

The logo for CEA (Comisión Económica para América Latina y el Caribe) is displayed in white lowercase letters on a red square background.

## CEA-Liten: I+D para una transición energética circular



Ciclo de seminario Red + Energía – Antofagasta, 17/11/2022

Robin HERVÉ – Representative in Chile – [robin.herve@airdata.cl](mailto:robin.herve@airdata.cl)

The background of the slide features a close-up of a woman's face and hands. She is looking directly at the camera with a neutral expression. Her hands are positioned as if she is interacting with a futuristic, semi-transparent digital interface. The interface is composed of various geometric shapes, including circles, lines, and rectangular panels, all in shades of light purple and white. Binary code (0s and 1s) is scattered throughout the interface, appearing to flow and interact with the woman's hands. The overall aesthetic is clean, modern, and high-tech.

# General presentation

## 4 RESEARCH DEPARTMENTS

SOLAR ENERGY



LI-ION BATTERIES



SMART GRID  
ELECTRIC MOBILITY  
CIRCULAR ECONOMY



HYDROGEN  
& P2X



ADVANCED MATERIALS  
FOR ENERGY

**Mission:** to accelerate the decarbonization of industries

**How?** By transferring knowledge and technology to our industrial partners

**2 sites**, 25.000 m<sup>2</sup> of facilities to test and develop pre-industrial prototypes

1.100 researchers, 200 patents/year, **250+ industrial partners**

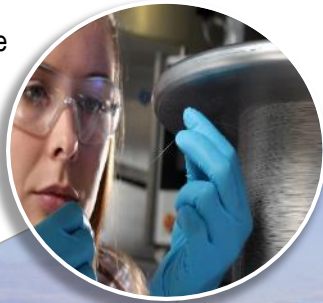
**12 technology platforms**



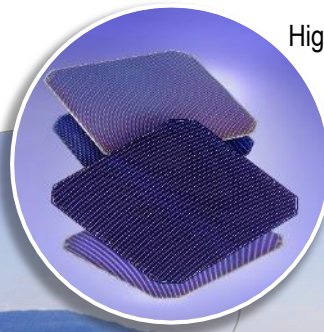
Silicon  
Cristallization



Diamond wire  
Wafering



High efficiency  
Cells



Innovative  
Modules



Energy efficiency for building  
BIPV



Production yield evaluation  
for PV power plant



Solar  
Mobility



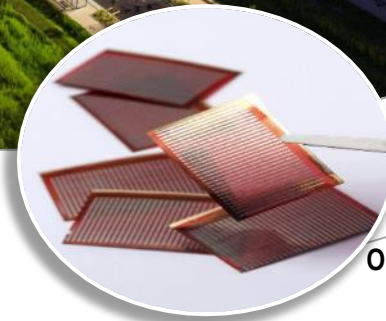
Smart electrical  
Systems & grids



Storage selection  
& management



Organic & Tandem  
(perovskite) PV



**Comprehensive vision  
of industrial challenges  
throughout the value chain,  
from materials to systems**

Comprehensive vision  
of industrial challenges  
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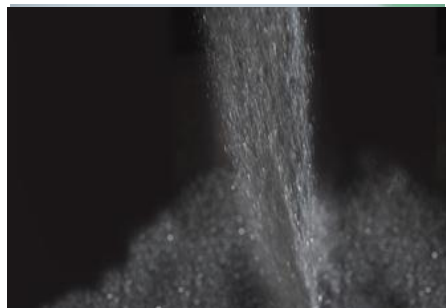
Materials  
synthesis

