to the large additions of renewable generation and conventional generation, these studies should not only analyse the impact of renewable generation but also have to consider all planned additional generators and other planned grid reinforcements.

8 Summary and Overall Recommendations

This report provides an overview of the Indian power sector and the Indian power system. Existing renewable generation and plans for further expansions are addressed in more detail.

For assisting Indian power companies in the grid development tasks, the following services could be offered:

- Review of studies looking at the integration of planned renewable generation.
- Review of existing or proposed grid codes for renewable generation.
- Workshop and training regarding the operation of power systems with high share of renewable generation.
- Assistance in the execution of stability studies.

Because of the large complexity of the Indian power system and the large number of studies that have already been executed, a detailed scope of work for studies cannot be proposed without any direct interaction with Indian power utilities for better understanding their actual requirements and needs.

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Registered offices
Bonn and Eschborn, Germany
Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
Phone: +49 61 96 79-0
Fax: +49 61 96 79-11 15
Email: info@giz.de
Internet: www.giz.de

Sector project:
Technology Cooperation in the Energy Sector

Responsible
Klas Heising / Stephan Remler
Contact: Stephan.Remler@giz.de

Authors
Moeller & Poeller Engineering
(M.P.E.) GmbH
(Consultancy)

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