Renewable Energy In Antarctica: A Review of the Current and Proposed Systems

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Carbon Neutral Antarctica

Princess Elisabeth Station

A "zero emission" facility in Antarctica, designed and built to operate entirely on renewable energies. Station systems are integrated and piloted by an programmable logic controller. The station's skin, insulation, shape, orientation and window disposition allow a ambient temperature to be maintained inside the building with minimal energy input combined with a sophisticated ventilation and air circulation systems for temperature management.

12% 22 m² thermal solar panels
40% 380 m² photovoltaic solar panels
48% 9 wind turbines

Backup : Two 44kWh backup generator and 6000Ah lead battery

408 photovoltaic panels : 50.6 kWh 9*Wind turbines : 6kW

Neumayer III

The station currently runs on an Enercon 30kW wind turbine and four 150kW diesel generators (one is used for emergencies). The generators waste heat is used to melt snow and heat the building. The current wind turbine was estimated to supply 12% of the bases power demand. The station plans to eventually become self sufficient by introducing 10 to 15 wind turbines in addition to flywheel or hydrogen as the storage method.

12% One 30 kW wind turbine
88% Four 150 kW diesel generator

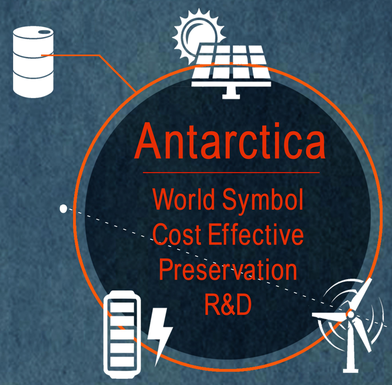
McMurdo & Scott Base

Since 2010, the Ross Island wind farm has been powering The US's McMurdo Station and New Zealand's Scott Base with three 330kW wind turbines. The expected diesel fuel reductions are estimated at 463,000 liters which cuts CO2 emissions by 1,242 tonnes a year, with the goal of eventually providing 100% of the power necessary for the two bases using diesel generators as merely backup. As of April 2012, the wind turbines produced 111% of their original projected energy production, supplying 11% of the energy for Scott Base and McMurdo Station (the largest settlement in Antarctica).

11% Three 330kw wind turbines (Ross Island)
89% Three diesel generators 180kW (Scott Base)
Six diesel generators totaling 2300kW kW (McMurdo)

$900 per barrel

7-20 years payback time



Ratio of fuel burned

Per barrel shipped

Sanae IV

A feasibility study outlines the installation of a 100 kW turbine, which would reduce the cost per kWh by up to 20%, with a payback period of 10 years. A flatplate solar thermal system could save over 10,000 liters of fuel annually and have a payback period of 6 years.

In Jaunary 2010, three 20kW wind turbines were installed and began testing. They were scheduled to be hooked up to the grid in 2011.

Mawson Station

Since 2003, two 300kW wind turbines are in operation. These turbines supplied 30% to 40% of the station's electrical and heat needs annually. This has resulted in a savings of up to 240,000 litres of fuel per year. Initial estimate of payback time was 10 years. Refuelling the base is now required only every other year

40% Four 120 kW diesel generators
60% Two 330 kW wind turbines

Amundsen-Scott Base

Feasability studies proposed the installation of nine, 100kW wind turbines at Amundsen-Scott Station, which is estimated to cost US $4.3 million with the potential to save approximately $18 million over the 20-year lifespan of the project. Another proposed addition is the 'supplementary accommodations' for an overflow of summer staff could house 100 people. This could be heated by solar energy, saving 13,000 gallons of fuel per year the savings would amount to $46,000 (using 2012 price of fuel) per year, raising to $350,000 when you consider delivery.

%100 Four diesel engines + (750kW + 250kW generators)