Center for Solar Energy Technologies „CSET“

- Fraunhofer Chile Research

„Workshop fotovoltaico internacional“




Prof. Dr. Frank Dinter

Executive Director y
PV Systems Leader

4th April 2019, Santiago

www.fraunhofer.cl

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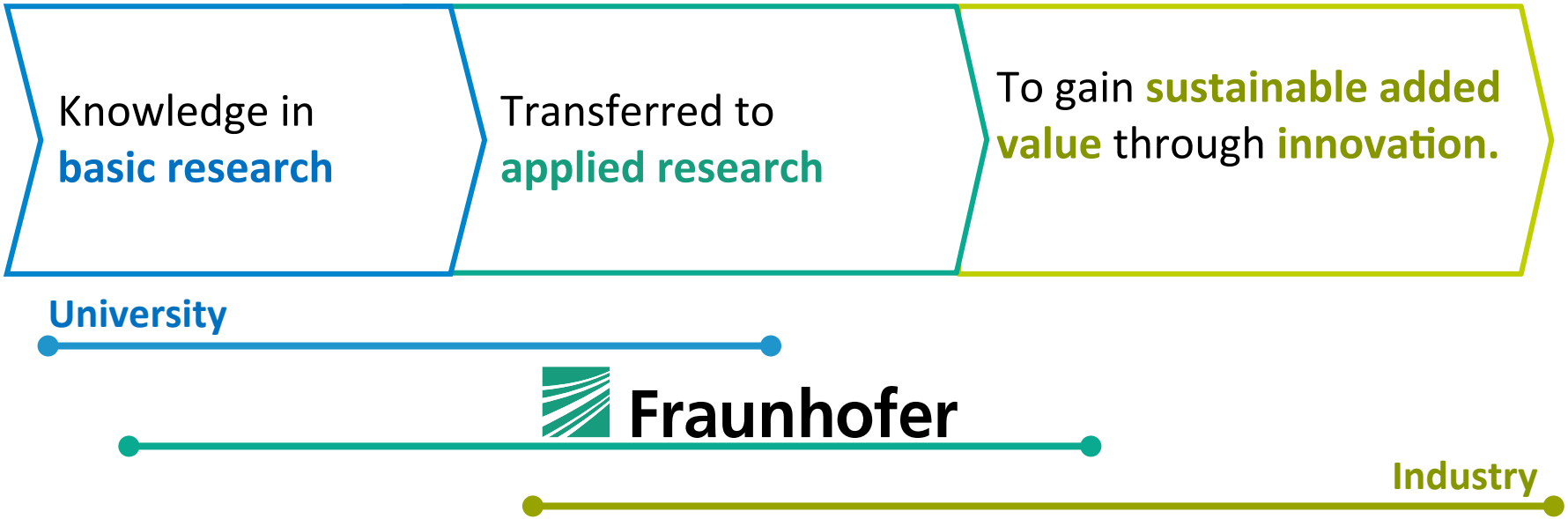
Center for Solar Energy Technology - CSET

Fraunhofer´s orientation



Fraunhofer Chile Research (FCR) Foundation
Center for Solar Energy Technologies (CSET)

- **2010: Fraunhofer Chile Research Foundation**
- **Center of Excellence**, co-funded by CORFO
- 2011: Center for Biotechnologies (CSB)
- 2013: Application for CEI Solar
- 2015: Operational Start of CSET
- Location: Innovation Center / Campus San Joaquín UC
- **Application oriented R&D and Support**
  1. PV System
  2. Solar Thermal Systems
  3. Transversal projects
- Adaption of Technologies for Chile
- Quality Assurance, Standards and Advising

Proyecto apoyado por CORFO
Gobierno de Chile
Fraunhofer CHILE

Center for Solar Energy Technology - CSET

Objetive and Associates

Generate **innovations** to achieve large scale implementation of solar energy in Chile for **main industrial** and **commercial/residential** sectors

