

# CHILE'S STRATEGIC CHALLENGE IN THE SOLAR INDUSTRY

The Chilean Government has developed a collaborative process through CORFO and the Ministry of Energy to draft the 2025 Solar Energy Program Roadmap, which included participation of different public, corporate, academic and civil society representatives. This document defined an initial series of 50 initiatives that seeks to take advantage of the Atacama Desert's unique features for developing a national solar industry, with highly developed technological capacities to deal with local challenges and which can insert itself as a competitive player in the international solar industry industry. This portfolio of projects has a total estimated budget of US\$800 million.

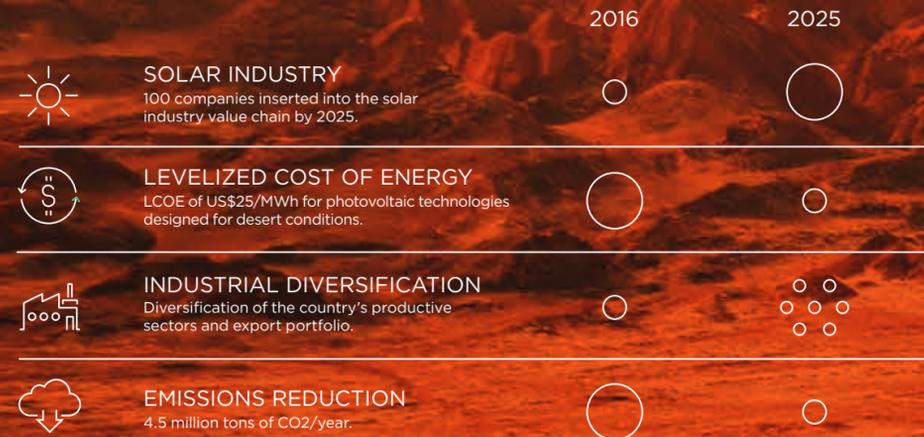
## SOLAR ROAD MAP STRATEGIC GUIDELINES

TECHNOLOGICAL DEVELOPMENT	INDUSTRIAL DEVELOPMENT	STRENGTHENING QUALITY INFRASTRUCTURE FOR SOLAR ENERGY
<ul style="list-style-type: none"> <li>Solar technology center</li> <li>Desert Module and System technology program</li> <li>Thermal energy storage systems program</li> <li>Solar desalinization program</li> <li>Solar fuels program</li> <li>Advanced Human Capital program</li> </ul>	<ul style="list-style-type: none"> <li>Open innovation platform</li> <li>Financing innovation challenges</li> <li>High-tech investment attraction program</li> </ul>	<ul style="list-style-type: none"> <li>Climate characterization</li> <li>Metrology network</li> <li>Regulation standards</li> <li>Conformity assessment schemes</li> <li>Drafting of labor skills profiles</li> </ul>

Cuenca del Salado Solar Corridor

Solar Technology District

## EXPECTED IMPACTS



## EXECUTIVE BOARD

**PRESIDENT**  
Minister of Energy, Andrés Rebolledo

### SCIENCE & TECHNOLOGY SECTOR

SERC - Rodrigo Palma  
CDEA - Edward Fuentealba  
Fundación Chile - Andrés Pesce  
Fraunhofer Solar Chile - Werner Platzer  
UAI - Gustavo Cáceres

### PRIVATE SECTOR

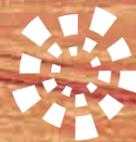
ACERA - Carlos Finat  
ACESOL - Pablo Pastene  
Asociación Generadores - Rodrigo Solís  
Asociación Empresas Eléctricas - Rodrigo Castillo  
CDEC SIC - Andrés Salgado  
AIC (Consultoras de Ingeniería) - Juan Carlos Olcay  
Colegio de Ingenieros - Christian Hermansen  
ASIMET - Juan Carlos Martínez  
AIE (Industria Eléctrica y Electrónica) - Juan Menchaca  
Corproa (Desarrollo de Atacama) - Daniel Llorente  
AIA (Asociación de Industriales de Antofagasta) - Andrea Moreno