Cell  
assembly

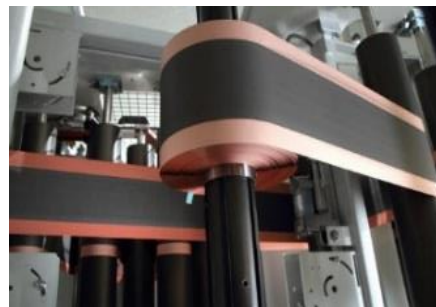
System  
development

System  
integration

HYDROGEN  
PLATFORM



BATTERY  
PLATFORM



Modelling, technological watch, market analysis, tec-eco/LCA

	Country	LCE IPFs	Share of IPFs in selected fields										
			Combustion	Alternative fuels	Nuclear	Solar	Batteries	CCUS	Hydrogen and fuel cells	Smart grid	Other enabling	Chemical and oil refining	ICT
CEA/Alternative Energies and Atomic Energy Commission	FR	1772	0.1%	0.2%	3.9%	0.9%	0.6%	0.0%	1.2%	0.1%	0.6%	0.2%	0.1%
Industrial Technology Research Institute	TW	846	0.1%	0.1%	0.0%	0.5%	0.2%	0.2%	0.3%	0.1%	0.2%	0.1%	0.2%
Fraunhofer Gesellschaft zur Förderung der angewandten Forschung e.V.	DE	725	0.1%	0.2%	0.0%	0.6%	0.1%	0.0%	0.3%	0.1%	0.2%	0.2%	0.1%
IFP Energies Nouvelles/IPFEN	FR	721	0.8%	1.2%	0.0%	0.0%	0.0%	1.4%	0.1%	0.0%	0.2%	1.2%	0.0%
University of California	US	666	0.1%	0.8%	0.4%	0.3%	0.2%	0.6%	0.4%	0.1%	0.3%	0.3%	0.0%
Electronics and Telecommunications Research Institute	KR	626	0.0%	0.0%	0.0%	0.3%	0.1%	0.0%	0.0%	0.5%	0.1%	0.0%	1.0%
CNRS/National Centre for Scientific Research	FR	594	0.0%	0.2%	0.1%	0.3%	0.2%	0.2%	0.3%	0.0%	0.2%	0.4%	0.0%
Tsinghua University	CN	569	0.1%	0.2%	0.3%	0.2%	0.4%	0.1%	0.2%	0.3%	0.3%	0.1%	0.0%
National Institute of Advanced Industrial Science and Technology	JP	455	0.0%	0.2%	0.0%	0.2%	0.3%	0.2%	0.2%	0.0%	0.1%	0.2%	0.0%
Battelle Memorial Institute	US	402	0.1%	0.3%	0.4%	0.0%	0.1%	0.5%	0.3%	0.2%	0.2%	0.3%	0.0%

Source:

