



Fraunhofer

CHILE

Seminario Solar Fraunhofer Chile - CSET

***SIMULACIÓN DE SISTEMAS PARA UNA OFERTA DEL 100% EN ENERGÍA
RENOVABLE***

Solar energy contribution towards 100% renewable energy supply in Chile

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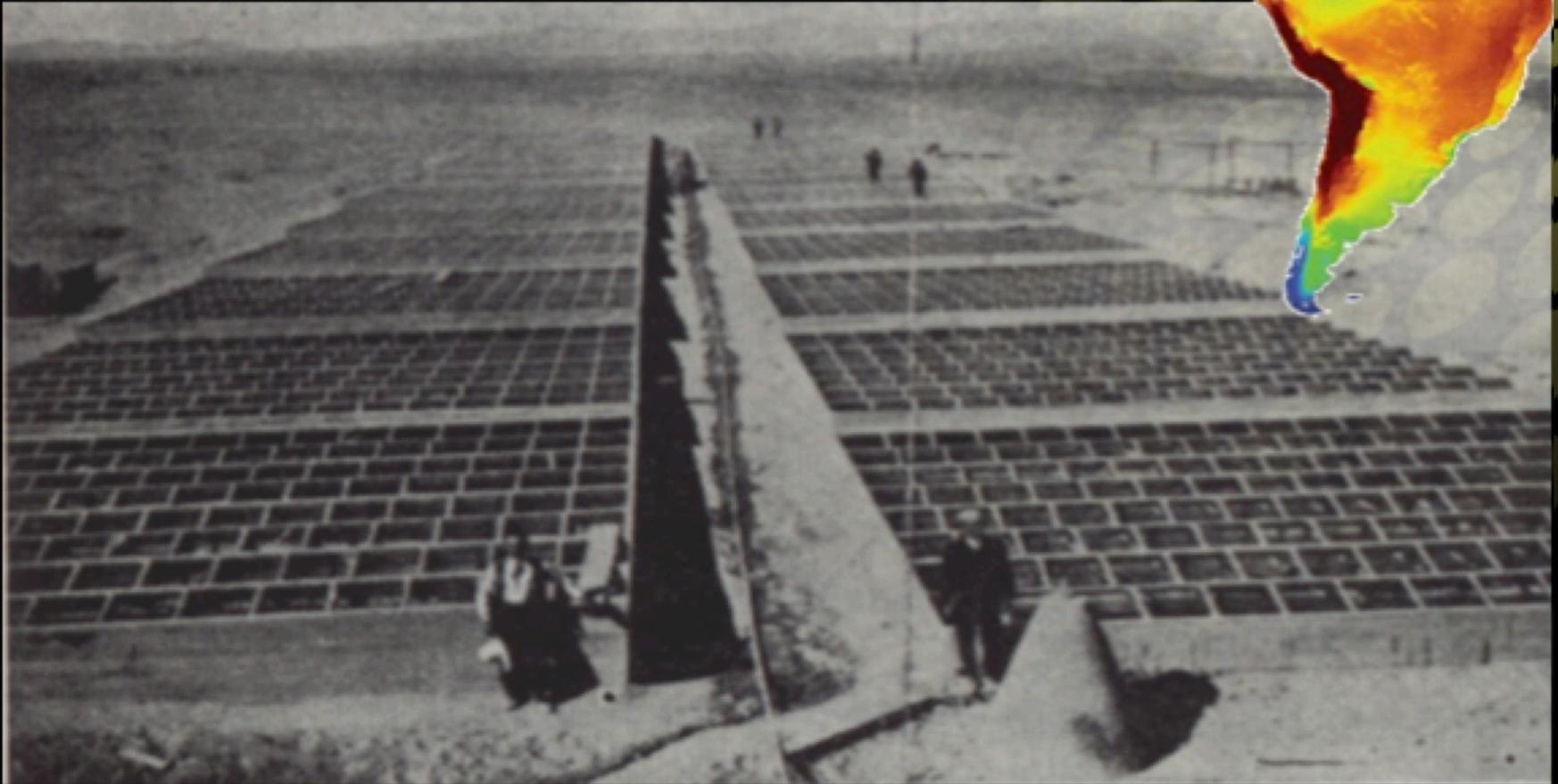
Chilean solar energy challenge







1872



Ref: J. Hirschmann
Charles Wilson, en 1872 se atrevió y construyó
un gran destilador solar en "Las Salinas", en las cercanías de la Salitrera Chacabuco.



