Solar Energy

The radiation that is received from the sun and utilized in the form electricity and thermal energy by using various available technologie like photovoltaic panels, solar heater etc.

Background

- India lying in tropical belt has an advantage of receiving peak solar radiation for 300 days, amounting 2300-3,000 hours of sunshine equivalent to above 5,000 trillion kWh.
- India's current installed solar power capacity, according to **Central electricity authority,** is 26025.97 MW which is 34% of total **renewable energy sources** i.e, 75055.92 MW till February 2019.
- India facing problems in fulfilling its energy demand, solar energy can play an important role in providing energy security.
- Debate of global warming and climate change is compelling the world to move from fossil based energy towards clean and green energy.
- With its pollution free nature, virtually inexhaustible supply and global distribution, solar energy is very attractive energy resource.
- India's Intended Nationally Determined Contributions (INDC's) commitment include 100 GW of solar power out of 175 GW renewable energy by 2022.

Need of solar energy

- **Energy security:**
    - India energy demands is largely fulfilled by non-renewable source of energy.
    - The scarcity of these fossil resources stresses the need for renewable energy sources.
    - Abundance of solar energy can fulfill India clean energy demands.
    - India is dependent on imports to fulfill its energy demands, thereby incurring huge expenditure and uncertainty with regards to energy security.
- **Economic development:**
    - India being a developing economy needs proper electricity for industrial growth and agriculture.
    - India also needs self sufficiency and minimal cost in power generation, assured regular supply, which will boost industries and economy.
- **Social development:**
    - The problem of power cuts and unavailability of electricity especially in rural area, leads to improper human development.
    - Mostly energy demands are fulfilled by subsidised kerosene, leading to loss for exchequer.
- **Environment concern:**
    - India's large part of energy demand is fulfilled by thermal energy largely dependent on fossil fuels.
    - It also causes environment pollution
    - Solar energy is clean form of energy resource, which can be a substitute.

Technology

- **Solar Photovoltaic:** Solar photovoltaic (SPV) cells convert solar radiation (sunlight) into electricity. A solar cell is a semi-conducting device made of silicon and/or other materials, which, when exposed to sunlight, generates electricity.
- **Solar thermal**: Solar Thermal Power systems, also known as Concentrating Solar Power systems, use concentrated solar radiation as a high temperature energy source to produce electricity using thermal route.

Types

- **Solar for grid connected electricity:**
    - Grid interactive solar energy is derived from solar photovoltaic cells and concentrated solar power Plants on a large scale.
- **Solar for off-grid solutions:**
    - While, the areas with easier grid access are utilizing grid connectivity, the places where utility power is scant or too expensive to bring, have no choice but to opt for their own generation.
    - They generate power from a diverse range of small local generators using both fossil fuels (diesel, gas) and locally available renewable energy technologies (solar PV, wind, small hydro, biomass, etc.) with or without its own storage (batteries). This is known as off-grid electricity.

Advantages

- Solar Energy is available throughout the day which is the peak load demand time.
- Solar energy conversion equipments have longer life and need lesser maintenance and hence provide higher energy infrastructure security.
- Low running costs & grid tie-up capital returns **(Net Metering)**.
- Unlike conventional thermal power generation from coal, they do not cause pollution and generate clean power.
- Abundance of free solar energy in almost all parts of country.
- No overhead wires- no transmission loss

Challenges in adoption

- India’s solar story is largely built over **imported products**.
- India’s **domestic content requirement** clause ia facing legal challenge at WTO.
- India is facing challenge to balance **Prioritising domestic goals and WTO commitments**.
- The **dumping** of products is leading to profit erosion of local manufacturers.
- Indian domestic manufacturers aren’t technically and economically strong to compete with Chinese companies.
- China’s strong manufacturing base is giving stiff challenge to domestic manufacturer.
- **Land availability** in India for solar plant is less due to high population density.
- India's **solar waste** is estimated to be around 1.8 million by 2050 also needs to be tackled.

Government initiatives

- **Ministry of new and renewable energy** is the nodal agency to tackle India's renewable energy issues.
- **National Solar Mission** is a major initiative of the Government of India and State Governments to promote ecologically sustainable growth while addressing India's energy security challenge.
- **The Indian Renewable Energy Development Agency (IREDA)** is a Non-Banking Financial Institution under the administrative control of this Ministry for providing term loans for renewable energy and energy efficiency projects.
- **National institute of solar energy** is created as autonomous institution under MoNRE is apex

body for R&D.
- Establishment of **solar parks and ultra major solar power project** and enhancing grid connectivity infrastructure.
- Promotion of **canal bank and canal tank solar infrastructure**.
- Sustainable rooftop implementation of **Solar transfiguration of India (SRISTI)** scheme to promote rooftop solar power projects in india.
- **Suryamitra** programme to prepare qualified workforce.
- **Renewable purchase obligation** for large energy consumer customers.
- National green energy programme and **green energy corridor**.

Potential

For a developing country like India, where electricity for every home was once considered a dream is now close to reality. The government initiative of **'power for all'** is changing the socio-economic structure of the country.

- The sector also has immense **potential to create new jobs;** 1 GW of Solar manufacturing facility generates approximately 4000 direct and indirect jobs.
- In addition solar deployment, operation and maintenance creates additional recurring jobs in the sector.
- Advancements are underway for storage, which has the potential to revolutionise this sector globally, till then **dependence on fossils can be reduced** by gradually increasing the share of renewables.
- India is expected to be **8% of global solar capacity by 2035**. With the future potential capacity of 363 Gigawatts (GW), India can be a global leader in term of encashing energy sector advantages.

International initiatives

- India's commitment as part of **INDC at Paris climate deal** to reduce the emissions intensity of its GDP by **33 to 35% by 2030 from 2005 level**.
- To achieve about **40 per cent 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, including from Green Climate Fund.
- The establishment of International Solar Alliance (ISA) of more than 122 countries initiated by India, most of them being sunshine countries, which lie either completely or partly between the Tropic of Cancer and the Tropic of Capricorn to promote solar energy.
- To mobilize more than US $ 1000 billion of investments needed by 2030 for massive deployment of solar energy, and pave the way for future technologies adapted to the needs.

Way Forward

- Strong financial measures are required to finance the solar projects, innovative steps like **green bonds, institutional loans and clean energy fund** can play a crucial role.
- Promotion of research and development in renewable energy sector, especially in storage technology.
- Proper mechanism should be provided to tackle China's dumping of solar equipments.
- Framework to avoid unnecessary delays in policy decision making and implementation.
- India needs a **Solar Waste Management and Manufacturing Standards Policy**.