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No (or Low) Carbon Islands

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Why are Islands So Enticing as Low Carbon Locations?

1. Rarely have a reliable, low cost fossil fuel source of energy. Imports of diesel very costly.
2. Less heavy industry, small population makes renewables more feasible alternatives.
3. Distance from any integrated grid. Less likely to trade with other jurisdictions.
4. Many islands located in areas with abundant renewables (wind, solar, geothermal).
5. “Boundedness” of islands; concept of “living laboratories” captures the imagination.

Isle of Eigg (“Green Eigg”), Scotland

- As of 2008, 80% of electricity from wind in hybrid/diesel system.
- Only 100 residents
- Most of financing for turbines and storage systems from external grants (so no payback required)



Island of Tilos, Greece

- Only 500+ residents.
- Mostly seasonal tourist economy.
- Wind and solar project to try to achieve 70% replacement of electricity from fossil fuels.
- Cost 15 million euros
- An ecotourism destination and educational facility.



Graciosa Island, Azores

- Portuguese territory.
- One of the smallest of the Azores Islands.
- 4,500 permanent residents.
- Combination of solar, wind and storage system in batteries.
- Just coming on stream now.
- Supposed to supply 70% of island electrical needs.
- 72 million euros.
- Run by German/American company Younicos with catchy slogans “*Let the fossils rest in peace*”, “*Adios supertankers, ahoy energy autonomy*”

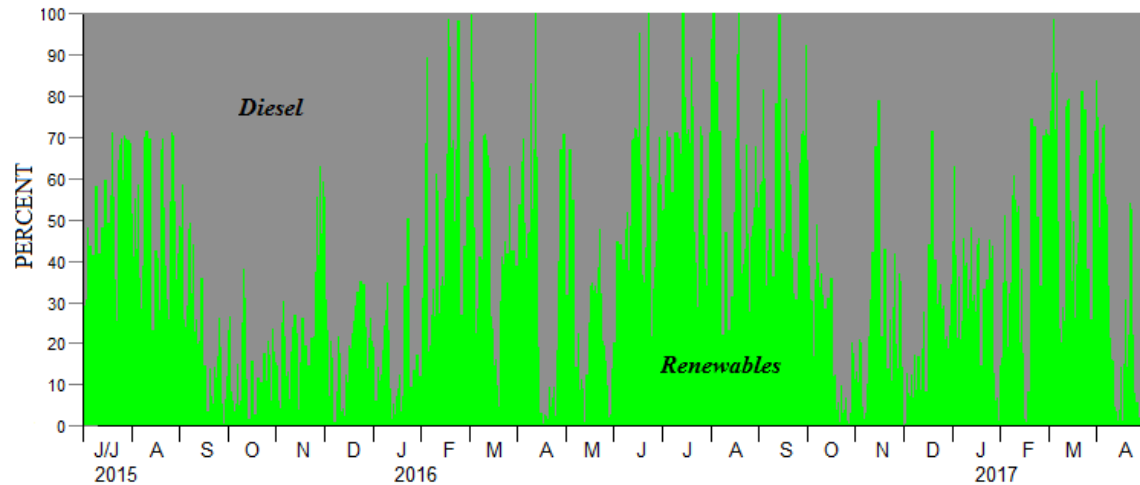


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El Hierro, Canary Islands, Spain

- Smallest of the Canary Islands, territory of Spain
- 10,000 population
- Combination of wind turbines and hydroelectricity from highland reservoirs
- Decrease battery storage problem
- Since start in 2015, not very successful in replacing diesel
- *“Because of a lack of wind GdV supplied only 27.5% of El Hierro’s electricity demand in April, down from 57.5% in March. As at the end of April renewable energy from GdV had supplied 38.1% of El Hierro’s electricity demand and 8.8% of its total energy consumption since project startup in June 2015.”* (Roger Andrews, May 4, 2017)
- Cost of 82 million euros to save 2 million euros/yr in diesel