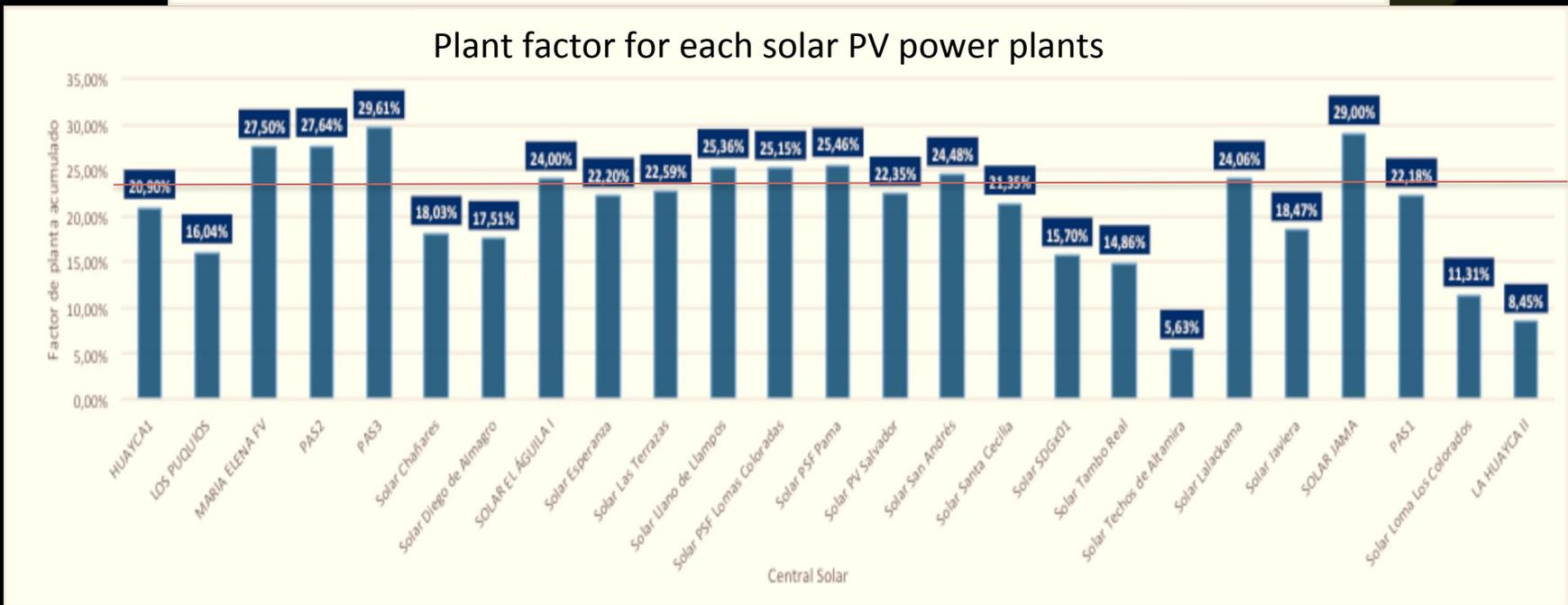
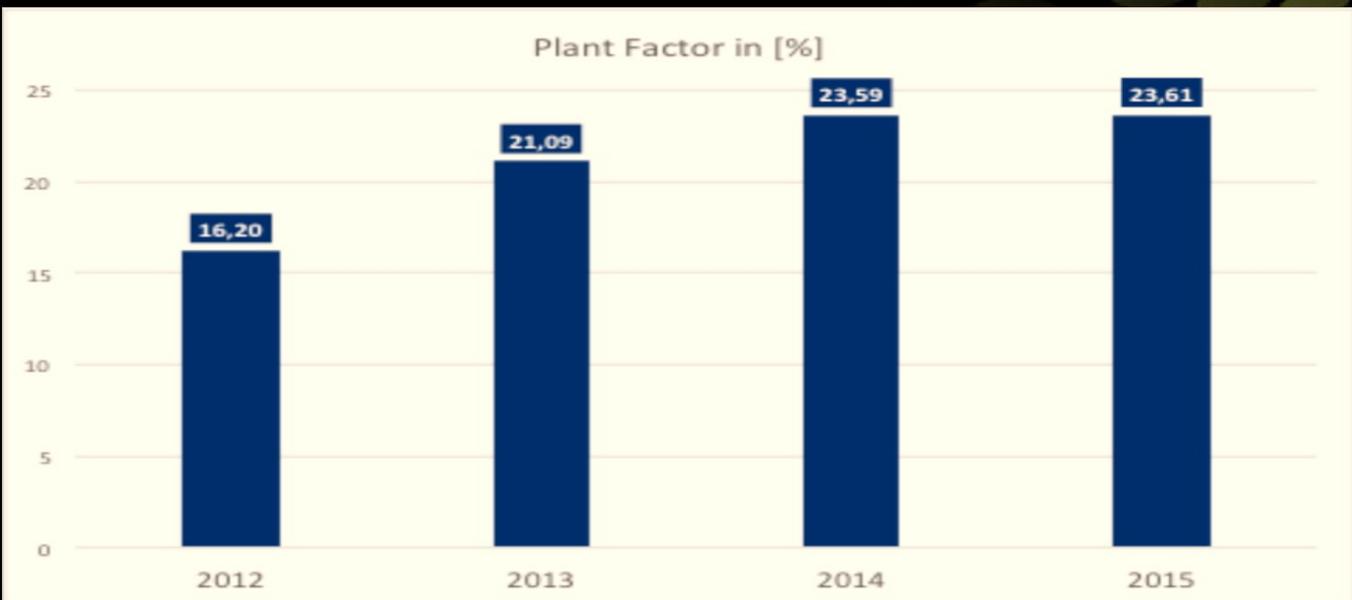
Big Picture for Renewable Energy in Chile

