Roadmap of Solar Energy for Universal Energy Access

For Prelims: Clean Energy, Solar Energy, International Solar Alliance**,** National Solar Mission, PM-KUSUM

For Mains: Solar Energy and Development in India, Challenges Related to Solar Energy, Government Schemes to Enhance Solar Energy Production in India.

Source: PIB

Why in News?

Recently, the **Ministry of New and Renewable Energy (MNRE)**, in partnership with the **International Solar Alliance,** unveiled the report titled **'Roadmap of Solar Energy for Universal Energy Access'** developed under **India's G20 presidency in 2023**. It showcased how solar energy **can play a key role in achieving electricity access** and providing socio-economic benefits globally.

- The roadmap is unveiled during **the 4th G20 Energy Transition Working Group** held in Goa. It focuses on achieving **Universal Energy Access by 2030 and** highlighted the crucial role of **solar mini grids** in driving **sustainable energy solutions.**

What are the Key Highlights of the Report?

- The roadmap emphasizes solar energy as a **key solution to achieve Universal Energy Access by 2030.**
- It identifies around **59% (396 million people) of the unelectrified population best suited for electrification through solar-based mini-grids.**
- Approximately **30% of the unelectrified population (203 million people) can be electrified through grid extensions, and the remaining 11% of the unelectrified population (77 million people) through Decentralized Renewable Energy solutions.**
- A total investment of **around USD 192 billion is required to accomplish the electrification goals,** distributed among solar-based mini-grids, solar-based decentralized renewable energy solutions, and grid extensions.
- **Viability gap funding of around 50% (USD 48.5 billion) is needed** to support mini-grid deployment.
- The roadmap underscores the importance of addressing challenges related to **policies, regulations, and financial risks** for successful and sustainable scaling up of solar energy solutions.
- It highlights the need for **technical and financial expertise, skill development, and awareness creation** in energy access-deficit regions to drive electrification initiatives.
- The report advocates for **increased investments, ecosystem development, and optimal resource utilization** to accelerate universal energy access.
- Integration of solar **PV-based cooking solutions with electrification** initiatives is emphasized as a way to enhance energy access in remote and underdeveloped areas.

What is Solar Mini-grids?

- **About:**
  - Solar mini-grids are **small-scale electricity generation and distribution systems** that use **solar photovoltaic (PV) technology** to generate electricity and store it in batteries.
  - They are typically designed to provide electricity to **communities or areas that either need to be connected to the main power grid** or experience frequent power outages.
- **Importance:**
  - Around **9% of the global population still lacks access to electricity,** with Sub-Saharan Africa and rural areas being the most affected.
    - Solar mini-grids can play a crucial role in addressing this challenge by providing reliable and affordable electricity to these communities.
  - Moreover, **over 1.9 billion people worldwide lack access to clean cooking,** and solar mini-grids can also power electric stoves or other cooking appliances, providing clean cooking solutions.
- **Benefits of Solar Mini-grids:**
  - **Reliability:** Solar energy, with the aid of energy storage systems, offers a reliable source of electricity that remains resilient even **during natural disasters or power outages.**
  - **Sustainability:** Solar energy is a clean and renewable energy source, which helps reduce greenhouse gas emissions and mitigate climate change.
  - **Scalability:** Solar mini-grids can be scaled up or down depending on the energy demand of the community, making them a flexible option for energy access.
  - **Solar Mini-grids Affordability:**
    - Solar energy is a cost-effective alternative to diesel generators in remote regions or islands, where expensive fuel transportation can lead to electricity costs as high as **Rs. 36 per unit.**
      - Harnessing **solar power offers a sustainable and economically viable solution** to reduce electricity expenses in these areas.
    - Deployment of decentralized solar is **supported through Feed-in Tariffs and tariff** restructuring for grid-connected capacity.
    - Expected reduction in battery costs with large-scale procurement further boosts the development of solar mini-grids.

What are the Challenges in the Deployment of Solar Energy for Universal Energy Access?

- Lack of **enabling policies and regulations** that can support the deployment of solar energy for universal energy access.
- Challenges in equipment manufacturing, on-ground execution, and maintenance need to be addressed for sustained affordability.
- Accumulation of dust on solar panels reduces their output by up to 30 percent in a month, necessitating regular cleaning.
  - Current water-based cleaning methods use about 10 billion gallons annually, but waterless methods are labor-intensive and cause scratching.
- **High financial risks in underdeveloped regions** increase project costs for developers, widening the gap between consumer affordability and supplier viability.
- Need for **more technical and financial expertise** to implement and maintain solar mini-grids.

What is the International Solar Alliance (ISA)?

- **About:**
  - Co-founded by India and France during 2015 during the **UN Climate Change Conference**, the **ISA** is an action-oriented, member-driven, collaborative platform for increased deployment of **solar energy** technologies.
  - Its basic motive is to facilitate energy access, ensure energy security, and drive energy transition in its member countries.
  - ISA is the nodal agency for implementing **One Sun One World One Grid (OSOWOG)**, which seeks to transfer solar power generated in one region to feed the electricity demands of others.
- **Headquarters:**

    - The Headquarters is in India with its **Interim Secretariat** being set up in Gurugram.
- **Member Nations:**
    - A total of 109 countries have signed the ISA Framework Agreement and 90 have ratified it.
    - All member states of the **United Nations** are eligible to join the ISA.
- **Observer Status to International Solar Alliance:**
    - The **United Nations General Assembly (UNGA)** has granted Observer Status to the International Solar Alliance (ISA).
    - It will help provide for regular and well-defined cooperation between the Alliance and the United Nations that would benefit global energy growth and development.
- **SDG 7:**
    - Sustainable Development Goal 7 (SDG7) calls for "affordable, reliable, sustainable and modern energy for all" by 2030. It's three core targets are the foundation for our work: By 2030:

What are the Government Schemes to Enhance Solar Energy Production in India?

- **International Solar Alliance**
- **National Solar Mission**
- **Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM)**
- **One Sun, One World, One Grid (OSOWOG)**
- **Solar Park Scheme**
- **Rooftop Solar Scheme**

Way Forward

- Assisting access-deficit countries in developing enabling policy and regulatory frameworks.
- Facilitating private-sector participation in energy access projects.
- Integration of solar PV-based cooking solutions with electrification initiatives.
- Incentives and subsidies to attract investments. Exploring innovative financing models like green bonds.
- Hybridization with wind or biomass energy enhances mini-grid reliability and lowers power equipment costs.

UPSC Civil Services Examination Previous Year Question (PYQ)

Prelims

Q. Consider the following statements: (2016)

1. The International Solar Alliance was launched at the United Nations Climate Change Conference in 2015.
2. The Alliance includes all the member countries of the United Nations.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: (a)

Mains

Q. India has immense potential of solar energy though there are regional variations in its developments. Elaborate. **(2020)**