**Patents and the energy transition**, IEA study, 2021

<https://www.iea.org/reports/patents-and-the-energy-transition>

2005

2010

2020

Transfer to industry

## PV modules

**Strategic decision**  
Launch of HJT activities



**Proof of concept**



**Demonstrators**



**Transfer to industry**



## Electrolyzers

**Strategic decision**  
Launch of SOC activities



**Proof of concept**  
First electrolyzer rSOC



**Demonstrators**



**Transfer to industry**



## Fuel cells

**Strategic decision**  
Launch of PEMFC activities



**Proof of concept**  
first stack PEMFC



**Demonstrators**  
From EZ to ~100 vehicles



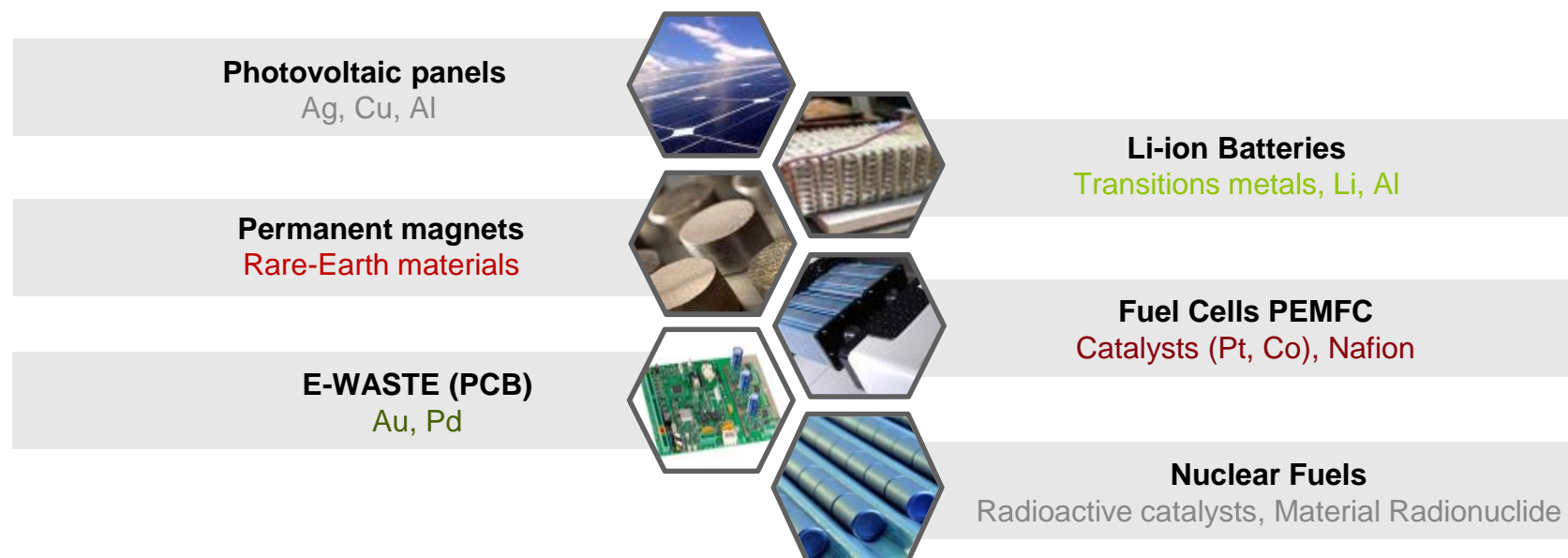
**Transfer to industry**



The background of the slide features a close-up photograph of a woman's face, looking directly at the camera. Overlaid on her face and hands are various digital and futuristic graphics. These include semi-transparent circular patterns, lines of binary code (0s and 1s), and glowing white dots. The woman's hands are positioned as if she is interacting with a virtual interface, with a central circular graphic appearing to be a focal point of her interaction.

# Circular economy approach at CEA

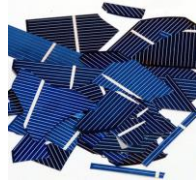




Creation of an internal experts network within CEA to support our researchers in the **systemic integration of environmental KPIs in the competitiveness analysis** of their R&D development:

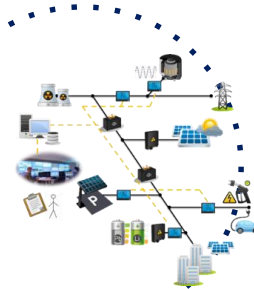
- Technical KPIs → Classic tec-eco analysis approach
- Economical KPIs
- **Environmental KPIs** → Environmental competitiveness approach (including LCA)

- 2nd life strategies (failure diagnosis, repair, re-use)
- New efficient recycling processes
- Ex. Photorama Project (solutions from diagnostic to recycling)



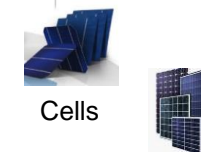
Valorization &amp; Recycling

- Improve durability of PV modules
- Improve system integration
- Ex. Atamostec (PV systems adapted to desert conditions)



Durability of use

- Selection of materials
- Alternatives to reduce raw materials consumption
- Selection of PV components
- Enable 2nd uses
- Improve recyclability
- Reducing Elec consumption by process