Technology	Operation	Construction	Approved unconstructed	Under evaluation
Biomass	417	0	73	116
Biogas	44	0	8	0
Wind	901	112	5.602	1.657
Geothermal	0	48	120	0
Micro-Hidro	390	67	429	104
Solar PV	741	2.110	10.332	3.566
Solar CSP	0	110	980	105
Total	2.494	2.448	17.543	5.549

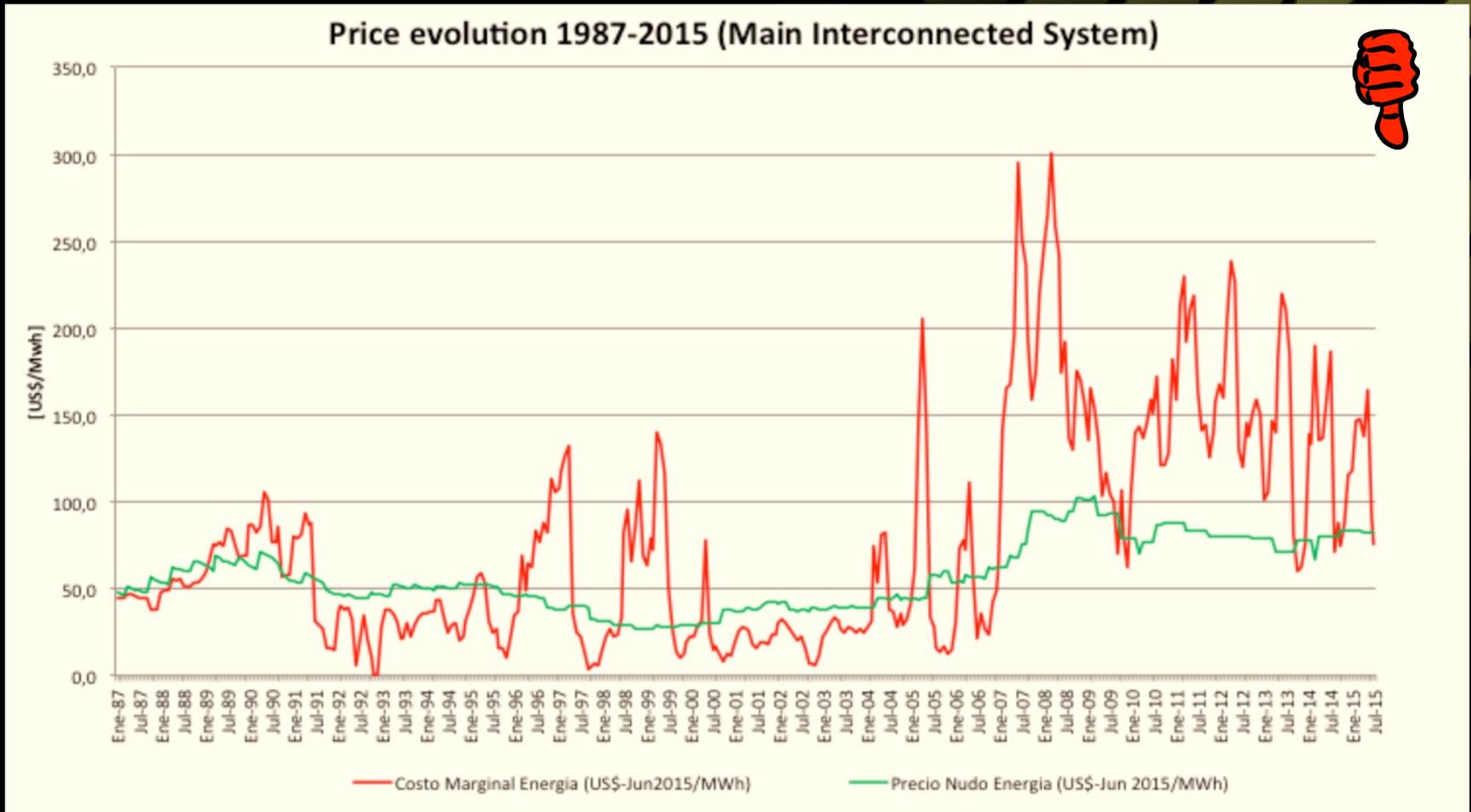
Fuente: CNE., SEIA, CDEC-SIC / CDEC-SING. CIFES, Octubre 2015

