# An Overview of Indian Power Sector and Development Plan for Distribution Sector

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# Present status of Indian Power Sector

| | |
|---|---|
| Installed Capacity | 360.5 GW (31.07.2019) |
| Gross Electricity Generation | 1374 BU (2018-19) |
| Per capita consumption (in kWh) | ~1250* (2018-19) |
| % AT&C Losses | ~18.39% (2018-19) |
| Peak Demand Met (in GW) | 183 GW (June 2019) |

* Provisional

# Fuelwise Generation Installed Capacity in India

(As on 31-07-2019)

| Fuel | Installed Capacity (MW) | % Share in Total IC |
|---|---|---|
| Coal | 195809 | 54.32% |
| Gas | 24937 | 6.92% |
| Lignite | 6260 | 1.73% |
| Diesel | 638 | 0.18% |
| **Thermal -Total** | 227644 | 63.15% |
| **Hydro** | 45399 | 12.59% |
| **Nuclear** | 6780 | 1.88% |
| **RES** | 80633 | 21.37% |
| Total | 3,60,456 | 100.00% |

# Ownership-wise Installed capacity

(As on 31-07-2019)

| Sector | Central | State | Private | Total |
|---|---|---|---|---|
| **Thermal** | 66718 | 73509 | 87417 | 227644 |
| **Hydro** | 15047 | 26595 | 3394 | 45399 |
| **Nuclear** | 6780 | 0 | 0 | 6780 |
| **Renewable** | 1632 | 2350 | 76651 | 80633 |
| **Total** | **90,176** | **1,02,818** | **1,67,462** | **3,60,456** |
| **%age contribution** | **24.32%** | **29.51%** | **46.17%** | 100% |

# Sector-wise Energy Contribution Vs IC

**(During 2018-19)**

| Sector | Installed Capacity (IC %age) | Energy contribution (% age ) |
|---|---|---|
| **Thermal** | 63.6% | 78.0% |
| **Hydro** | 12.7% | 10.2% |
| **Nuclear** | 1.9% | 2.7% |
| **Renewable** | 21.8% | 9.1% |
| **Total** | 100% | 100% |

# Power Supply Position

**( as per CEA report)**

| | 2017-18 | 2018-19 | 2019-20 (upto July2019) |
|---|---|---|---|
| Energy Requirement (BU) | 1213.33 | 1274.56 | 464.7 |
| Energy Supplied (BU) | 1204.69 | 1267.20 | 462.5 |
| Shortage % | -0.7% | -0.6% | -0.5% |
| Peak Demand GW | 164.07 | 177.02 | 183.8 |
| Peak Met GW | 160.75 | 175.52 | 182.5 |
| Shortage % | -2.0% | -0.8% | -0.7% |

# Category wise Consumption In India

| Category | Avg %age of consumption (2017-18) |
|---|---|
| Domestic | 24.2% |
| Commercial | 8.5% |
| Industrial | 41.5% |
| Agriculture | 18.1% |
| Misc. | 6.5% |

# Demand Projections of the Country

| Year | Peak Demand (GW) | CAGR | Energy Requirement (BU) | CAGR |
|---|---|---|---|---|
| 2016-17 | 156.9 | | 1160 | |
| 2021-22 | 225.7 | 7.5% | 1566 | 6.2% |
| 2026-27 | 298.8 | 5.8% | 2047 | 5.5% |

**Source: 19th Electric Power Survey (EPS) published by CEA**

# Proposed Installed Capacity by 2022 (As per National Electricity Plan of CEA)

| Source | Capacity in GW | %age |
|---|---|---|
| Coal | **217.3** | **45%** |
| Hydro | **51.3** | **11%** |
| Gas | **25.7** | **5%** |
| Nuclear | **10.1** | **2%** |
| **Renewable** | **175.0** | **37%** |
| **Total IC** | **479.4** | **100%** |

| IC of non-fossil fuel/Total IC (%) |
|---|
| **49.3%** |

# Proposed Installed Capacity by 2027 (As per Draft National Electricity Plan )

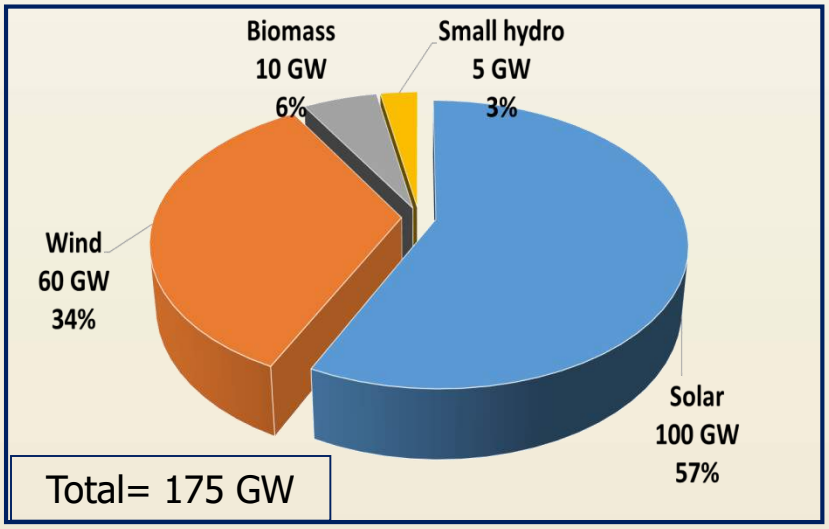
| Source | Capacity in GW | %age |
|---|---|---|
| Coal | **238** | **39%** |
| Hydro | **63** | **10%** |
| Gas | **26** | **4%** |
| Nuclear | **17** | **3%** |
| **Renewable** | **275** | **44%** |
| **Total IC** | **619** | **100%** |