### GOVERNMENT SECTOR AND INTERNATIONAL COOPERATION AGENCIES

Min. Energy, Div. Prospectiva y Política Energética - Javier Bustos  
Min. Energy, Div. Energías Renovables - Christian Santana  
Conicyt - Mario Hamuy  
Corfo - Marcela Angulo  
Corfo - Juan Rada  
GIZ - Rainer Schröer

**CIVIL SOCIETY**  
Instituto de Ecología Política - Manuel Baquedano

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PROGRAMA ENERGÍA SOLAR



# SOLAR INDUSTRY

ROAD MAP 2016-2025

## CHILE ATACAMA DESERT

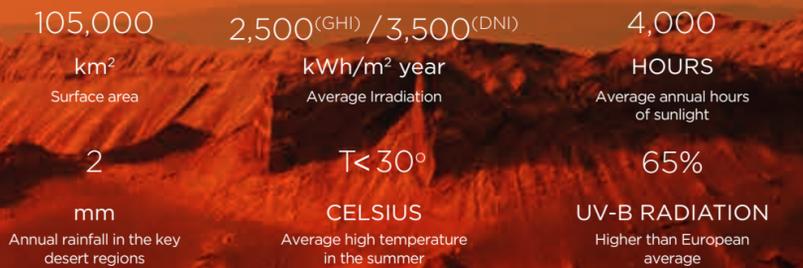


Important natural resources abound in the Atacama Desert. Its soils hold the world's largest copper and non-metallic minerals reserve, sustaining an active mining industry that has been the country's main productive and economic sector for over a century. Another important natural resource in this broad territory comes from its skies, as it has the highest levels of solar irradiation in the world.

The Desert also presents challenges. The lack of water and the high cost of reliable and sustainable energy supplies are a real threat to the mining sector's competitiveness.

Chile understands that this context presents it with an opportunity for development as a nation. The mining industry's urgent need can be a powerful ally to concentrate resources on the search for innovative energy solutions. One process that is already under way is the birth of a solar energy industry that develops applications specific to the desert's unique environmental conditions through R&D&I to take advantage of solar energy in its full thermal and electrical potential.

Solar Energy can become an engine that drives the transformation of the country's productive base.



## MARKET POTENTIAL



## SOLAR TECHNOLOGY CENTER TECHNOLOGICAL DEVELOPMENT

The purpose of this project is to strengthen technology infrastructure and human capital to develop solar industry technology programs, which will consider the following lines of work:

- › Photovoltaic systems for desert regions.
- › Solar metallurgy.
- › Thermal storage of solar energy.
- › Solar desalination.
- › Solar fuels.

### OBJECTIVE

To strengthen and maintain technology infrastructure and excellence in human capital in all areas to create new technology applications and implement solar energy solutions with a high R&D&I content, connected with local energy demands and the solar industry's global value chain.

### EXPECTED RESULTS

- R&D: simulation systems and technology services, development of small-scale prototypes and testing of new materials and technologies.
- Industry services: product pilot programs, monitoring and certification systems and skills.
- Transfer and sale of technology: sale and licensing of technologies and materials.
- Creation of spin-offs and design of business models.
- Generation of information for the drafting of policies for the development, regulation and strengthening of Chile's solar power, mining and raw materials industries.

**FINANCING 2016 - 2025**  
**US\$14** MILLION CHILEAN GOVERNMENT  
**US\$20** MILLION PRIVATE SECTOR CONTRIBUTIONS

## DESERT MODULE AND SYSTEM TECHNOLOGY PROGRAM TECHNOLOGICAL DEVELOPMENT

This initiative brings the government, national and international companies and technology centers together in a partnership to implement a portfolio of R&D&I projects to develop photovoltaic systems created specifically for desert conditions.