Eco-design

## Circular Economy of PV system

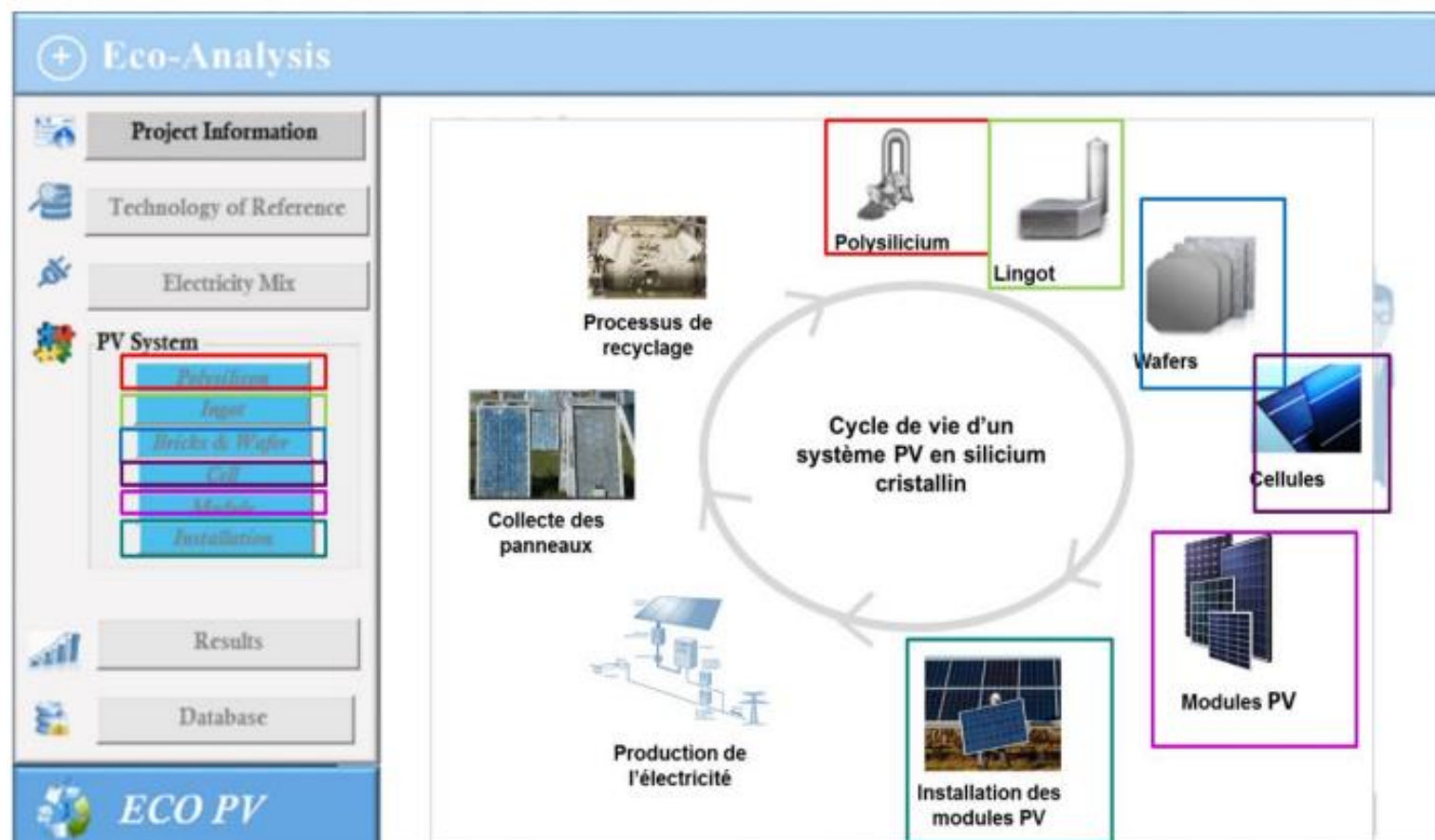
Classic  
tec-eco tools

Tools	Expertise
CoO tool (internal tool)	<ul style="list-style-type: none"> <li>CoO (Cost of Ownership) assessment of PV technologies</li> </ul>
BP tool (internal tool)	<ul style="list-style-type: none"> <li>Business plan for Giga Factory</li> </ul>
LCOE tool (internal tool)	<ul style="list-style-type: none"> <li>Assessment of energy systems (LCOE, VAN etc.)</li> </ul>
CoO/BP tools (internal tools)	<ul style="list-style-type: none"> <li>Technical-economical assessment of different components of PV systems</li> </ul>

## LCA tools

Tools	Expertise
Sima Pro (licence)	<ul style="list-style-type: none"> <li>Carrying out complete LCA studies over the entire life cycle of a product, process or system</li> </ul>
ECO-PV (internal tool) PV database (internal database)	<ul style="list-style-type: none"> <li>Rapid diagnosis of one solution compared to another from an industrial perspective</li> <li>Assessment of scenarios and orientation of technological choices for eco-designed solutions</li> <li>Sensitivity analysis and tec-eco-env optimization</li> </ul>

Life Cycle Analysis of a PV manufacturing process compared to other processes from CEA's database



Definition of KPI's optimization according to company's goals:

