

Ai Stratis - Green Island: Early operational results from a high RES penetration electrical system

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Transition to RE penetration exceeding 85% in the autonomous power system of Agios Efstratios Island, Greece

The “Ai Stratis- Green Island” project is a pioneering project, in which mature Renewable Energy (RE) technologies were applied, so that through a Hybrid Power Generation Station (HPGS) the island’s energy, electrical and thermal needs, could be covered at a high percentage, >85% on an annual base, from renewable energy sources. Part of the electricity produced by RES covers the island’s electricity demand, while the surplus energy is stored as thermal energy in the form of hot water to cover the residents’ heating needs through a District Heating System (DHS).

The energy management of the hybrid station is carried out through an advanced central control and supervision system, which monitors the production of electricity in real time, dynamically covering demand and channeling the excess RE into the integrated DHS, which serves the residences of the settlement.

The project aims to cover the island’s electrical load from RES at a rate of 100%, without the participation of conventional power generation units during most of the year. It is co-financed by the European Regional Development Fund and national funds under EPAnEK (NSRF 2014-2020) and the Competitiveness Programme (NSRF 2021-2027).

The main components of the Hybrid Power Generation Station are:

- An E44-900 wind turbine,
- Photovoltaic (PV) panels of 226.8 kWp,
- Battery energy storage system (BESS): 2,560 kWh Li-ion batteries, 1,680 kVA bidirectional inverters, Hybrid Power Station (HPS) internal management system.

The main components of the District Heating System are:

- 1,005 kW heat generation station, including a continuous power regulation system,
- 500 m3 hot water storage tanks,
- Recirculation pumps and control system,
- Connection substations and underground distribution network,
- Auxiliary conventional fuel boiler, to be used when stored thermal energy or surplus energy from the RES is unavailable).



Start dates of HPGS:

- trial operation: 10/07/2025.
- commercial operation: 06/11/2025.

By early Feb/2026, HPGS had completed >3,100 hrs of operation as the island’s exclusive power producer (grid-forming operation with full load coverage).

From Dec/2025 to Jan/2026, renewable energy (RE) penetration in the electricity grid exceeded 90%, while more than 85% of the settlement’s district heating demand was covered using excess power from the hybrid station.