### OBJECTIVE

To contribute to the installation of technological capacities to adapt and/or develop new materials, components and operation and maintenance services for photovoltaic systems that ensure their durability and performance under desert climate conditions, contributing to the installation of technological capacities and fostering the creation of a national ecosystem for the solar power industry in partnership with local and international companies and technology centers.

### EXPECTED RESULTS

- Development of the Desert Module (DEMO) in 4 versions showing growing efficiency and durability.
- Technological baselines for the drafting of standards and the creation of compliance evaluation systems for photovoltaic technologies under desert conditions.
- Specialized services for the operation and maintenance of these systems.
- Development of applied BoS (Balance of System) technology innovations, including component integration, assembly systems, and power inverters.
- Reinforced R&D infrastructure and a team of 20 researchers (engineers, MSc and PhD holders) with research skills and inserted into international innovation networks.

**FINANCING 2016 - 2025**  
**US\$12** MILLION CHILEAN GOVERNMENT  
**US\$5** MILLION PRIVATE SECTOR CONTRIBUTIONS

## OPEN INNOVATION PLATFORM AND FINANCING FOR INNOVATION INDUSTRIAL DEVELOPMENT

This project considers the development of a virtual supply-and-demand interaction platform, in addition to a specialized team in charge of studying the main energy-related problems, needs and opportunities in national industry so they can translate into business innovation challenges. It also contemplates a specialized team in charge of incentivizing participation by local suppliers and advising them on the construction of value proposals to face those challenges.

Part of this line of action considers financing through competitive CORFO funds aimed at contributing to the development and construction of prototypes and/or scaling and commercial testing of technology solutions.

### OBJECTIVE

To contribute to closing the existing information and knowledge gaps between suppliers and demanders of energy solutions and to facilitate access to financing to materialize the proposed innovations.

### EXPECTED RESULTS

- Strengthening of innovation ecosystem related to the development of solar energy.
- Creation of solar energy innovation communities.
- Increased number of competitive domestic suppliers to the local solar industry.
- Diversification of domestic suppliers' lines of business.

**FINANCING 2016-2019**  
**US\$4** MILLION CHILEAN GOVERNMENT  
**US\$2,2** MILLION PRIVATE SECTOR CONTRIBUTIONS



Gentileza: CINTAC

## STRENGTHENING QUALITY INFRASTRUCTURE FOR SOLAR ENERGY

Aimed at standardizing measurement, testing, regulations, standards and certification processes associated with the design, development, construction, operation and maintenance of solar power generation systems, in addition to component design and manufacture processes with a focus on technologies for desert environments.

### OBJECTIVES

- › To support an emergent national solar power industry so it can develop under the highest internationally recognized quality standards.
- › To contribute to raising the quality standards of solar power generation projects in the country by placing special emphasis on the duration and performance of their components.
- › To position Chile as an important player in the market niche of solar power for extreme desert conditions.

### EXPECTED RESULTS

- To obtain a detailed characterization of the climate conditions that might affect the durability and performance considered of photovoltaic systems in the Atacama Desert.
- Quality assurance guides/manuals for products and processes, in line with international standards.
- Chile's inclusion on the international technical committees that design the standards for solar photovoltaic energy systems (TC82 IEC, solar thermal electric plants (TC117 IEC) and conformity assessment schemes (IECRE).
- Participation in international work groups (The International Photovoltaic Quality Assurance Task Force - PVQAT, Photovoltaic Power Systems - PVPS IEA) to exchange best practices and strengthen human capital.
- Frameworks for verification of compliance by approved products and processes.
- To have a designated custodian laboratory with at least one metrological pattern by 2018.

**FINANCING 2016-2019**  
**US\$1,5** MILLION CHILEAN GOVERNMENT  
**US\$0,45** MILLION PRIVATE SECTOR CONTRIBUTIONS

## CUENCA DEL SALADO SOLAR CORRIDOR

The aim is to study and to test technical, social and productive solutions that allow a massive adoption of solar energy in the Cuenca del Salado Solar Corridor, which considers the cities of Chañaral and Diego de Almagro.