**Customers Priorities**

Please define customer's priorities to quantify the needs

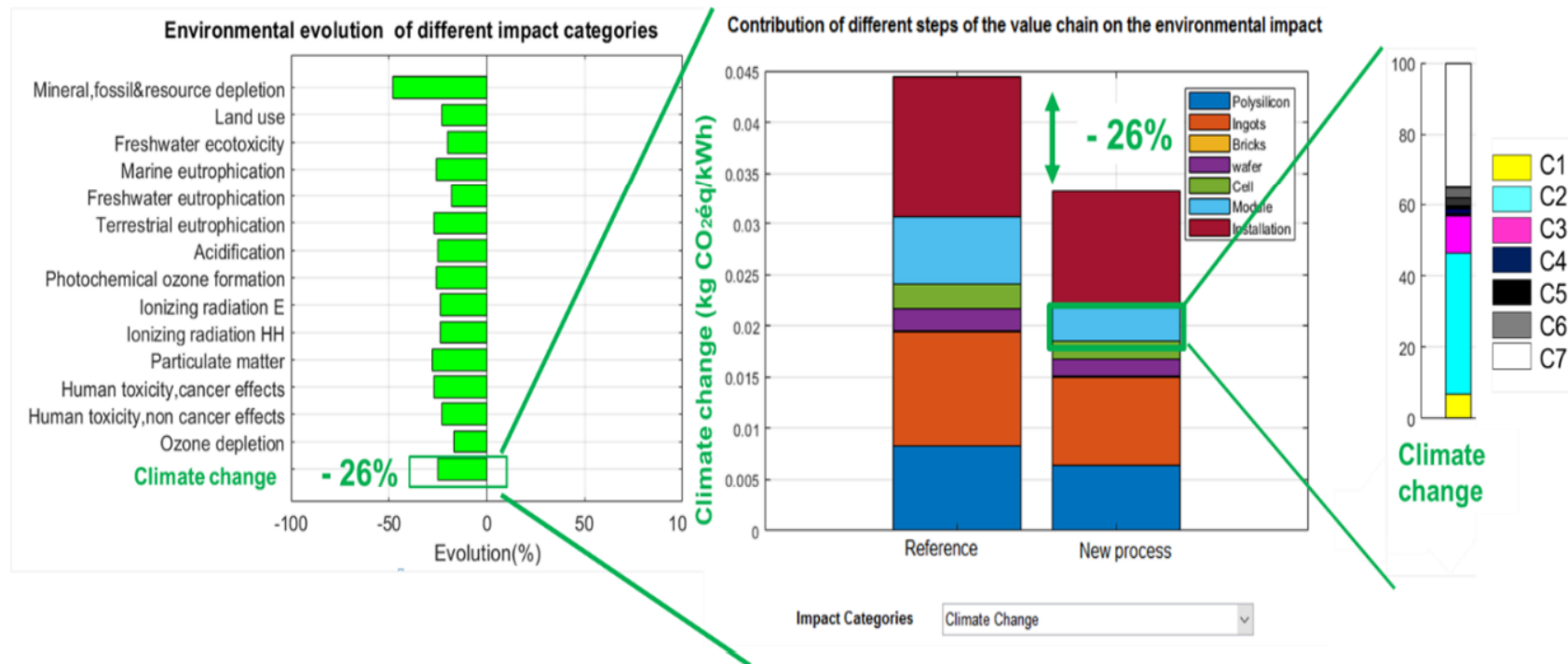
	Low priority	Medium priority	High priority	Weighted Vector
Economic Performance	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	54 %
Technical Performance	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	30 %
Environmental Performance	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	16 %

Cancel Save

Project Requirements: Priorities (selected), Fixed targets, No requirements

Next

Example of results for a new PV panel manufacturing process:

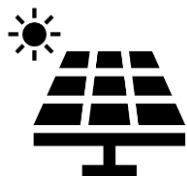


The background of the slide features a close-up photograph of a woman with long, wavy brown hair. She is looking directly at the camera with a neutral expression. Overlaid on her face and hands are various digital and futuristic graphics. These include semi-transparent circular patterns, lines of binary code (0s and 1s) arranged in arcs, and a central circular interface element with radiating lines, resembling a futuristic control panel or data visualization. The overall aesthetic is clean, modern, and tech-oriented.

# Activities in Antofagasta Region



Solar energy



Green hydrogen



Green mining



Advanced materials for  
the energy transition





# ATAMOSTEC: THE BIFACIAL INSTITUTE FOR DESERT PV



ATAMOSTEC



**CDEA**  
CENTRO DESARROLLO  
ENERGÉTICO ANTOFAGASTA



## Objective:

To minimize LCOE in Atacama Desert's conditions

## CEA-Liten contribution in ATAMOSTEC :

- Design of PV panels adapted to Atacama desert
- Qualification → Desert Label
- Modeling and data analysis
- Competitiveness analysis (objective LCOE < 15 USD/MWh)
- Training, Technological Transfer