CSP developers: Abengoa, Solar Reserve, Ibereólica

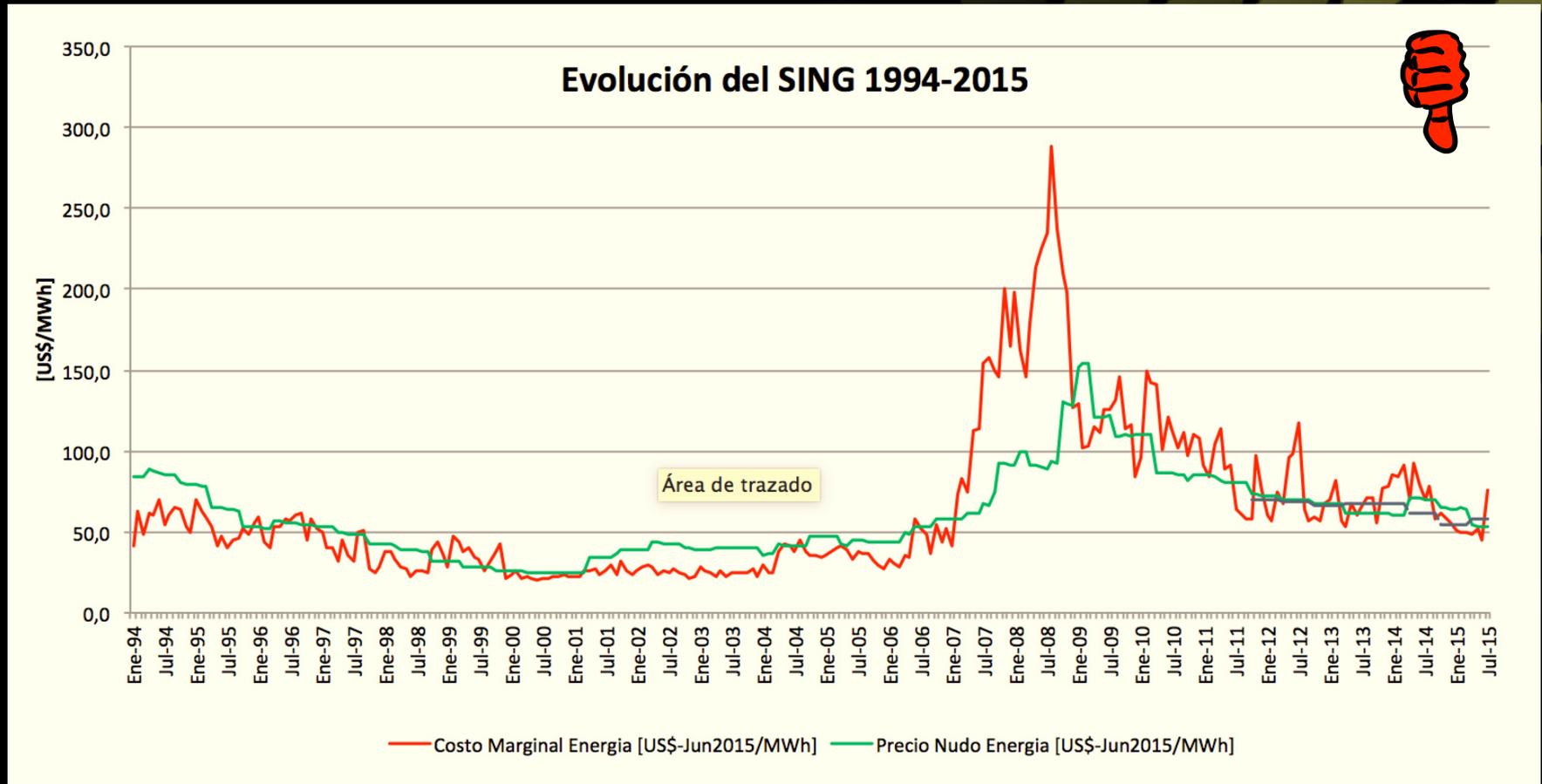
Performance for PV (capacity/plant factor, September)



