

Graphite in Renewable Energy Solar Power

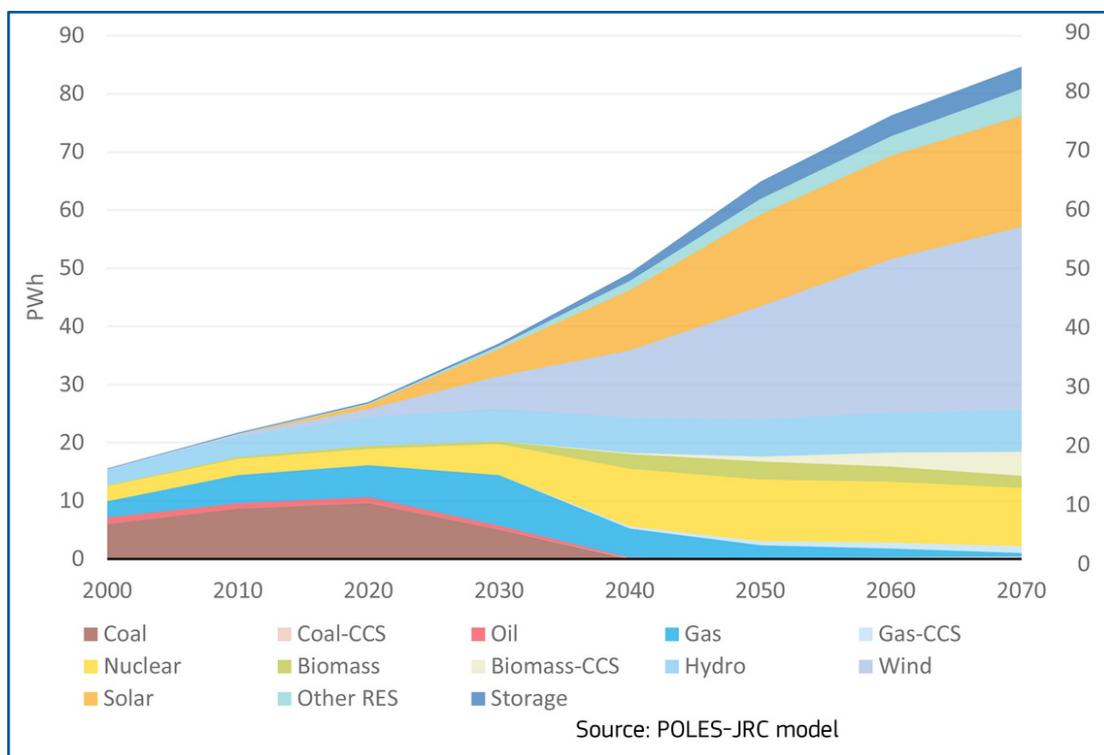


Overview

Solar power, an integral part of the renewable energy landscape, is undergoing rapid growth globally. The European solar photovoltaic market expanded significantly in 2021, with the EU solar photovoltaic market growing by 18.3 GW for a total installed capacity of 162 GW. Graphite's exceptional properties make it a key resource in the production and storage of solar energy.

World power generation by technology, 1.5°C-Uniform scenario

Source: JRC Science for Policy Report, Global Energy and Climate Outlook 2021: Advancing towards climate neutrality, 20213



Graphite's Unique Advantages

Graphite is essential in solar cell production due to its special properties:

- **High Temperature Resistance:** Graphite can withstand extreme temperatures up to 3000°C. Making it ideal for high-temperature processes in solar cell manufacturing.
- **Electrical and Thermal Conductivity:** With conductivity one hundred times higher than ordinary non-metals and superior to many metals, graphite is crucial in managing heat and electrical conduction in the manufacturing process.
- **Plasticity and Thermal Shock Resistance:** Its toughness and ability to withstand sudden temperature changes without damage are beneficial in solar cell production.

