

PROJECT DESCRIPTION

Belgian scientific research station on Antarctica uses AC•THOR and AC•THOR 9s for hot water production and electric space heating

System: Off-grid PV and wind power
+ hot-water + electric space heating
with AC•THOR and AC•THOR 9s

Control: SMA Sunny Island

Planner: Pull The Plug, energy-autonomy engineering, Belgium



Figure 1: The Princess Elisabeth Antarctica station

Object data

- 9 x 6 kW SD Wind Energy wind turbines
- 60 kWp solar photovoltaic
- Off-Grid 60 kW SMA multi-cluster system
- 192 x 1250 Ah lead-acid batteries
- 4 x my-PV AC•THOR 9s (9kW)
- 1 x my-PV AC•THOR (3kW)



Figure 2: AC•THORs for hot-water preparation

Description

The Belgian polarbase Princess Elisabeth in Antarctica was the first (and still is the only) station that is powered completely by renewable energy. The station is operated by the Brussels-based International Polar Foundation (IPF). This non-profit foundation set itself the aim of establishing the first completely carbon-neutral polar base. This is because pure diesel operation is harmful to the environment and very expensive due to the long transport distances for fuel. Here, one liter of diesel can cost as much as €12.

Sun and wind keep the 15 tonnes of batteries charged to power the scientific instruments, the kitchen, laundry machines, internet satellite, etc.

The system needed to be oversized in order to make sure that there is enough power during days with few wind or sun available. This results in days with a lot of excess power of both, and thus energy surplus which until now was not used.

For this reason, the station engineers implemented the several AC•THOR units which can linearly use all electricity surplus to heat up large buffer tanks and spaces. The stored hot water is used to melt snow, which is necessary as vital drinking water for the station crew and scientists. The same principle is used to melt snow for showers and kitchen use.

Before implementing the AC•THOR units, immersion heaters were controlled by the PLC in on/off mode, which made the island system very unstable.

During season 2019/2020, a complete new mechanical garage building was constructed. The goal was to equip this building with infrared heaters to use more energy surplus and to provide our mechanics with some comfortable space heating.



Figure 3 and 4: AC•THORs for electric space heating

Why hybrid storage?

Photovoltaic off grid systems need to be oversized in order to provide enough energy during all periods. This leads to unutilized PV power and a significant energy loss during sunny seasons. The AC•THOR detects the grid frequency of the inverters and in case of excess energy, power is diverted to boost the electric heating elements all over the station. The desired target-temperature can also be easily adjusted with AC•THOR. Storage capacity in the off-grid system can be inexpensively scaled up. Energy is now used that was wasted before.

Functionality

Among many other outstanding features, AC•THOR operates with frequency-shift battery inverters. These inverters raise the AC frequency when the battery is fully charged. This signals the PV inverter to limit power to prevent battery overcharge. AC•THOR detects excessive power by measuring this frequency rise. It increases heating power until the system is balanced, before the PV inverter derates. Thereby it automatically uses the excess energy for thermal storage by controlling its power linearly to use exactly the amount of the remaining PV power and to avoid discharging the battery.

System schematic

AC•THOR is plugged into an AC socket like any other load. No additional communication wiring is required.



Figure 5: AC•THOR in an AC off-grid

This is real „plug-and-play“: Just plug into the power line, done! There is no need of any additional communication wiring.

The chronological order of the hybrid storage concept is to supply the present loads first, afterwards surpluses are used to charge the battery and only the remaining excess energy is used for water heating.

Compatible batter inverters

The list of manufacturers that supply compatible products to control AC•THOR continues to grow. Please check our website for latest info. www.my-pv.com

Product details AC•THOR

- Supply voltage 230-240 V
- Linear power control 0 – 3,000 W
- Mains connection single-phase, Mains plug
- Load connection Mains socket for resistive loads
- Color Touch Screen 2.83"
- Power cord 2.8 m
- Dimensions 135 x 210 x 65 mm

Product details AC•THOR 9s

- Supply voltage 3 x 230-240 V
- Linear power control 0-3,000 W, three outputs, max. 9,000 W
- Mains connection 3-phase with neutral conductor
- Load connection plug-in contacts for resistive loads
- Color Touch Screen 2.83"
- Dimensions 135 x 195 x 65 mm



Contact person

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