Electricity price evolution in SIC (US\$/MWh)



Electricity price evolution in SIC (US\$/MWh)

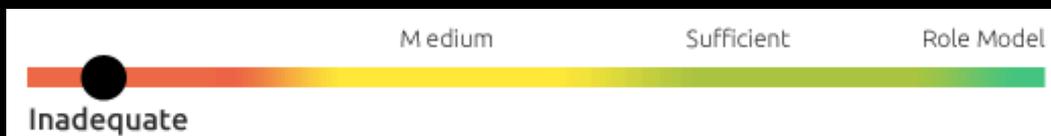
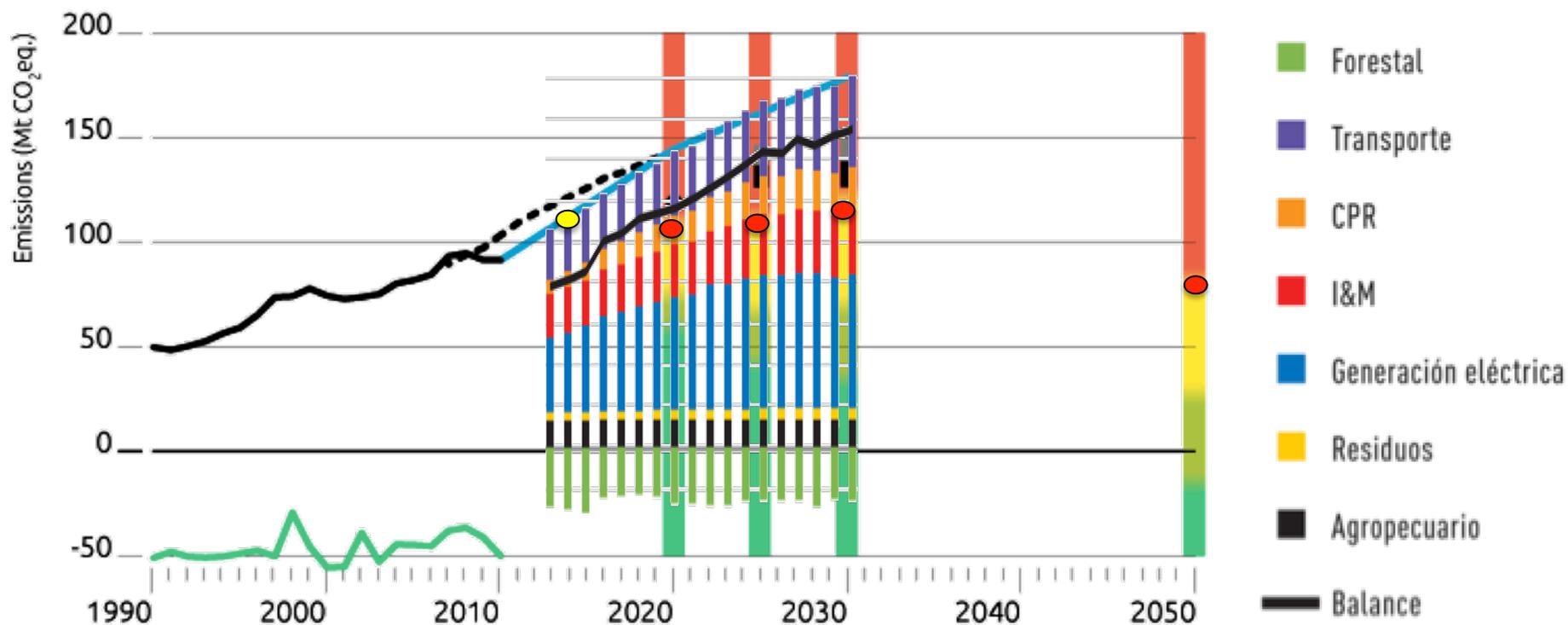


