

Lesson 2: Energy Production Methods, SDG 7, and NASA Data

Goal 7:

Ensure access to affordable, reliable, sustainable and modern energy for all.



Introduction: Energy Production and Sustainability

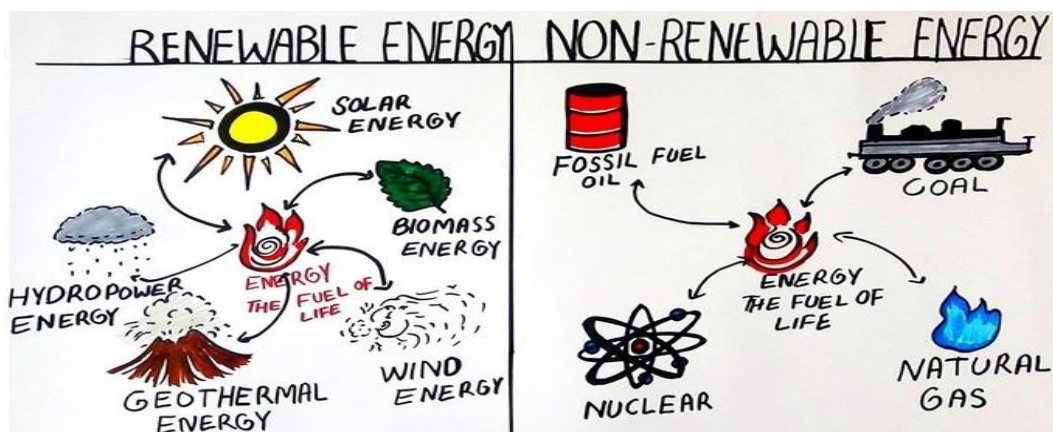
Energy production plays a central role in modern society. However, different methods of energy generation have varying impacts on the environment. In the context of **Sustainable Development Goal 7 (SDG 7)**, which aims to provide **affordable and clean energy for all**, we need to prioritize renewable energy sources that reduce environmental damage while ensuring energy accessibility.

NASA's Earth observation data is essential in helping governments and organizations optimize the placement and management of renewable energy sources like **solar, wind, and hydropower** to meet the needs of SDG 7.

Types of Energy Production

There are two main categories of energy production:

1. **Non-renewable energy:** These include fossil fuels like coal, oil, and natural gas. They contribute significantly to greenhouse gas emissions and climate change. Although still widely used, they are not aligned with SDG 7's goals due to their environmental impact.
2. **Renewable energy:** This includes sources like **solar, wind, hydropower, and geothermal energy**. These sources are more sustainable because they are abundant and have minimal impact on the environment. Renewables are central to achieving SDG 7.



Comparison between Non-renewable energy resources and renewable energy resources

Criteria	Non-renewable energy resources	Renewable energy resources
Repetitively used energy sources	One-time use	Can use again and again
Perpetual sources	Vanish one day	Available for perpetual use
Eco-friendly sources	Emits gasses and pollute the environment	Do not emit gases and does not pollute the environment
Availability	Limited quantity	Unlimited quantity.
Production cost	High	Low
Maintenance cost	Low	High
Production quantity	Large	Less

NASA's Contribution to Renewable Energy

NASA provides **Earth observation data** that helps monitor environmental conditions and assess the potential for various renewable energy sources. Here's how NASA's data can aid energy production:

1. Solar Energy:

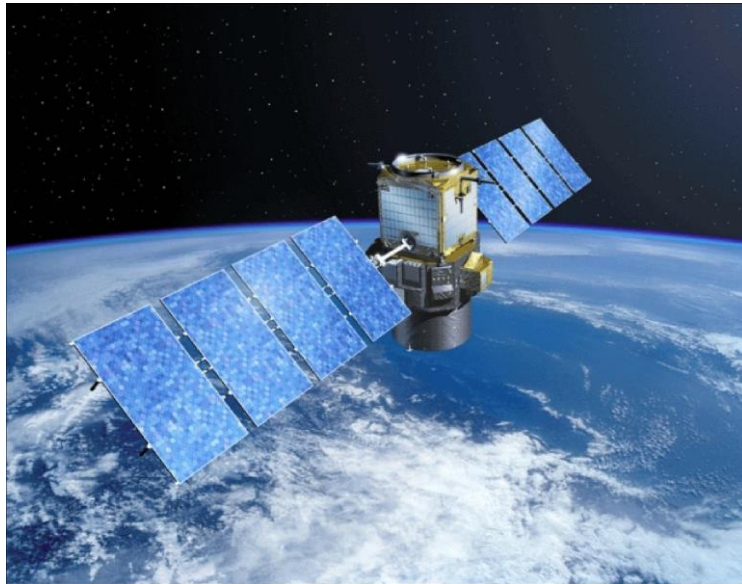
- NASA's **MODIS** and **CERES** instruments measure **solar irradiance** and **cloud cover** across the globe. This data is critical for determining the best locations for **solar farms**, where there is consistent sunlight and minimal interference from clouds. Optimizing these locations ensures efficient energy generation.