To "solarize" Chile

- **Subsidiary of FRAUNHOFER ISE** / Freiburg
- Based on the existing infrastructure of Fraunhofer Chile Research Fundation (FCR)
- **Co-Executor**: Pontificia Universidad Católica de Chile and located in UC Innovation Center
- ➢ Since 2015 operating in Chile
- ➢ **Team** of more than 60 people in FCR & UC

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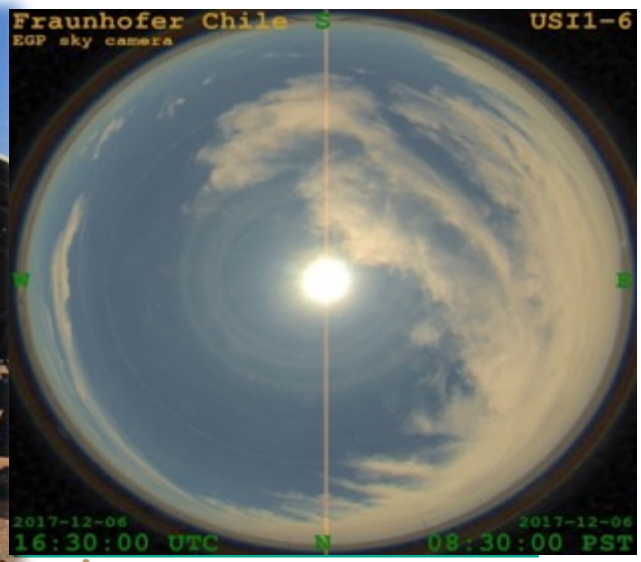
Research Line: PV Systems

Main Topics

- Quality assessment for materials, modules and systems
- Cleaning, soiling
- Fore- and Now-casting
- O&M Issues, system optimization, etc.



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Research Line: Solar Thermal Systems

Main Topics

CSP and Solar Heat for Industrial Apllications

- Studies in industrial branches with high heat demand
- Solar heating, - cooling, - drying in industry

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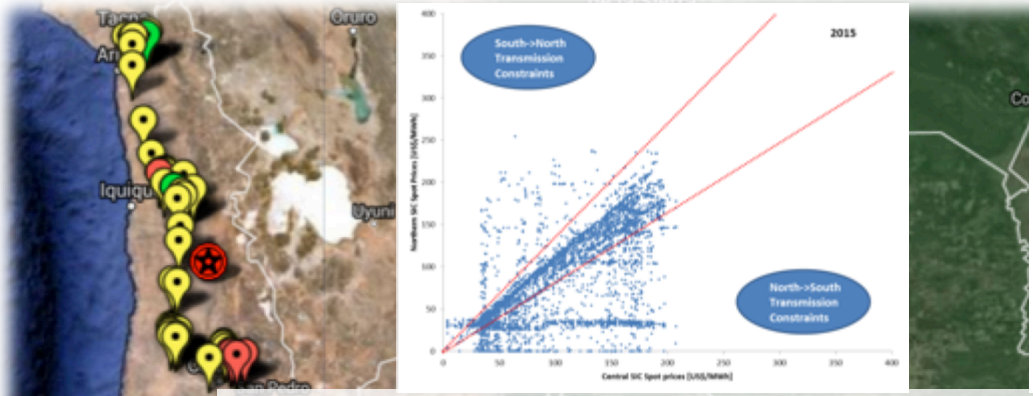
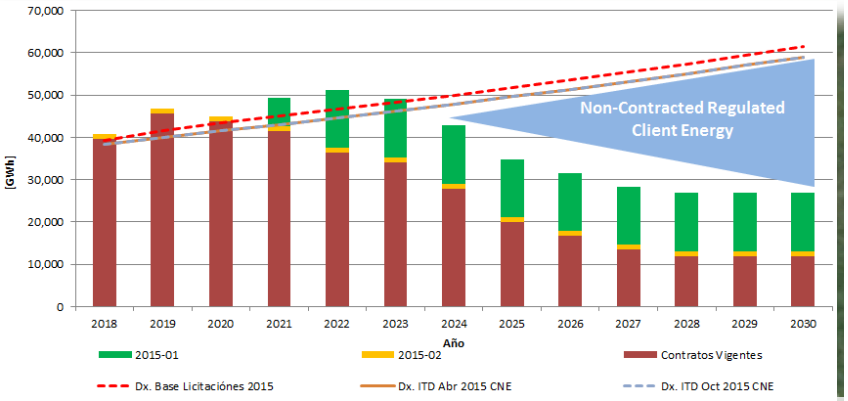
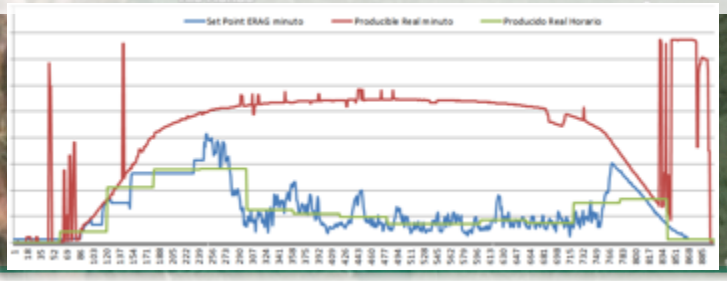
Additional Research at CSET