| IC of non-fossil fuel/Total IC (%) |
|---|
| 57.4% |

# DEMAND PROJECTION ( 19th EPS)

| Year | Peak Demand (GW) | Installed Capacity (GW) | Energy Requirement (BU) |
|---|---|---|---|
| 2021-22 | 225.7 | 479 | 1,566 |
| 2026-27 | 298.8 | 619 | 2,047 |

# RES CONTRIBUTION IN TOTAL ENERGY REQUIREMENT DURING 2017-22




| Scenario | RES IC by 2022 (GW) | RES Energy Contribution (BU) in Total Energy requirement |
|---|---|---|
| I | 175 | 327 (20.8%) |

## India's Intended Nationally Determined Contribution (INDC)-

**40 % cumulative power installed capacity should be from non-fossil fuels by 2030.**

| Year | Likely IC (GW) | Likely IC of Fossil Fuel (GW) | Likely IC of Non-Fossil Fuel (GW) | % of Non-Fossil Fuel in IC |
|---|---|---|---|---|
| March 2022 | 479.5 | 243.1 | 236.4 | 49.3% |
| March 2027 | 619.1 | 263.9 | 355.2 | 57.4% |

# PER CAPITA CONSUMPTION (Avg World)

| Country | kWh |
|---|---|
| World Average | 3052 |
| USA | 12833 |
| Australia | 9892 |
| Japan | 7865 |
| Germany | 7015 |
| Italy | 5099 |
| Brazil | 2516 |
| China | 4047 |
| India | 1250 |

**(IEA- International Energy Agency)**

# AT&C LOSSES

| Discom | AT&C losses |
|---|---|
| | |
| Ps VVNL,Meerut | 37.87% |
| PuVVNL, Varansi | 37.14% |
| DVVNL, Agra | 40.13% |
| MVVNL, Lucknow | 38.57% |
| KESCO, Kanpur | 27.32% |
| | |
| **UP Total** | **37.95%** |
| | |
| **All India Avg** | **20.86%** |
| | |
| (Source: UDAY PORTAL) | |
| WORLD AVG 9% | |

# MAIN FACTORS FOR HIGH AT&C LOSSES

- **Technical Losses**
  - Overloading of existing lines and substation equipment
  - Low HT:LT lines ratio
  - Poor repair and maintenance of equipment
  - Non-installation of sufficient capacitors/reactive power equipment
  - Non balancing loading of system

- **Commercial Losses**
  - Low metering/billing/collection efficiency
  - Theft, pilferage of electricity and tampering of meters
  - Absence of Energy Accounting and Auditing
  - Wrong estimation of un metered/ agriculture energy

# INITIATIVE BEING TAKEN BY DISTRIBUTION COMPANIES

- Achieving 100% Metering, Billing & Collection efficiency
- Metering of all 11 KV feeders & Dist transformers for energy auditing
- Augmentation of overloaded distribution system
- Implementation of HVDS
- Use of star rated Distribution Transformers
- Use of ABC in theft prone areas
- IT initiative like SCADA, DMS, GIS mapping, AMR/AMI etc
- Segregation of rural & agriculture feeders etc

# THRUST AREAS IN DISTRIBUTION

- 24x7 RELIABLE, QUALITY & AFFORDABLE POWER TO ALL
- 100% HOUSEHOLDS ELECTRIFICATION-Already Achieved
- REDUCTION OF AT&C LOSSES BELOW 10%
- FINANCIALLY VIABLE DISCOMS
- IMPROVEMENT IN SUB-TRAN. AND DIST.NETWORK
- 100% METERING, BILLING & COLLECTION
- ADOPTION OF IT FACILITIES IN DISTRIBUTION
  (Smart Grid, GIS Mapping , SCADA, AMR, RMUs etc.)
- MORE CONSUMER SATISFACTION
- EFFECTIVE CONSUMER GRIEVANCES REDRESSAL

