SHIFT TO RENEWABLE ENERGY

Renewable Energy (RE) uses inexhaustible and natural resources, such as the sun, wind, plants and water, to generate sustainable and clean energy. The environmental and economic benefits of RE include:

- Energy generation without greenhouse gas emissions and reduction of air pollution.
- Energy diversification reducing dependency on imported fuels.
- Economic development and jobs in manufacturing, installation and more.

Renewable Energy Sources

Solar Energy uses the power of sunlight for generating electricity to heat and light buildings, for hot water, cooling and a variety of other commercial and industrial uses.

Wind Energy uses the energy in wind for electricity generation, battery charging, pumping water and grinding grain. Many turbines are built close together to form a wind farm to provide utility-scale grid power generation.

Biomass Energy uses organic matter such as plants, residue from agriculture and forestry and organic components of municipal and industrial waste to produce power. For example, wood has been used to provide heat for thousands of years.

Hydro Power uses capture of flowing water to produce electricity. Large and small-scale hydropower production technologies are available.

Geo-Thermal Energy uses the heat from the earth as the source for energy. Geothermal energy sources range from shallow ground to hot water and hot rock found a few miles beneath the earth's surface.

Ocean Energy produces two types of energy: Thermal Energy from the sun's heat and Mechanical Energy from the tides and waves. Oceans cover more than 70% of the earth's surface, making them the world's largest solar collectors. The sun's heat warms the surface water more than the water in the deep and this temperature difference creates thermal energy.

Renewable Electricity Projects

Small Scale Technologies

These RE systems or devices are located where the power is used (e.g.)roof-tops of buildings. Small-scale RE technologies are localised and decentralised (i.e. provide electricity or cooling / heating to meet local needs such as an apartment, industrial plant, recreation centre or local community). Small-scale RE generation systems are either (1) embedded (i.e. physically connected) into an electricity grid, (2)connected to district heating and/or cooling network or (3) used as a stand-alone off-grid system.

Roof Top Solar

Roof Top Solar electricity systems use photovoltaic panels, installed on rooftops of buildings, to convert sunlight into electricity.

Small-scale Wind Turbines

Small Wind Turbine' refers to a size that would suit the needs of a domestic dwelling or a small business. These are less than 100 KW and are most commonly in the range 1-10 KW.

Domestic Solar Water Heaters

Domestic Solar Water Heating systems are commonly used for providing hot water in residential homes. The solar hot water systems have roof-mounted solar collectors (or panels) that absorb sunlight to heat the water, and a water storage tank. These systems may also have a gas or electric booster to heat the water when necessary on cloudy days.

Heat Pumps

Heat pump technology will take the heat out of your house (where you don't want it) or elsewhere, and will transfer it into the water. And, as the excess heat in your house or in the atmosphere is heated by the sun, this is indeed a form of solar hot water.

Commercial Industrial Solar Water Heaters

Another promising use for solar thermal systems is for commercial and small industrial applications (e.g.) hospitals, laundries, schools, multifamily houses.

Solar Cooling Systems

Solar Cooling Systems refer to air conditioning systems that use solar power. This can be done through passive solar, solar thermal energy conversion and photovoltaic conversion (sunlight to electricity)

Large Scale RE Systems

RE systems can be set up that feed into the electricity grid. Grid-interactive renewable power projects based on wind power, biomass and solar (above 1 MW) and small hydro (below 25 MW) are mainly private investment driven, with tariff policy regimes established by State Electricity Regulatory Commissions (SERC).

Medium Scale RE System

Community Based - Decentralized Distributed Generation (DDG)

Solar Power Plant

Wind Power Plant

Biomass Plant

Small Scale Hydro Power Plant

DDG comprises small, modular, decentralized off-grid RE systems located in or near the place where energy is used. It is ideal for villages that are located in off-grid areas or are not connected to the electricity grid due to distance/terrain. However these stand-alone systems are suitable due to advantages for local employment, recycling of local waste and local control over infrastructure and usage of energy.

DDG systems can be from single source (e.g. a central wind or solar) or multiple (hybrid) sources (e.g.a combination of wind and solar). DDG provide an alternative to or an enhancement of the traditional electric power system. It is electric Power generating Units connected to the network on the consumer side. It involves low T&D loss.

Distributed Solar Plant

Distributed Biogas Plant

Distributed Wind Plant

Policies and Incentives to Promote RE

- **Renewable Portfolio Standards (RPS)**

  Indian states have been giving RPS in order to promote RE. The RPS mechanism generally places an obligation on (a) electricity supply companies to produce a specified fraction of their electricity from renewable energy sources and (b) distribution companies to purchase from RE sources. For this purpose, State Electricity Regulatory Commissions are encouraging the development of renewable energy by obligating electric utilities to pay pre–established above-market rates for RE power fed onto the grid. These tariffs, which may vary depending on the type of resource used, provide renewable generators with a set stream of income from their projects.