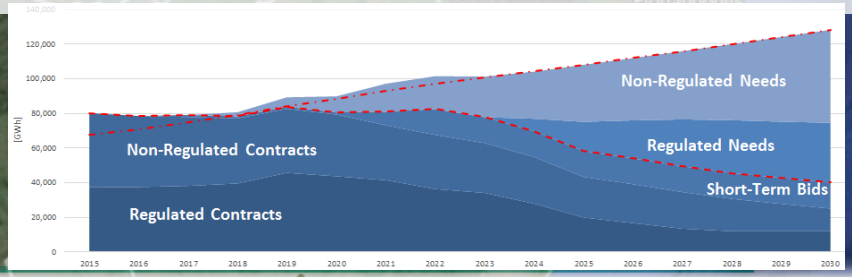
Transversal Projects





- Integrated Studies for high efficiency and solar energy
- Techno-economical studies
- Design studies and Prototype recommendation for clients
- And other activities related to solar energy and markets





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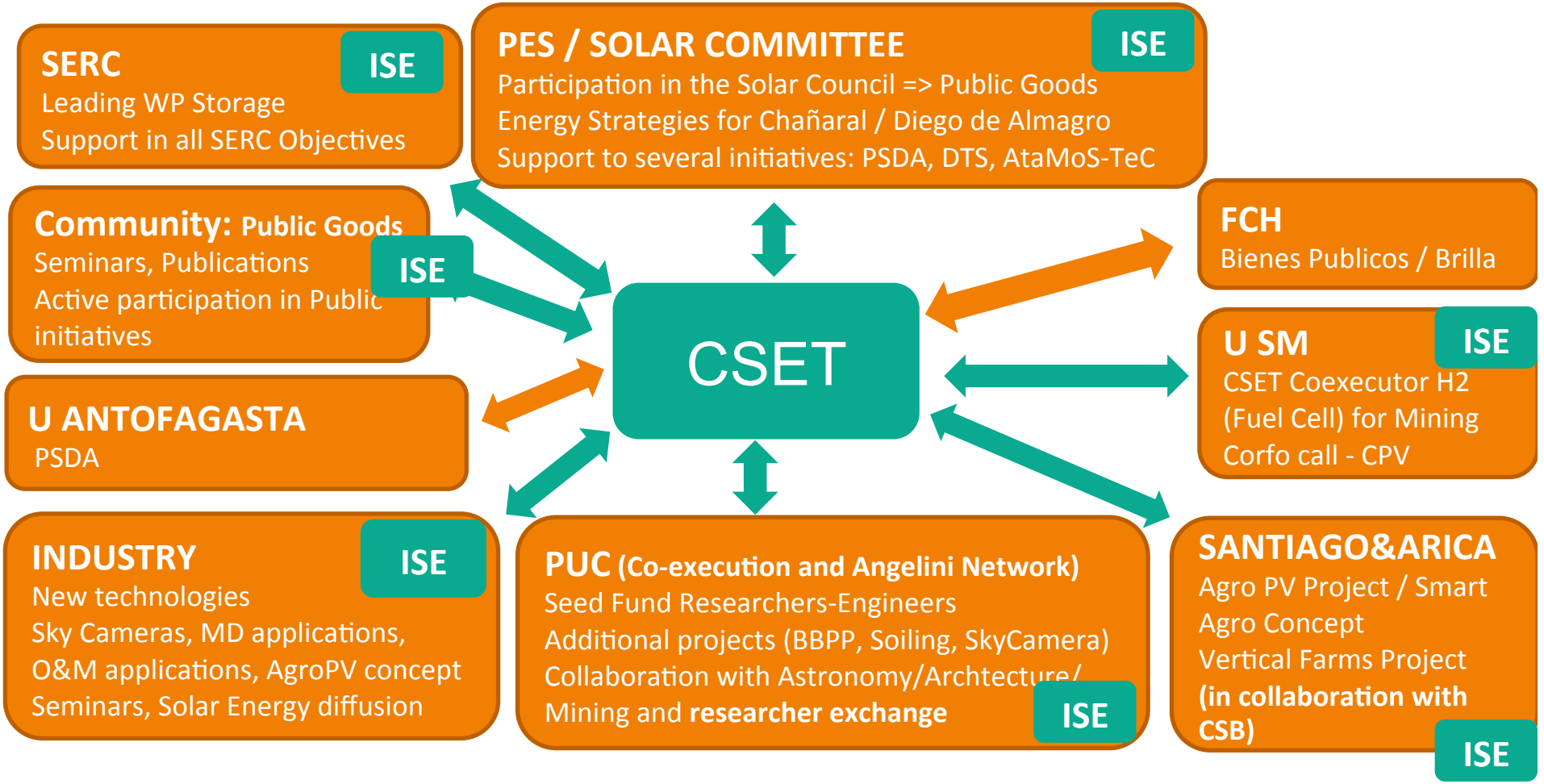
CSET in the Chilean Solar Ecosystem

supported by Fraunhofer ISE



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Some Projects of Photovoltaic Systems (PV)

- AtaMoS-TeC
- Agro PV
- North Chile Investment
- PV Optimization and advanced Service Offers

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Project: AtaMoS-TeC

(Atacama Module System and Technology Center)

- A 6 years project of 3 stages, 2 years each. Corfo fund of 8.5 MUSD
- The project started at the end of November, 2017
- CSET is responsible for evaluating and comparing performance and quality of various PV modules exposed to harsh desert conditions (WP2)
- CSET gets 1 Mio € of subsidy and the compromised in-kind contribution is 250 k€ during the whole project. **Subcontract with ISE: 200 k€**