Emissions projection of aggregated Scenarios



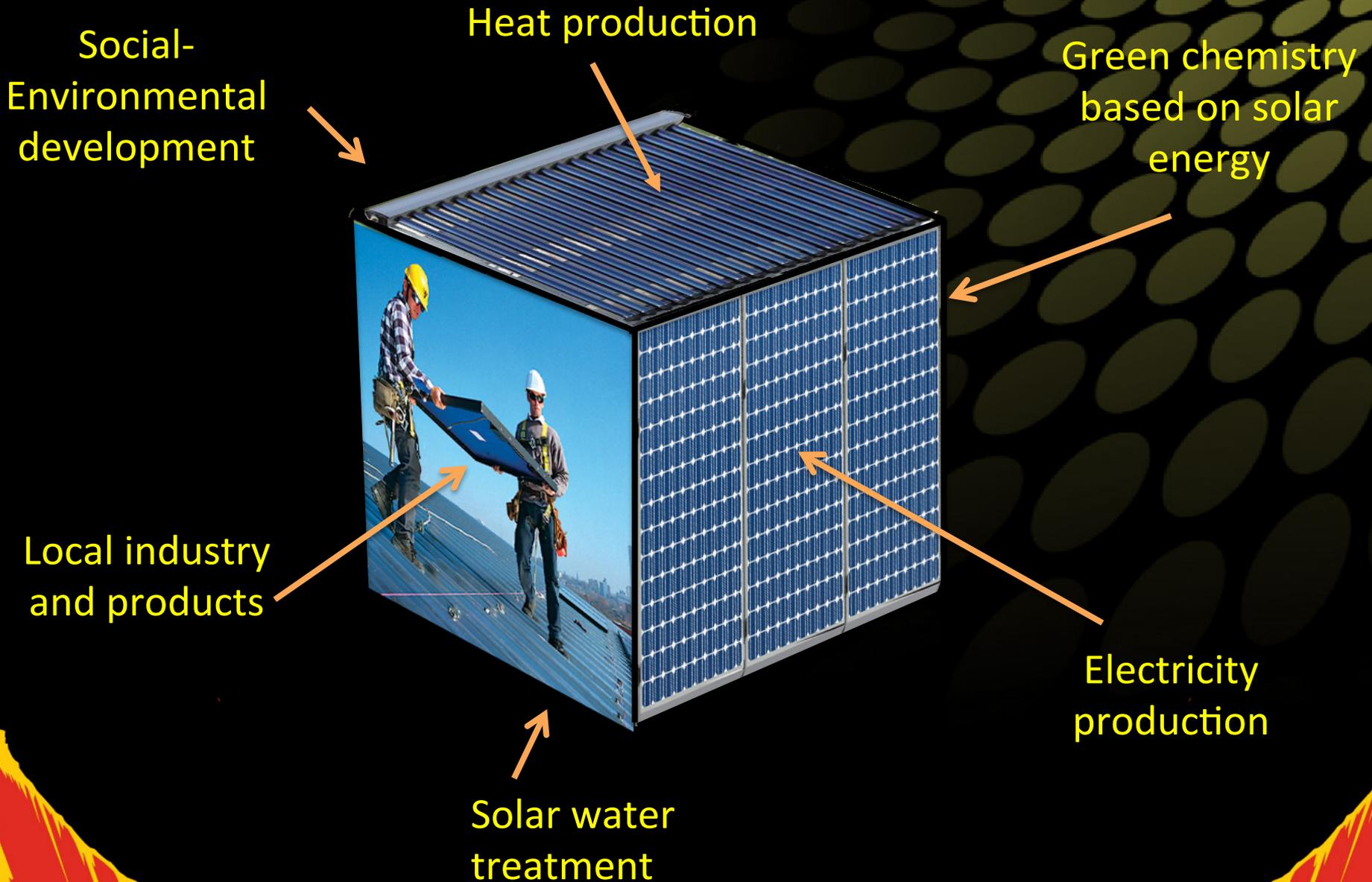
MAPS

Mitigation Action