- **Renewable Energy Certificates (RECs)**

  The shift to RE is also promoted through RE Certificates. These are given for the technology and environmental attributes of electricity generated from renewable sources and are distinct from the power generated. These attributes are unbundled from the physical electricity and REC is issued for the former. In effect, there are two products available to be sold or traded – the RE Certificate and the power generated. One REC represents that 1MWh of energy is generated from renewable sources. Those interested in trading or investments need not use RE power to own RE Certificates.

- **Open Access**

  Open Access allows large users of power — typically having connected load of 1 megawatt (MW) and above — to buy cheaper power from the open market or from renewable energy sources. The Electricity Act, 2003 allows open access to the transmission and distribution (T&D) networks of the licensees with the payment of a surcharge and payment by open access consumers for using the lines (wheeling charge) to compensate them for the loss of revenue. The idea is that the customers should be able to choose among a large number of competing power companies–instead of being forced to buy electricity from their existing electric utility monopoly. It helps large consumers particularly the sick textile, cement and steel industrial units by ensuring regular supply of electricity at competitive rates and boost business of power bourses.

- **Net Metering**

  The net metering system encourages on-site generation of RE power through roof top systems (e.g. solar photovoltaic panels or windmills) that can also feed into the grid. Generators will receive compensation for the quantity put into to the grid. Net metering system ensures that generators' electric meters track the quantity of electricity used on site and the quantity that is fed into the grid. When generation is insufficient to meet on-site needs, electricity from the grid may be used.

Net metering is a billing agreement between the electricity service provider and their customers to facilitate the connection of small, renewable energy-generating systems to the power grid. The grid acts as the battery back-up for the excess power generated. For net- metering to be implemented, a special meter is to be installed. The existing service connection meter needs to be replaced with the new meter which measures the energy generation, the import and export in respect to its produce.

How it works?

In grid-connected solar PV systems the solar energy produced by the solar panels is converted to AC (alternating current) by a solar grid inverter. The output of the solar grid inverter is connected to the distribution board switch board of the building. The electrical energy flows to the loads of the buildings (lights, fans, appliances etc.). If the solar energy produced is more than what the building loads consume, the surplus energy will automatically be exported to the distribution network (the grid). If there is less solar energy than what the loads of the building require, the shortfall will be drawn from the grid (energy import).

When the clientis producing more power than is being consumed, the electric meter runs backward generating credits. Whenever the net metering customer uses more power than is being produced, the meter runs forward normally.

Tariff structure in net metering

Although every state varies in its compensation for electricity to be paid for the produced power, the prevalent methodology is paying to the energy difference between the import and export of power generated.

Net metering customers are charged only for the net power that they consume from the electricity service provider that has accumulated over a specific period. In other words, if their renewable energygenerating systems make more electricity than is consumed, they may be credited or paid for the excess electricity contributed to the grid over that same period. For example, Generation: Units/month = 360 kWh Consumption: Units/month = 400 kWh. The consumer has to pay for the extra 40 units he used according to the existing tariff structure in the state.

Consumer Guide, Tamil Nadu Solar Net- Metering
(http://teda.in/pdf/Solar%20net%20metering%20Consumer%20Guide.pdf

- **Subsidies**

  Financial incentives, such as grants, loans, rebates, and tax concessions, to encourage RE development, is given by the Ministry of New and Renewable Energy, through Indian Renewable Energy Development Agency Limited (IREDA)and state governments.

- **Generation Based Incentive (GBI)**

  Government of India has introduced and incentivised additional generation of electricity from grid-connected wind and solar power projects through Generation Based Incentive. Under the scheme, in addition to payments for feed-in tariffs - for the quantity of power put into the grid- financial incentives are given to generators of wind and solar electricity. Under the scheme, a GBI will be provided to wind electricity producers at the rate of Rs. 0.50 per unit of electricity fed into the grid for a period not less than 4 years and a maximum of 10 years with a cap of Rs. 100 lakhs per MW.

- **Accelerated Depreciation**

  Accelerated depreciation refers to any one of several methods by which a company, for 'financial accounting' or tax purposes, depreciates a fixed asset in such a way that the amount of depreciation taken each year is higher during the earlier years of an asset's life. For financial accounting purposes, accelerated depreciation is expected to be much more productive during its early years, so that depreciation expense will more accurately represent how much of an asset's usefulness is being used up each year. For tax purposes, accelerated depreciation provides a way of deferring corporate income taxes by reducing taxable income in current years, in exchange for increased taxable income in future years. This is a valuable tax incentive that encourages businesses to purchase new assets.

  In the case of solar power generation, in order to incentivize the entrepreneurs to enter the solar power generation market, the Government of India has allowed claiming 80% depreciation in year one of the commissioning of the solar power generation plant.