- **Partners:**

ines INSTITUT NATIONAL DE L'ENERGIE SOLAIRE

UA Universidad de Antofagasta

UNIVERSIDAD TECNICA FEDERICO SANTA MARIA

Universidad de Concepción

ISC International Solar Energy Research Center Konstanz

Fraunhofer CHILE

UNIVERSIDAD DE CHILE

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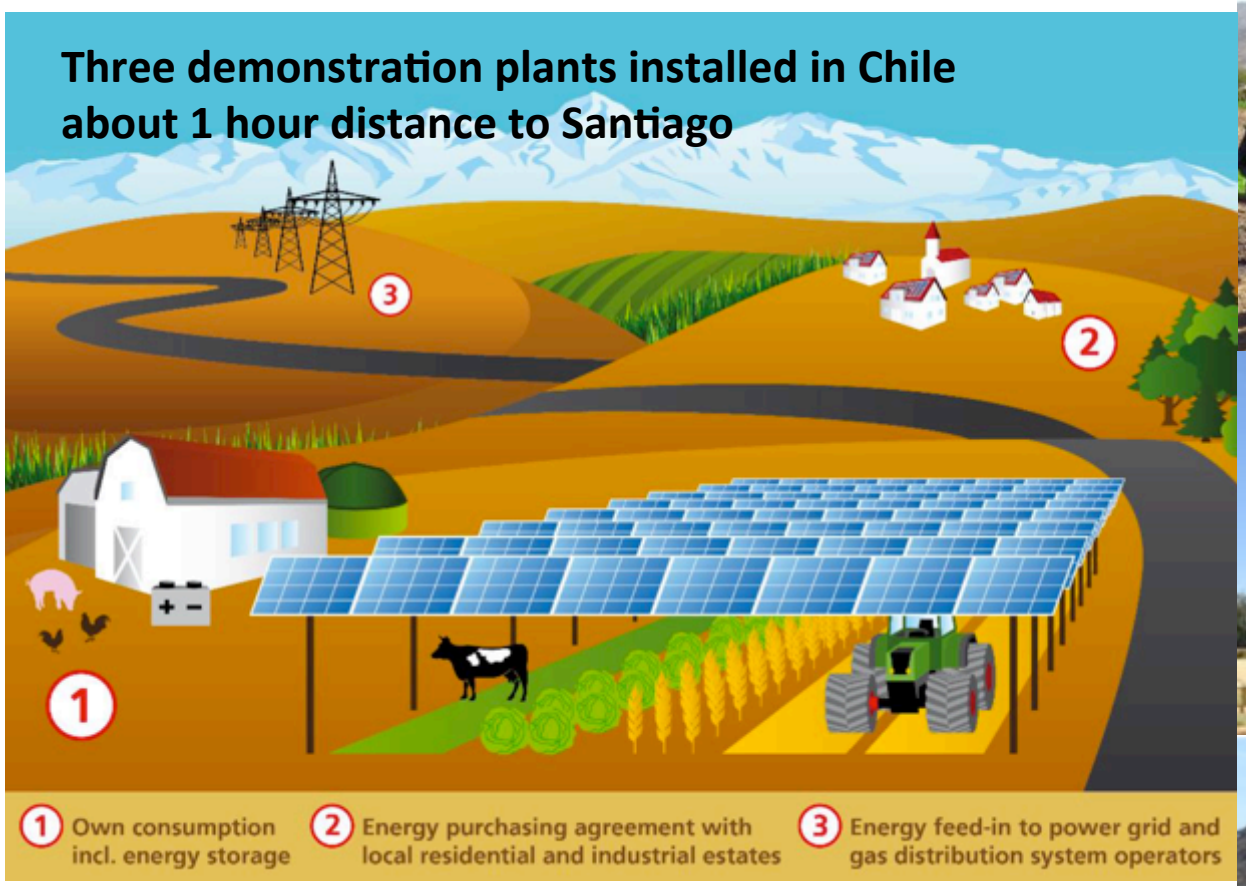
Project: Agro-PV with CSB



Already some instalations in Europe

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Project: North Chile Investment

- Duration: 18 months
- **Purpose: design and construction of a cleaning prototype for PV plants**
- **Objectives:**
  - Reduce LCOE
  - Reduce water consumption
  - Reduce time of cleaning
  - Reduce labor costs
  - Small to fit between rows of PV plants
- **Finalization of the Project in March 2019**

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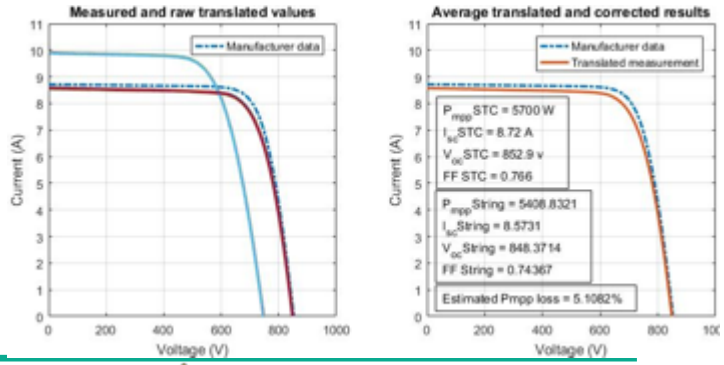
PV Optimization and advanced Service Offers