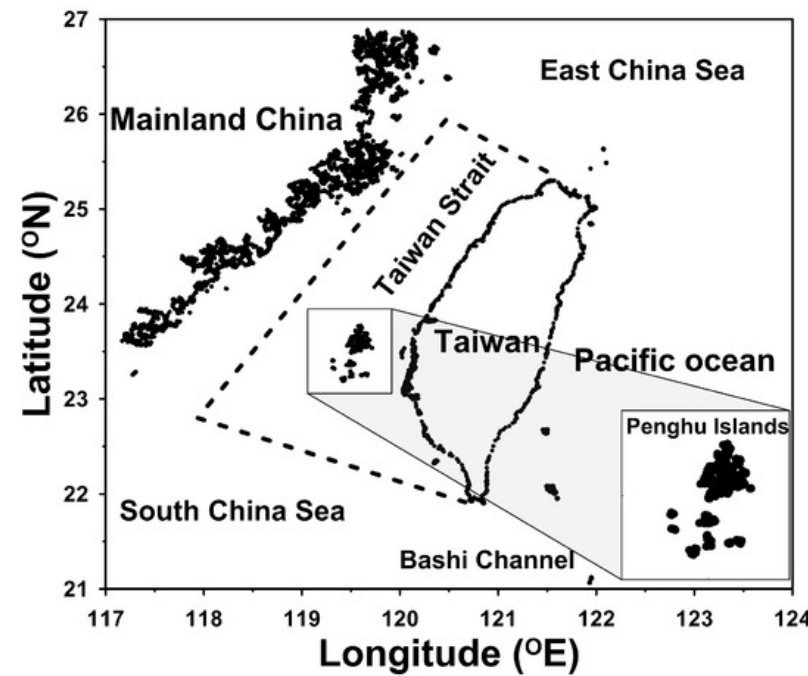
The wind-hydro power station: How it works



- 1 **Population:** more than 10000 inhabitants for a surface area of 276 km²
- 2 **Conventional power station:** 8,3 MW diesel fired system
- 3 **Wind farm:** 9,35 MW installed power
- 4 **Maximum penetration rate of wind energy for direct consumption into the grid:** 30%
- 5 **Pumping station**
- 6 **Hydropower station:** 3 x 3,3 MW Pelton turbines, able to operate from 10% to 100% of their power capacity while keeping the same efficiency
- 7 **Upper reservoir:** Height: 700 m above sea level // Capacity: 200000 m³, coverage of the energy demand during seven consecutive days without wind (Beyond this, the existing diesel power station will take over to meet the entire demand).
- 8 **Lower reservoir:** Capacity: 200000 m³
- 9 **Desalination plant:** Capacity: 5 to 10 m³/day. It fills the reservoirs and compensates the evaporation losses. The plant will also provide water for irrigation purpose and other use.

Penghu Islands, Taiwan

- “Low Carbon” Islands
- Especially Penghu (90 islands)
- Largest island has 60,000 + population
- Has served as a cultural tourist destination
- Taiwanese government has invested \$266 million US
- Further \$1.5 billion US by 2025
- Mostly wind and solar
- Ecotourism attraction to complement cultural tourism



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Samsø, Denmark

- Located off coast of Denmark
- First stage was wind and solar electrical replacement
- Second stage biomass fuel for heating and farm vehicles (methane)
- Energy Academy; 4,000 visitors/yr.
- Ecotourism and energy consultants



SOLAR & BIOMASS

75%
of Samsø's heat comes from
SOLAR POWER & BIOMASS ENERGY

STRAW FIRED PLANTS
Quantity: 3
Fuel: Wheat and rye straw, a creative use of local resources which are abundant on the island
The generators are especially efficient because they produce both heat and electricity.

SOLAR
Quantity: 1
Area: 9,500 square foot solar panel field; that is approximately 1/6th of a football field
Features: Panels heat the water to 158°F, which is combined with the high efficiency fuel of a wood chip fired boiler, and then piped into local homes for heating. All four combined heat 894 households



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