UNIT – IV

POWER / ENERGY SECTOR

Introduction

Energy is one of the most important building blocks in human development, and as such, acts as a key factor in determining the economic development of all the countries. In an effort to meet the demands of a developing nation, the energy sector has witnessed a rapid growth. It is important to note that on renewable resources are significantly depleted by human use, whereas renewable resources are produced by on-going processes that can sustain indefinite human exploitation.

Tamil Nadu is already a pioneer state in implementing 24x7 Power to all sectors. The state has already achieved 100% village electrification level.

Tamil Nadu Electricity Board (TNEB) was formed on July 1, 1957 under section 54 of the Electricity (Supply) Act 1948 in the State of Tamil Nadu as a vertically integrated utility responsible for power generation, transmission and distribution. The electricity network has since been extended to all villages and towns throughout the State. As per the provisions under the section 131 of the Electricity Act, 2003 TNEB was restructured on 1.11.2010 into TNEB Limited; Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO); and Tamil Nadu Transmission Corporation Limited (TANTRANSCO). Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO) is responsible for electricity generation and distribution within the state.

Tamil Nadu Transmission Corporation Limited (TANTRANSCO) is responsible for electricity transmission of the state To satisfy the energy needs of the State, Tamil Nadu Generation and Distribution Corporation Limited has an installed capacity of 18,747.28 MW which includes TANGEDCO owned State projects, share from the Central Generating Stations (CGS) and private producers including renewable energy generators. Other than this, the State has installations in renewable energy sources like wind mill, solar, biomass and cogeneration up to 10,479.61 MW.

TEDA is Tamil Nadu Energy Development Agency. It is an independent agency setup by Government of Tamil Nadu in the year 1984, as a registered society with a specific purpose – to create awareness and migrate the State from using fossil fuels to renewable energy.

Of the total renewable energy capacity of about 32,730MW installed all over India, TN alone has about 8326.86MW, thus about 25.44% of the total installed capacity. In the important sector of wind energy, this number is even more dominant, with Tamil Nadu having about 34.31% of the total wind energy installed capacity in India.

GENERATION:

Status of Demand – Supply:

The present average demand of power in the State is around 14,500 MW 15,500 MW. Tamil Nadu operates the most diversified electricity generation portfolio in India, with an installed capacity of 31,894 MW which includes 50% of renewable energy, 28% from coal based power plants including shares from central generating stations, 5% from nuclear power plants, 3% from gas power plants and 14% through Long term and Medium term Open Access and Captive Power Plants (CPP).

Tamil Nadu is a pioneer in renewable energy, having an installed capacity of 15,779 MW of renewable energy, which constitutes around 50% of the State's total installed capacity. The State has harnessed 11,717 million units of wind energy and 3,842 million units of solar energy during 2019-20.

RENEWABLE ENERGY SOURCES:

A 2018 report lists Tamil Nadu as one of the top nine renewable energy markets in the world. Today, 14.3 per cent of all the energy demand in the state is met by renewable energy, primarily solar and wind.

There is an ever increasing demand for energy in spite of the rising prices of oil & other fossil fuel / depletion of fossil fuels. Energy demand, in particular electricity production has resulted in creation of fossil fuel based power plants that let out

substantial greenhouse gas / carbon emission into the atmosphere causing climate change and global warming.

The Government of Tamil Nadu is committed to mitigate the climate change effects by bringing out policies conducive to promote renewable energy generation in the State. The Government intends to make renewable energy a people's movement just like rain water harvesting.

The State is blessed with various forms of renewable energy sources. The environment-friendly renewable energy sources are perennial in nature, available locally and quite suitable for decentralized applications. The important renewable energy sources are as follows:

- Wind Energy (including offshore wind)
- Solar Energy
- Biomass and other forms of bio energy
- Small Hydro
- Tidal Energy
- Ocean Thermal Energy

Among the above mentioned sources, the first three renewable energy sources, viz., wind, solar and bio energy are being harnessed in a big way in India and also in Tamil Nadu. With a view to develop and propagate the non-conventional sources of energy, the Tamil Nadu Energy Development Agency (TEDA) was formed.

Cumulative achievement of renewable energy up to 01.04.2019 (MW), TEDA

Renewable Energy	**Programme/ Systems Cumulative achievement up to 01.04.2019 (MW)**
Wind Power	8468.11 MW
Bagasse Cogeneration	721.40 MW
Biomass Power	265.59 MW
Solar Power (SPV)	2724.55 MW
Total	**12179.65 MW**

Wind Energy:

Tamil Nadu is pioneer in promoting wind energy in the country. The State has the highest wind power capacity in the India, contributing about 23% of the country's total wind installed capacity, with an installed capacity of 8,506.72 MW contributing about 27% to the State's total installed power capacity.

Total wind installed capacity is 8507 MW. With 23% of India's total wind installed capacity, Tamil Nadu holds first place in the country. The State has harnessed around 11,717 million units of wind energy during 2019-20 upto January 2020.

Maximum wind generation harnessed to the grid was 5095.6 MW on 27.07.2017 and 107.317 MU on 19.07.2018.

Solar energy:

Total solar installed capacity is 3974 MW. The State has harnessed around 3,842 million units of solar energy during 2019-20 up to January 2020 which is around 35% increase compared to last year. Maximum solar generation harnessed to the grid was 3018 MW on 19.02.202 and 20.12 MU on 17.02.2020.