Graphite in Renewable Energy

Solar Power

Graphite's Essential Role in Solar Cell Production

Graphite's high-temperature resistance, excellent electrical and thermal conductivity, and chemical stability are vital in the production of photovoltaic cells.

1. Manufacturing Process:

- Crystalline silicon, a key material in solar cells, is produced through a succession of high-temperature and corrosive processes, where graphite's resistance to extreme heat is crucial.
- Graphite components like crucibles, molds, heat shields, and thermal insulation are indispensable in this manufacturing process.

2. From Quartz to Polysilicon:

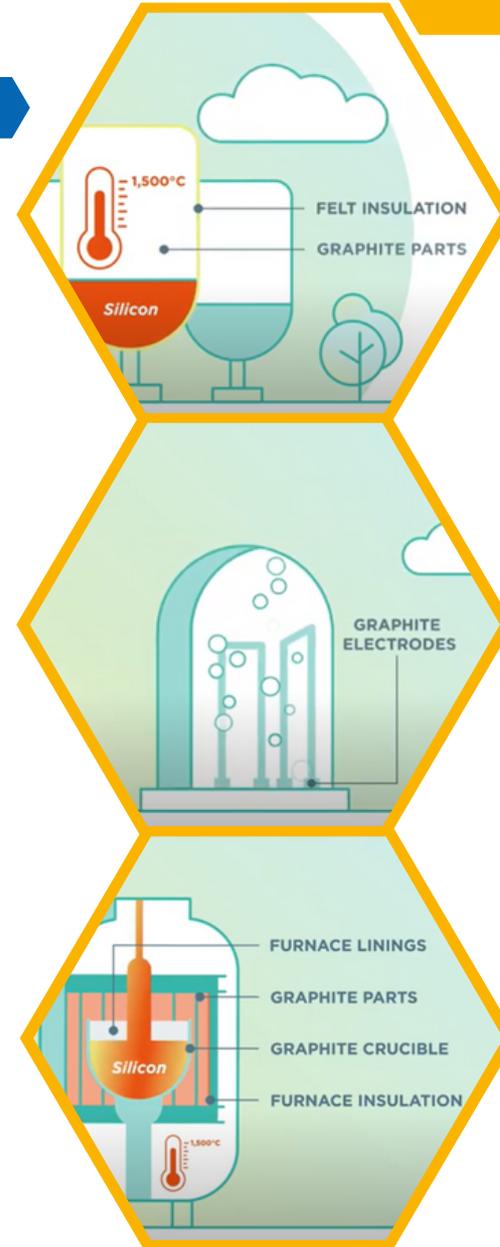
- Quartz is melted into liquid silicon in furnaces at 1500°C, using graphite parts for insulation.
- Graphite electrodes then transform this liquid silicon into polysilicon rods, the primary component of solar cells.

3. Enhancing Cell Efficiency:

- Graphite's role extends to the performance of photovoltaic cells, with efficiencies of up to 25% in solar energy conversion.
- Furnace linings, graphite parts, and insulation all contribute to the high-quality production of solar cells.

4. Solar Panel Production Chain:

- The silicon ingots, cut into thin wafers, are doped and metallized to produce photovoltaic cells, which are then assembled into solar panels.



Graphite in Power Storage Solutions



- Solar power's efficacy is heavily reliant on energy storage solutions for periods without sunlight. Lithium-ion batteries, with graphite as the anode material, are prominent in storing solar energy.
- The World Bank forecasts that low-carbon energy storage technologies will need 4.5 million tonnes of graphite per year by 2050, a 500% increase from 2018 levels and a 3018% increase from the total graphite produced in 2019. This surge in demand positions graphite as a critical material in the renewable energy storage market.

Graphite's role in solar power production and energy storage underscores its importance in the renewable energy sector. With the continuous expansion of solar energy, driven by global renewable goals and technological advancements, graphite remains a crucial material in this sustainable energy revolution.