

## Lesson: Alternating Current, SDG 7, and NASA Data

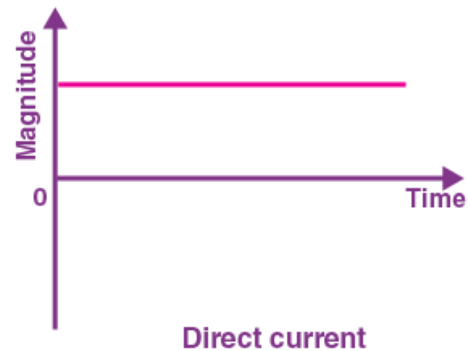
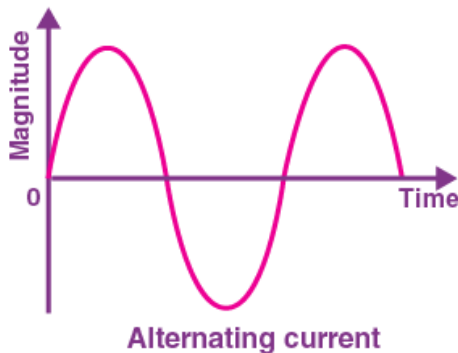
### Goal 7:

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



### Introduction: What is Alternating Current (AC)?

**Alternating Current (AC)** is a type of electrical current where the flow of charge periodically reverses direction. In contrast, **Direct Current (DC)** flows in only one direction. The ability to easily change the voltage of AC with transformers makes it ideal for the transmission of electricity over long distances.



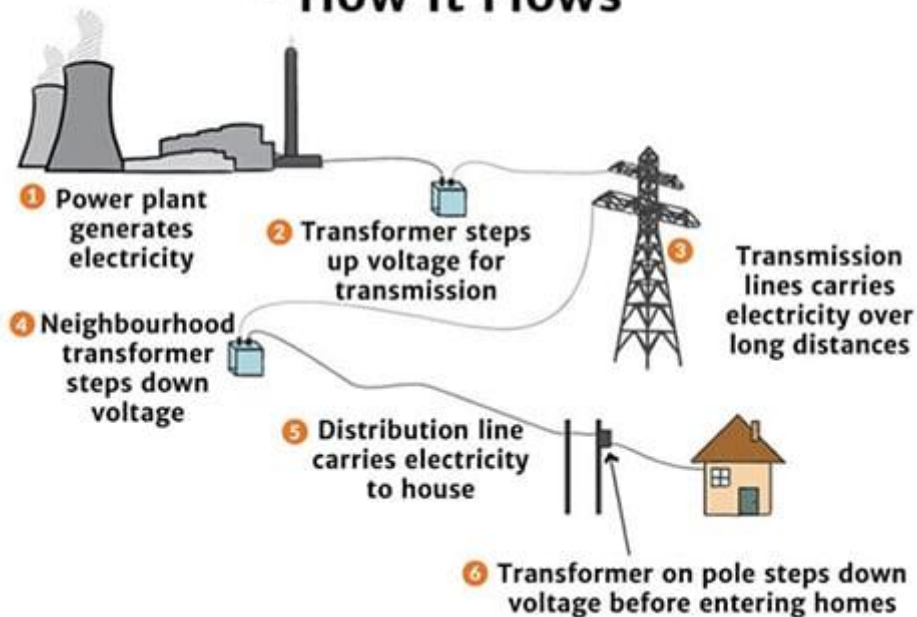
AC is widely used in power grids around the world because of its efficiency and ease of transformation between high and low voltages. This is a crucial technology for achieving the **United Nations Sustainable Development Goal (SDG) 7**, which aims to ensure access to affordable, reliable, sustainable, and modern energy for all.

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### Why Use Alternating Current?

The key advantage of AC over DC is its efficiency in **long-distance transmission**. AC can be stepped up to high voltages, which reduces energy loss as electricity travels over vast distances from power plants to homes and businesses. It is easier to convert AC to lower voltages when it reaches its destination, which makes it versatile for residential and industrial use.

# Transporting Electricity - How It Flows



In the context of **SDG 7**, AC is vital for integrating **renewable energy sources** such as solar, wind, and hydropower into national grids. These renewable energy sources generate power that can be easily converted to AC and distributed over large areas to ensure reliable access to clean energy.

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## Connection to SDG 7: Affordable and Clean Energy

SDG 7 focuses on increasing the use of **renewable energy sources** and improving energy efficiency. AC plays a pivotal role in this goal as it is the standard for energy distribution in most modern electrical grids.

1. **Solar Power**: Solar energy captured through photovoltaic cells is first generated as **DC**, but it needs to be converted to AC using **inverters** to feed into the national grid. This allows clean, renewable energy to be distributed efficiently to homes and businesses, supporting the aim of affordable and sustainable energy access for all.
2. **Wind Energy**: Wind turbines generate power as AC, which is fed directly into the grid. The **frequency and voltage** of the generated power need to match the grid's standards, and AC systems provide flexibility in managing this connection.
3. **Hydropower**: Dams and hydropower plants also produce AC electricity, which can be transmitted over long distances to major cities and industries. AC systems ensure that the energy produced by water movement can be efficiently utilized across large geographic areas.



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### NASA's Role: Leveraging Earth Observations for Renewable Energy

NASA provides critical data to optimize the production and distribution of renewable energy, which is crucial for the **global shift to clean energy** as envisioned by SDG 7.

1. **Solar Energy Optimization:** NASA satellites like **MODIS** (Moderate Resolution Imaging Spectroradiometer) and **CERES** (Clouds and the Earth's Radiant Energy System) provide data on solar radiation and cloud cover, helping scientists identify optimal locations for **solar farms**. This data is crucial for ensuring the efficient use of solar energy, which is then converted to AC for distribution.
2. **Wind Energy Assessment:** Satellites such as **CALIPSO** and **MODIS** offer information on **wind speeds and patterns**, which are used to assess the best locations for wind farms. This is essential for generating AC electricity from wind turbines and integrating it into the grid.
3. **Water Resource Management for Hydropower:** NASA's **GRACE** and **GPM** satellites monitor global water cycles, precipitation, and river flows. This data helps optimize the operation of **hydropower dams**, which generate electricity as AC. These dams rely on a steady flow of water, and the data provided by NASA supports efficient management of this resource.



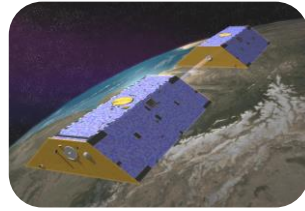
MODIS



CERES



CALIPSO



GRACE



GPM

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### Practical Example: Solar to AC Conversion

When solar panels capture sunlight, they generate **Direct Current (DC)**. However, the power grid runs on AC, so **inverters** are used to convert the DC to AC. This process allows homes, industries, and businesses to tap into the clean, renewable energy generated by the sun. NASA's data on **solar irradiance** ensures that solar panels are installed in the best possible locations to maximize energy output.

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### Conclusion

**Alternating Current (AC)** is a key technology that supports the efficient distribution of renewable energy, contributing to the global effort to achieve **SDG 7**. By integrating data from **NASA's Earth observation satellites**, we can further optimize the production and distribution of clean energy, ensuring that it reaches even the most remote areas. This collaboration between advanced technology and renewable energy infrastructure is essential for a sustainable energy future.

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### Sources:

- **NASA Science for Educators:** [NASA Educational Resources](#)
- **MODIS (NASA):** [MODIS Data](#)
- **United Nations SDG 7:** [UN SDG 7](#)