

Mid-Scale RI-1(M1:IP):

Power Infrastructure Enabling Cosmic Microwave Background Science

Proposed to be initially operated as part of Simons Observatory.

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Overview

- Proposes a photovoltaic power plant that, synchronized with a diesel power plant, increases the robustness and decreases the cost of power at the Cerro Toco site.
- Based on proof-of-principle existing photovoltaic power use in the Cerro Toco area.
- Initial implementation is enough power for Simons Observatory (380 kW). The power plant will be easily expandable as power requirements on Cerro Toco increase.



Why a Photovoltaic Array in Chile?

- **Robust power is critical in delivering the science of Simons Observatory and CMB-S4 in Chile.**
 - Simons Observatory will operate 11 pulse tube coolers and 4 telescopes.
 - CMB-S4 could require as many as 30 (or more) pulse tube coolers!
 - Power interruptions could result in extended loss of observing due to warming of the receivers.
- **Continuous diesel generation is logistically difficult in Chile (and the South Pole).**
 - When fully operational, the Simons Observatory will require almost 2,500 liters of diesel per day.
 - Diesel delivery is challenging and could pose a risk to continuous operation.
- **The site in Chile is one of the best places on the planet for solar power generation.**
 - Tropical latitude (23.5° South) and high altitude provide increased efficiency.
 - Green generation could save up to 2.5 MILLION kg of CO₂ emissions per year.
 - The project is cost neutral on the ~4-8 year time scale.

A 380 kW PV Power Plant Feasibility Study



Experiment	Existing or expected start	Average Power [kW]
POLARBEAR	Existing	100
ACT	Existing	59
CLASS	Existing	30
Simons Observatory	2022	330
CMB-S4 Chile	2027	500



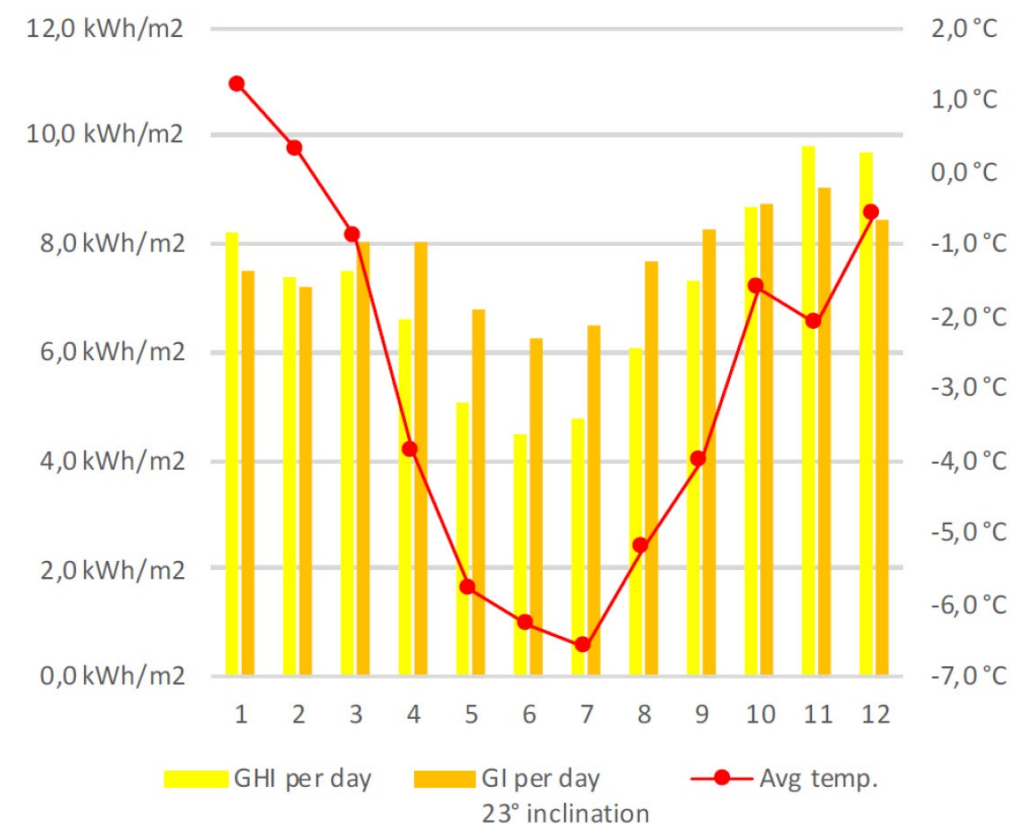
Universidad de Santiago PV power plant

- In continuous operation for two years, no degradation in panel performance
- Batteries working as expected.

Feasibility study with Kraftwerk



- Kraftwerk has systems deployed in the Atacama.
- Deployment and costing information.
- Batteries are becoming more efficient and the prices are dropping!



Solar Irradiation Study:

- The Atacama is a great site for Solar Power Generation!
- Yearly total – 2.8 MWh/m²

SUMMARY:

- **Logistics benefits:**

- 10 deliveries of diesel per year as opposed to **200+**.
- Reduced maintenance cost.
- Reliability - Two synchronized power sources.

- **Cost benefits:**

- Up to \$1.28M per year savings in diesel!
- Break-even point in 4-8 years
- PV panel lifetime expected to be 20 years, battery replacements expected to start being required after 10 years.

- **Environmental Benefits:**

- Save up to 2.5 Million kilograms of CO² emissions per year.
- We need to show that we are conscientious guests of our hosts in Chile.
- Serves as a model for future remote power generation.