Green Energy:

A renewable energy based future is necessary not only addressing climate change challenges, but also for local communities to move away from the current fossil fuel economy, reduce pollution, enhance energy security, lower risk of fuel spills and reduce the need for imported fuels. Also, it helps in conserving the nation's natural resources.

The "Tamil Nadu Electric Vehicle Policy 2019" has been released by the Hon'ble Chief Minister of Tamil Nadu on 16.09.2019. Government of Tamil Nadu has also notified Industries, Energy and Transport Departments as nodal Agencies for the implementation of this policy in the State. The installed capacity is 31,894 MW of which 7,175 MW is own generation (from all its power plants) by TANGEDCO.

- The year 2020 is the fifth anniversary of the adoption of Sustainable Development Goals (SDGs) by 193 countries at the UN General Assembly.

Gas Turbine Station:

The Gas Turbine Power Stations of TANGEDCO are generating power as per the availability of natural gas being supplied by M/s.Gas Authority of India Limited (GAIL). The installed capacity and generation during FY 2019- 2020 are as below.

- Thirumakottai (Kovilkalappal) Gas Turbine Power Station has installed capacity of 107.88 MW and has generated 223 MU.

The Gas Turbine Generator has achieved a continuous running of 118 days for one time. Against the 4,50,000 SCM/day agreed quantity of gas only 2,25,000 SCM/day (approximately) is being supplied and the plant is operated at 31% of PLF.

Valuthur Gas Turbine Power Station-Phase-I has installed capacity of 95 MW and has generated 604 MU. The Gas Turbine Generator has achieved a continuous running for more than 100 days twice during FY 2019-2020. Against the 4,50,000 SCM/day agreed quantity of gas only 4,05,000 SCM/day (approximately) is being supplied and the plant is operated at 96% of PLF.

Valuthur Gas Turbine Power Station- Phase-II has installed capacity of 92.2 MWand has generated 489 MU. The Gas Turbine Generator has achieved a continuous running for more than 100 days once during FY2019-2020. Valuthur Gas Turbine Power Station has generated power with the minimum variable cost of generation of Rs.2.28 per Unit.

Kuttalam Gas Turbine Power Station has installed capacity of 101 MW and has generated 86 MU. Against the 4,50,000 SCM/day agreed quantity of gas only 2,70,000 SCM/day (approximately) is being supplied and the plant is operated at 39% of PLF.Basin Bridge Gas Turbine Power Station has installed capacity of 120MW (4x30MW). The fuel used for this station being Naphtha, the station is being operated only during emergencies based on the grid demand.

Biomass Energy:

Biomass is a renewable and widely available resource for generating electricity. Since it is carbon neutral, it is considered an eco-friendly energy source. TANGEDCO promotes Bio-mass power plants in Tamil Nadu with co-operation extended by the Tamil Nadu Energy Development Agency.

- Bio-mass based Cogeneration Plants
- Bagasse based Cogeneration Plants
- Biomass gasification based Power Projects
- Municipal Solid waste & Vegetable based Power Plant

Biomass has always been an important energy source for the country considering the benefits it offers. It is renewable, widely available, carbon-neutral and has the potential to provide significant employment in the rural areas. Biomass is capable of providing firm energy. About 32% of the total primary energy use in the country is still derived from biomass. Ministry of New and Renewable Energy has initiated a number of programmes for promotion of efficient technologies for its use in various sectors to ensure derivation of maximum benefits. For efficient utilization of biomass, bagasse based cogeneration in sugar mills and biomass power generation / co-generation in industries have been taken up under biomass power and cogeneration programme.

Biomass power & cogeneration programme is implemented with the main objective of promoting technologies for optimum use of country's biomass resources for grid power generation and captive power production. Biomass materials used for power generation include juliflora, bagasse, rice husk, straw, cotton stalk, coconut shells, soya husk, de-oiled cakes, coffee waste, jute wastes, groundnut shells, saw dust etc.

It is thermo-chemical conversion of solid biomass into a combustible gas mixture (producer gas) through a partial combustion route with air supply restricted to less than that theoretically required for full combustion. The newest method for generating electricity is gasification. This method captures 65-70% of the energy present in solid

fuels by converting it first to combustible gases. These gases are then burnt as we currently burn natural gas, and create energy. The technologies for this synthetic fuel are still new and therefore not quite ready for commercial production.

Composition of Producer gas:

- Hydrogen - 15%-20%
- Methane - 1%-5%
- Carbon Dioxide - 9%-12%
- Nitrogen - 45%-55%
- Calorific value - 1000 – 1200 kcal/m3

Biogas:

A gas mixture of methane, carbon dioxide and small quantities of hydrogen and hydrogen sulphide – is created under air exclusion through the fermentation of organic substances with microorganism assistance. Biogas is a gas mixture, consisting of approximately 40 to 75 % methane (CH4), 25 to 60 % carbon dioxide (CO2), and approx. 2 % of other gases (hydrogen, hydrogen sulphide and carbon monoxide).

Advantages of Biogas:

- No smoke , Clean Fuel
- Produces organic manure for a sustainable agriculture
- It reduces fossils fuels Dependency