2. Wind Energy:

- NASA's **CALIPSO** and **MODIS** satellites provide **wind speed** and **directional data**, which help determine the most viable locations for **wind farms**. By identifying areas with stable and strong wind patterns, wind farms can maximize their energy production. This data supports the goal of integrating wind energy into the power grid as a clean alternative to fossil fuels.

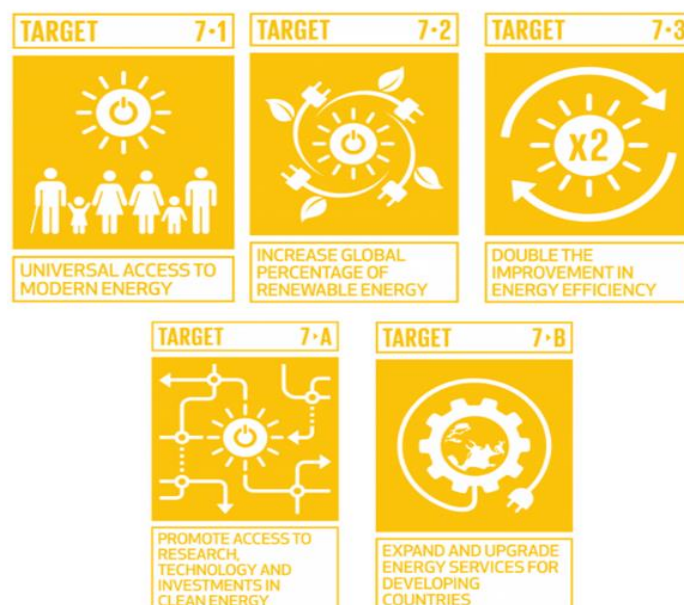
3. Hydropower:

- Hydroelectric power is produced by harnessing the kinetic energy of flowing water. NASA's **GRACE** (Gravity Recovery and Climate Experiment) and **GPM** (Global Precipitation Measurement) satellites track **precipitation**, **river flow**, and **snowmelt** data, helping optimize the use of water resources for energy generation. Hydropower plants use this information to regulate dam activity, ensuring they produce maximum energy while minimizing environmental impact.



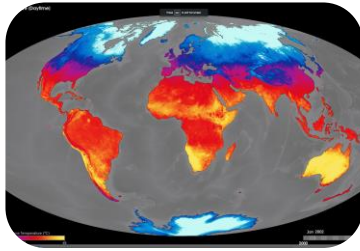
Why Renewable Energy is Crucial for SDG 7

Renewable energy sources contribute to the reduction of **greenhouse gas emissions** and improve access to reliable and affordable energy, particularly in remote and underserved areas. By switching to **solar, wind, and hydropower**, nations can reduce their dependence on fossil fuels, contributing to cleaner air, healthier ecosystems, and more sustainable energy practices.

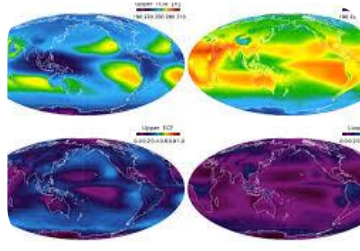


NASA Data in Action

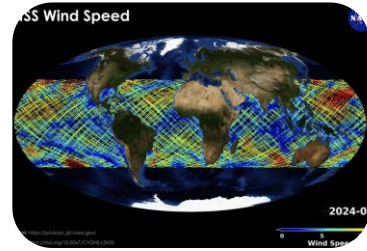
For example, in regions with abundant sunlight but variable weather, NASA's data on **cloud cover** and **solar radiation** helps solar farms operate efficiently. Additionally, NASA's data on **wind speeds** can guide the development of **offshore wind farms**, which have high potential but require detailed environmental data to ensure sustainability.



Solar radiation for common latitudes



Cloud observations



Wind speeds

Conclusion

By leveraging NASA's Earth observation data, we can identify the best locations for renewable energy projects and optimize their operation. This ensures that energy production is both sustainable and aligned with the goals of **SDG 7**, helping us move toward a future where clean, affordable, and reliable energy is available to all.

Sources:

- NASA Earth Science for Energy: [NASA Science Resources](#)
- MODIS Solar Data: [MODIS Instrument Data](#)
- United Nations SDG 7: [UN SDG 7](#)