- On-site electricity production performance under real conditions and Maximum Power Point (MPP)
- On-site estimation of electric parameters of operation of PV modules
- On-site power degradation studies
- On-site soiling studies (production decrease)
- New technologies analysis (i.e. Bifacials)
- Low uncertainty IV curve measurements
- Estimation of physical parameters of PV modules
- Degradation analysis
- Soiling analysis
- Electroluminescence

Quality assessment of solar field at an AES Gener Plant.



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Grupo Solar UC

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Solar Energy Group Presentation

The Solar Energy Group of the Catholic University in Chile (UC) has a **team of researchers specialized in photovoltaic and solar thermal technologies**. Along with state-of-the-art infrastructure and equipment, it addresses challenges related to the development of solar energy initiatives **from the measurement** of the solar resource **to the implementation** of generation projects.

www.uc.cl

The Team

Rodrigo Escobar
Leading Researcher
Director

EQUIPO

7 Professionals
M.Sc.,
mechanical
electrical and
industrial
engineering

8 PhD Students

Collaborations

Centro UC Energía

Fraunhofer CHILE

Universidad de Chile

UA Universidad de Antofagasta

GTC Industrias Eléctricas Ltda.

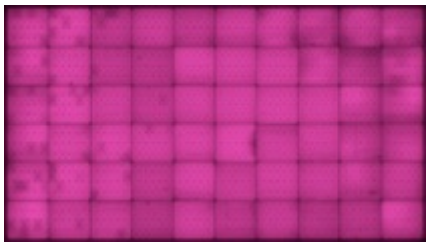
acciona

SALMAG

Santiago Outdoor Laboratory

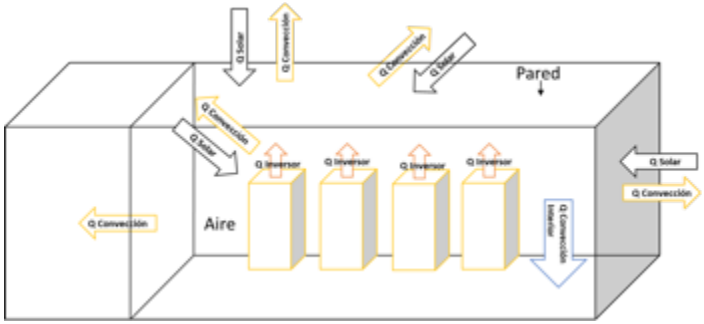
Our solar laboratory in Santiago has more than 150 m^2:

- Comparison of photovoltaic modules of **different technologies** (c-Si, thin-film, bifacial, CPV, hybrid);
- Experiments with **design configurations**;
- Analysis of **soiling** rates;
- Analysis of **critical meteorological variables**, from irradiation to temperature and humidity.
- **Robotics equipment** for maintenance of solar panels;
- Measurement of **performance** variables, I-V curves and electroluminescence of PV modules.



Industry Services

- Solar resource measurements and calibration of pyranometers;
- Analysis of PV plant feasibility;
- Design of optimized PV inverter cabinet;
- Testing of innovative PV technologies;
- Benchmarking of PV modules;
- Analysis of anti-soiling measures.



R&D: Latest activities

PV:

- Effect of soiling in bifacial PV modules and cleaning schedule optimization.
- Enhancement of the cooling capability of a high concentration photovoltaic system using microchannels with forward triangular ribs on sidewalls.
- State of the art and future prospects for solar PV development in Chile.

Solar Resource:

- Standard or local solar spectrum? Implications for solar technologies studies in the Atacama desert.