Laboratorio outdoor - PSDA (Plataforma solar del desierto de Atacama)



cea

# ATAMOSTEC: PROYECTO ATAMO II



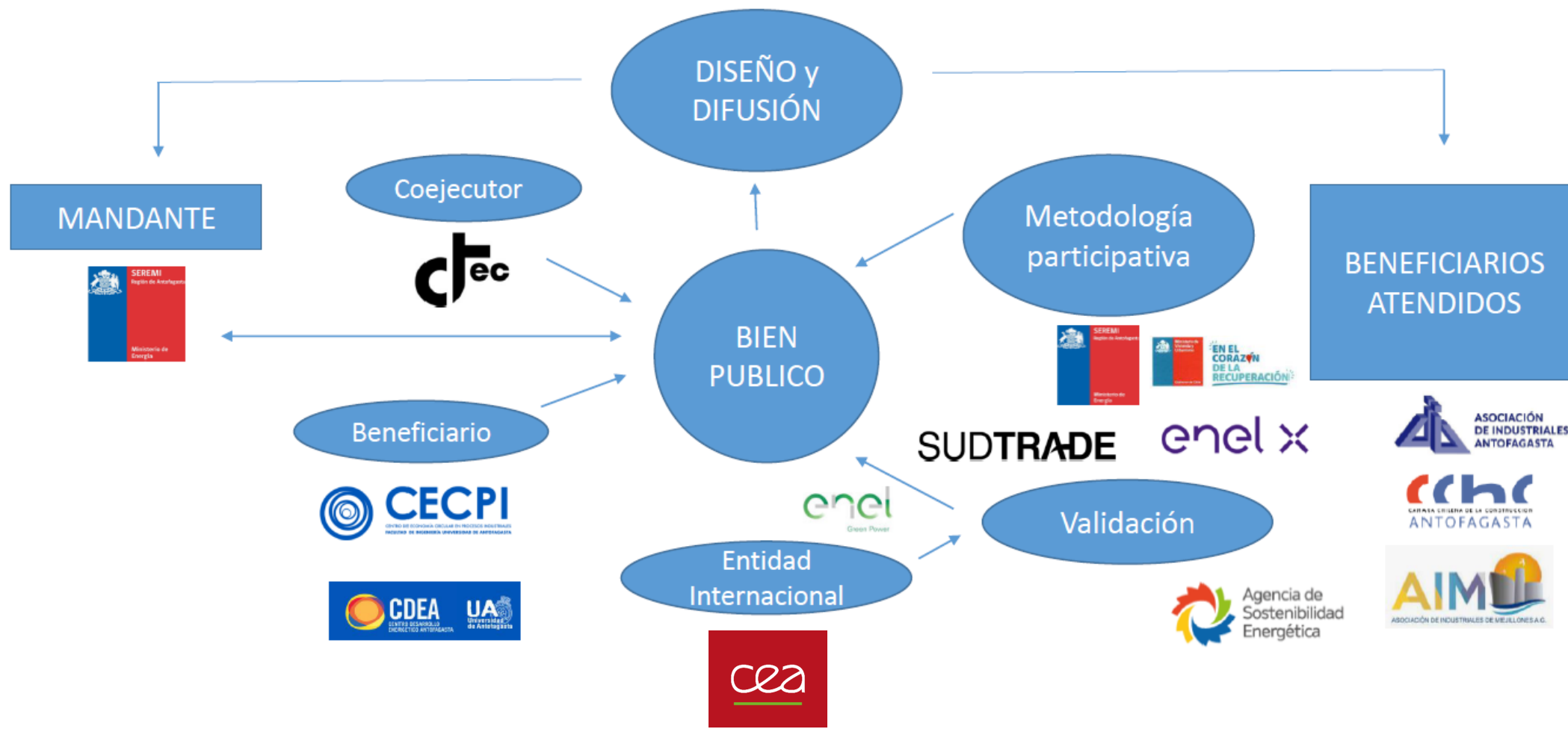
ATAMOSTEC



**CDEA**  
CENTRO DESARROLLO  
ENERGÉTICO ANTOFAGASTA



Inauguración abril 2022



The CEA logo is located in the top left corner, consisting of the lowercase letters 'cea' in white on a red square background.An aerial photograph of Grenoble, France, showing the city built on a valley floor. The city is bisected by the Isère river, which flows through the center. A large, circular stadium is prominent in the middle ground. In the background, the French Alps are visible, with several peaks covered in snow under a clear blue sky. The foreground shows green hills and residential areas.

# GRACIAS

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Representative in Chile  
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**Gracias y bienvenidos a visitar nuestras instalaciones en los Alpes franceses!**