# GOI SCHEMES/PROGRAMS FOR DEVELOPMENT OF DISTRIBUTION SYSTEM

- **24x7 Power For All:** A joint initiative of GOI with States to provide 24x7 power supply to All consumers
- **IPDS:** Launched in 2014 for providing funding for augmentation of distribution system in urban areas. Earlier RAPDRP scheme subsumed in this scheme.
- **DDUGJY** : Launched in 2014 for electrification of villages, augmentation of distribution system in rural areas and feeder segregation etc. Earlier RGGVY scheme subsumed in this scheme. 100% villages have been electrified in May 2018 under the scheme.
- **SAUBHAGAYA :** Launched in 2018 for providing funding for 100% household electrification by Dec 2018
- **UDAY :** Launched in 2015 for Operational and Financial Turnaround of Power Distribution Companies (DISCOMs)
- **NSGM:** Launched in 2015 for development of smart Grid in the country.30% funding is being provided for smart grid projects

# Initiatives taken in Energy Efficiency

- Star labeling of appliances and equipment (A.C, Refrigerator, fans, Ag motors, Dist Transformers etc.)- covered 23 appliances /equipment with star rating of 10 equipment are mandatory
- UJALA Scheme for providing LED bulbs to Domestic consumers for energy efficiency in domestic sector- Replacement of 77 Crore bulbs with LED bulbs- more than 35.8 Crore LED bulbs distributed
- LED based Street Lightning(NSLP)- Replacement of 1.4 Crores Street Lighting with LED lighting- more than 97 Lakh Street Lights have been installed
- PAT(Perform Achieve & Trade) Scheme for energy efficiency in Industries and Discoms ( Ph-I, II & III)
- Demand side Management (DSM) in Agriculture-use of energy efficient Agriculture pump sets
- Energy Conservation Building Code(ECBC) Revised in 2017- applicable for commercial buildings having load more than 100 KW
- Certification of Energy Auditor and Energy Managers

# Distributing Perspective Plan -2022

- *CEA is preparing a Distribution Perspective Plan- 2022 for sub-transmission and distribution system infrastructure requirement by the Discoms by 2022 to meet the expected demand and to provide 24x7 supply to all consumers. It would also help the industry to gear up to supply the requisite equipment as and when requirement.*

# National Plan– Network Expansion

| SN | Description | Unit | March 2017 | March 2022 | Increase % |
|---|---|---|---|---|---|
| 1 | S/S (66/33/22 kV)--Count | Nos | 32,991 | 43,097 | 31% |
| 2 | S/S (66/33/22 kV)--Capacity | MVA | 3,81,583 | 5,25,539 | 38% |
| 3 | Feeders(66/33/22kV)-Count | No | 30,373 | 45,330 | 49% |
| 4 | Feeders(66/33/22kV)-Length | CKM | 4,30,011 | 5,39,934 | 26% |
| 5 | Feeders (11kV) Nos | Nos | 1,93,911 | 2,68,087 | 38% |
| 6 | Feeders (11kV) Length | CKM | 42,05,043 | 56,22,121 | 34% |
| 10 | LT Feeders (1-Ph & 3 Ph ) | CKM | 75,96,311 | 95,92,453 | 26% |

# National Plan– Network Expansion

| Sr | Description | Unit | March 2017 | March 2022 | Increase % |
|---|---|---|---|---|---|
| 1 | Distribution Transformer(DT) (11/0.433 KV) count | Nos | 93,29,354 | 122,67,104 | 31% |
| 2 | Distribution Transformer(DT) (11/0.433 KV) capacity | MVA | 5,04,831 | 6,61,632 | 31% |

# CEA REGULATIONS FOR DISTRIBUTION TRANSFORMERS

- **As per CEA ( Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2010 ( Amended in 2015) , All Distribution Transformers should be as per relevant Indian Standards ( IS 1180) . DTs are under mandatory certification by BIS.**

- **The Standard Technical Specifications of DTs have been included in the Standard Bidding Document (SBD) 0f DDUGJY/IPDS**

- **Choices :**

| | |
|---|---|
| **Type** | **Oil /Dry** |
| **Core material** | **CRGO/ Amorphous** |
| **Winding** | **Cu / Al** |
| **Oil** | **Mineral/ K class** |
| **Star Rating** | **3*/4*/5*** |

( IS under Amendment to include new star rating notified by MOP)

# CEA REGULATIONS FOR DISTRIBUTION TRANSFORMERS

- All safety measures should be as per the Central Electricity Authority (Measures relating to Safety and Electricity Supply) Regulations 2010 ( as amended upto date)
- The transformer can be oil filled, or dry type depending on requirements and shall be as per the Central Electricity Authority (Measures relating to Safety and Electricity Supply) Regulations 2010.
- Dry type of transformers only shall be used for installations inside the residential and commercial buildings;

# New Technologies in Distribution Transformers

- **Under Ground Distribution substations - Space constraint in big cities**
- **On line monitoring of data from Distribution transformers- whether AMR meters can be made a compulsory part of the Transformer Specifications**
- **DTMU (Dist Transformer Monitoring Units) are being installed under smart grid projects for Health Monitoring of Dist transformers for Reliability**
- **Compact and fail safe transformers**
- **Using Ring Main Units (RMUs) with Important Distribution Transformers for higher reliability of power supply to consumers**
- **K class oil filled transformers – New Indian standard is being developed by BIS**

# THANK YOU