R&D: Latest activities

CSP:

- Modelling of a small parabolic trough plant based in direct steam generation for cogeneration in the Chilean industrial sector.
- Multi-objective optimization of hybrid CSP+PV system using genetic algorithm.
- Materials corrosion for thermal energy storage systems in concentrated solar power plants.
- Solar extinction modelling for central receiver towers.

Solar Heating:

- Comparison of the levelized cost and thermo-economic methodologies – Cost allocation in a solar polygeneration plant to produce power, desalted water, cooling and process heat.

Market:

- Net energy analysis and life cycle energy assessment of electricity supply in Chile: Present status and future scenarios.
- Sensitivity and effectiveness analysis of incentives for concentrated solar power projects in Chile.
- Sustainability evaluation of Concentrated Solar Power (CSP) projects under Clean Development Mechanism (CDM) by using Multi Criteria Decision Method (MCDM).

Thank you very much for you attention !!!

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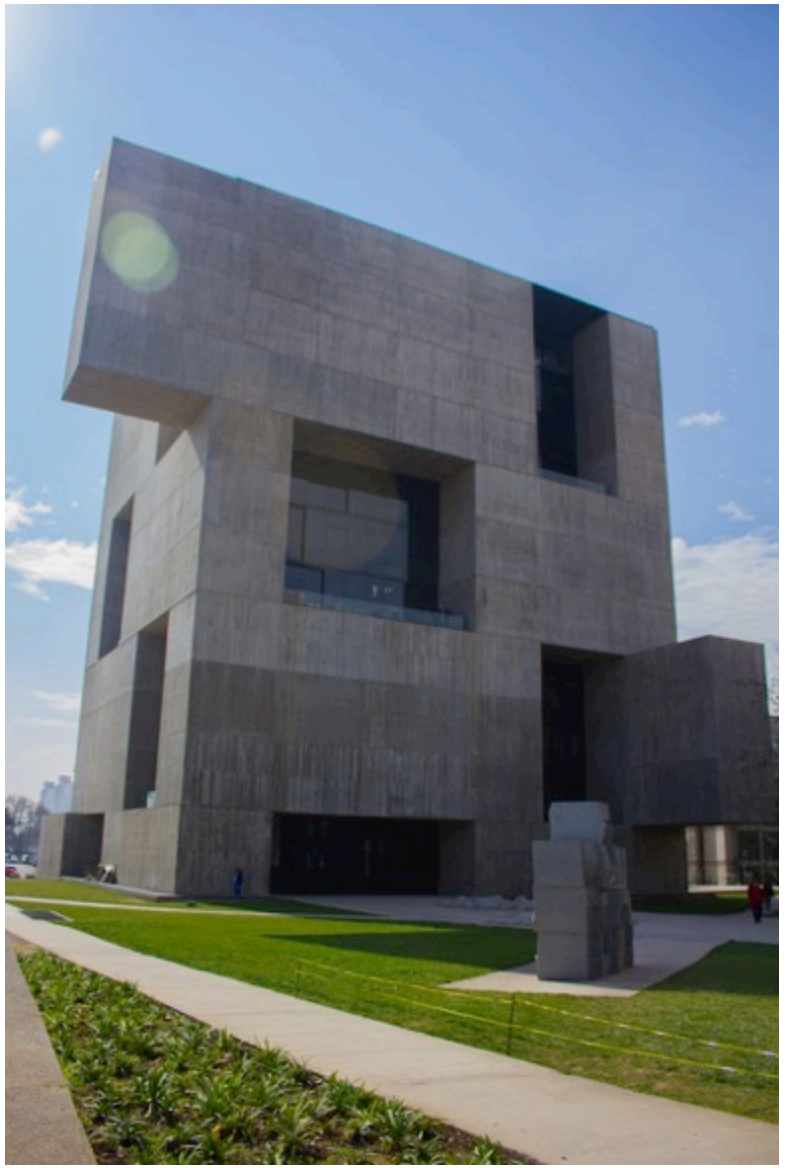
“CSET”
for a Solar Future in Chile



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