### OBJECTIVE

The main target is to create an urban model where solar energy benefits local residents and the local productive ecosystem, considering the inhabitants, the local economy and technical matters related to power generation and the technology solutions that help to increase solar power's penetration in electrical distribution grids.

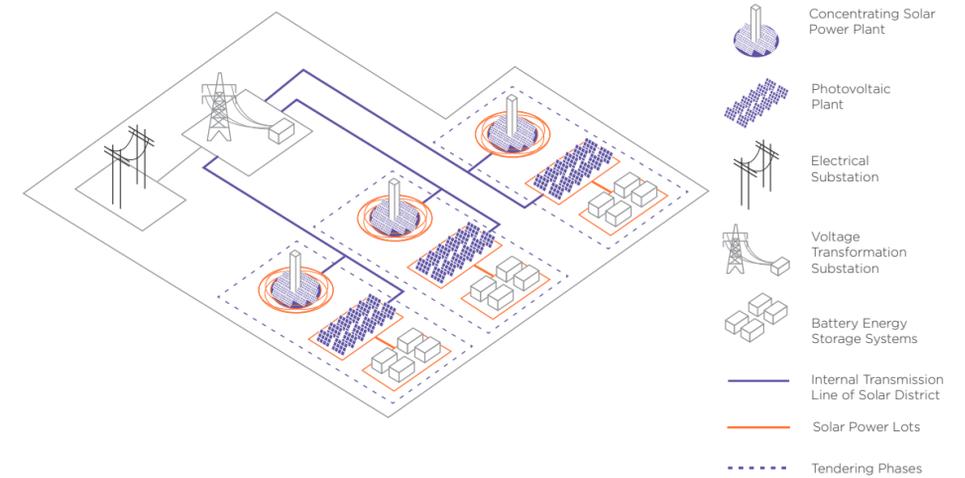
### EXPECTED RESULTS

- Energy strategy for the entire province: Municipalities of Chañaral and Diego de Almagro.
- Design and proposal of replicable solar city model, considering what the most convenient solutions (individual or associative) might be, incorporating business models into said solutions that are suitable to the most important local economic sectors, such as tourism and small-scale mining for example.
- Methodology for upgrading electrical distribution grids with different levels of solar power generation in the rest of Chile.
- Development and implementation of model projects to test the best technologies in the field.
- A local community actively involved in solar energy.

**FINANCING (Pre-investment phase) 2016 - 2017**  
**US\$0,45** MILLION CHILEAN GOVERNMENT  
**US\$0,1** MILLION PRIVATE SECTOR CONTRIBUTIONS

## SOLAR TECHNOLOGY DISTRICT (DTS)

The concept DTS refers to the development of territories covering large areas, chosen for their optimal conditions for solar power generation and subdivided into lots, awarded to generation companies in a concession for the development, construction and operation of solar power plants using different technologies. A Technology Master Plan will determine choice of technologies and the total installed capacity in these districts, whose optimization criteria will include the technology mix that best contributes to a stable supply of energy at competitive prices, promoting participation by local companies in the different project stages.



### OBJECTIVE

Development of a national solar power industry through the implementation of large-scale generation initiatives that help to increase domestic suppliers' participation and foster the competitive development and technological innovation in solar power generation and storage.

### EXPECTED RESULTS

- US\$ 4 billion in private investment for each STD Project of ~750 MW.
- Creation of direct jobs (~3,000 in construction and ~300 in operation) and indirect jobs (~12,000 during the project life cycle).
- Development and diversification of suppliers' business lines in national industry.
- Development of solar power generation and storage technologies.
- Reduction of greenhouse gas emissions (~1,000,000 tons of CO2 eq. annually).

**FINANCING 2016 - 2017 (Pre-investment phase)**  
**US\$0,8** MILLION CHILEAN GOVERNMENT