Renewable Energy in Electricity Act 2003, National Electricity Policy 2005 and National Tariff Policy

Electricity Act 2003	Preamble (Page No-1) "An Act to consolidate the laws relating to generation, transmission, distribution, trading and use of electricity and generally for taking measures conducive to development of electricity industry, …, promotion of efficient and environmentally benign policies …."
Mandate of Regulators to promote RE	Section 2(47) "Non-discriminatory provision for the use of transmission lines or distribution system or associated facilities with such lines or system by any licensee or consumer or a person engaged in generation in accordance with the regulations specified by the Appropriate Commission". Section 86 (1) (e) of the Electricity Act 2003 states that the State Commission shall promote cogeneration 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. Section 61 (h) the Appropriate Commission shall, .., specify the terms and conditions for determination of tariff and in doing so shall be guided by the following namely : …… …… (h) the promotion of cogeneration and generation of electricity from renewable sources of energy, (i) the National Electricity Policy and Tariff Policy.
National Electricity Policy	"5.2.20 Feasible potential of non-conventional energy resources, mainly small hydro, wind and bio-mass would also need to be exploited fully to create additional power generation capacity. With a view to increase the overall share of non-conventional energy sources in the electricity mix, efforts will be made to encourage private sector participation through suitable promotional measures."
National Tariff Policy	6.4 "… It will take some time before non-conventional technologies can compete with conventional sources in terms of cost of electricity. Therefore, procurement by distribution companies shall be done at preferential tariffs determined by the Appropriate Commission. (2) Such procurement by Distribution Licensees for future requirements shall be done, as far as possible, through competitive bidding process … within suppliers offering energy from same type of non-conventional sources. ..."

Institutions To Promote RE

Organisation	*Objective*	*Details*	*Address*
Ministry of New and Renewable Energy (MNRE)	Nodal Ministry of the Government of India for all matters relating to new and renewable energy.	Facilitate research, design, development, manufacture and deployment of new and renewable energy systems/ devices for transportation, portable and stationary applications in rural, urban, industrial and commercial sectors	Block-14, CGO Complex, Lodhi Road, New Delhi-110 003, India. Tel: +91-11-24362772 Email: secy-mnre@nic.in
Indian Renewable Energy Development Agency Limited (IREDA)	Promotes, develops and extends financial assistance for Renewable Energy and Energy Efficiency/ Conservation Projects.	Give financial support to specific projects and schemes for generating electricity and / or energy through new and renewable sources and conserving energy through energy efficiency	3rd Floor, August Kranti Bhawan, Bhikaiji Cama Place, New Delhi – 110 066. Tel : +91 11 26717400 - 413 Fax: +91 11 26717416 Email: cmd@ireda.gov.in
Renewable Energy Development Agencies	Functions as the state nodal agency for promoting RE Works under the MNRE umbrella and guided by its policy and respective state's policy	To promote the use of new and renewable sources of energy (NRSE) and to implement projects therefore. To promote energy conservation activities. To encourage research and development on renewable sources of energy.	Tamil Nadu Energy Development Agency E.V.K Sampath Maaligai, 5th floor, No.68, College Road, Chennai-600 006 Phone: (044) 28224830 & 28236592 Fax: 2822 2971 Email: info@teda.in

Organisation	*Objective*	*Details*	*Address*
			Karnataka Renewable Energy Development Agency No.39,"Shanthigruha" Bharath Scouts & Guides Building Palace Road Tel: (080)22207851/22208109/9480691041. Fax: 080-22257399 Email: kredlnce@yahoo.co.in Kerala Agency for Non-conventional energy and Rural Technology, Police Parade Ground, Thycaud, Thiruvananthapuram – 695014. Tel: (0471)2329854, 2338077, 2334122, 2333124 &2331803 Fax: (0471)2329853 Email: director@anert.in Andhra Pradesh: Non-conventional Energy Development Corporation of Andhra Pradesh Limited [NEDCAP] 5-8-207/2, Pisgah Complex, Nampally, Hyderabad - 500 001. Tel: (040)2320 2391 Fax: (040)23201666 Email: info@nedcap.gov.in, nedcap@ap.nic.in
State Electricity Regulatory Commission	Rationalisation of electricity tariff, transparent policies regarding subsidies, promotion of efficient and environmentally benign policies and for matters connected therewith or incidental thereto.	Section 84 (1) (e) mandates the electricity regulatory commission to promote RE	Tamil Nadu: No 19A, Rukmini Lakshmipathy Salai, Egmore, Chennai - 600 008. Tel: (044) 28411376,28411378, 28411379 Fax : (044) 28411377. Email: tnerc@nic.in

Organisation	*Objective*	*Details*	*Address*
			Karnataka: 6th & 7th Floor, Mahalaxmi Chambers, # 9/2, M.G.Road, Bangalore - 560 001 Tel: (080) 25320213 / 214, 25320339, 25323765 Fax: 080-25320338, Email: kerc35@bsnl.in Andhra Pradesh: 4th & 5th Floors 11-4-660, Singareni Bhavan Red Hills, Hyderabad 500 004 Tel: (040) 23397381 Fax: (040) 23397378 &23397489 Email: chmn@aperc.gov.in Kerala: K.P.F.C. Bhavanam, C.V. Raman Pillai Road, Vellayambalam Thiruvananthapuram Kerala 695010 Tel: 0471 2735544 Fax:0471 2735599 E-mail: kserc@erckerala.org