Plans & Scenarios



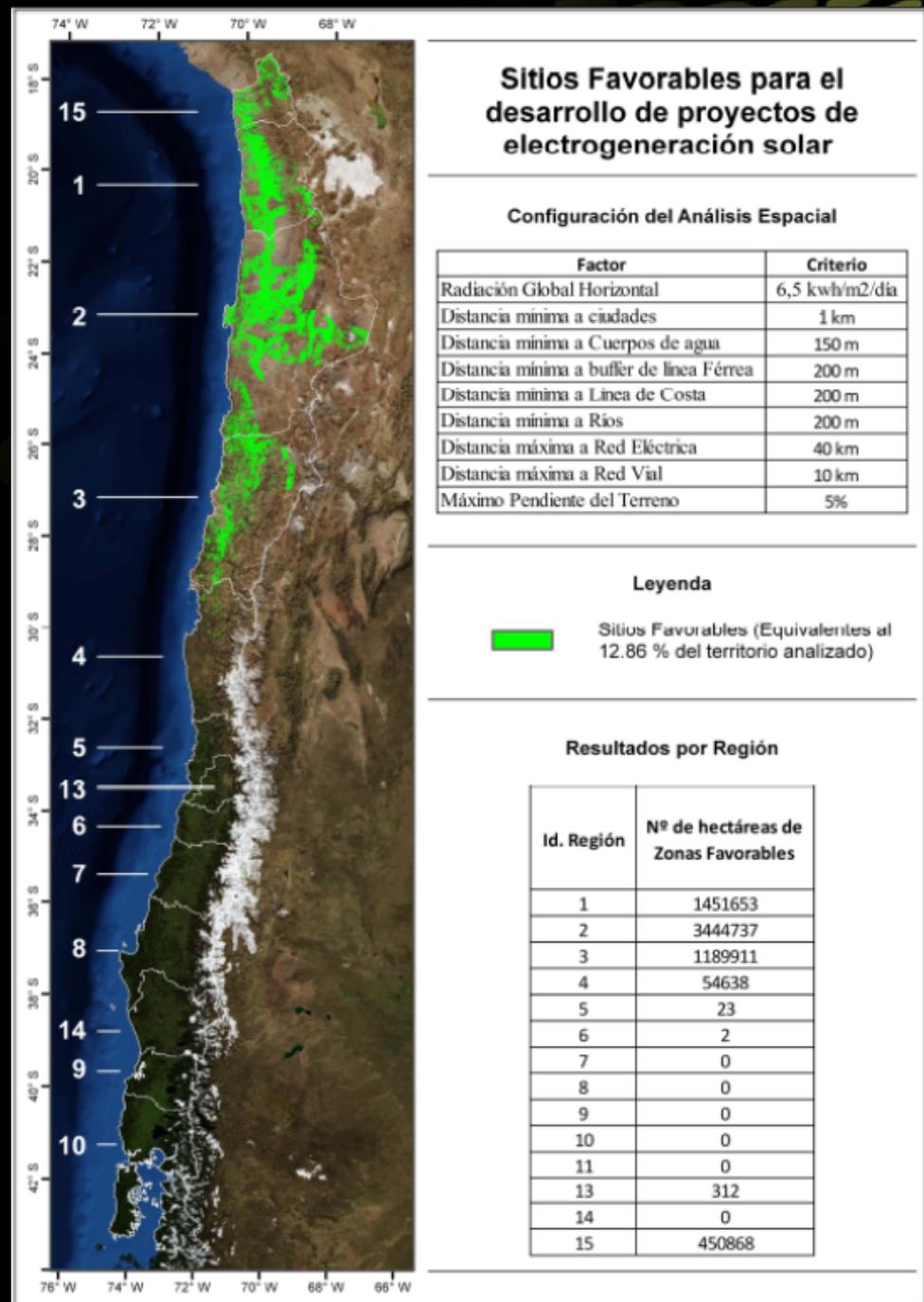
Source: MAPS Chile

Multidimensional challenge



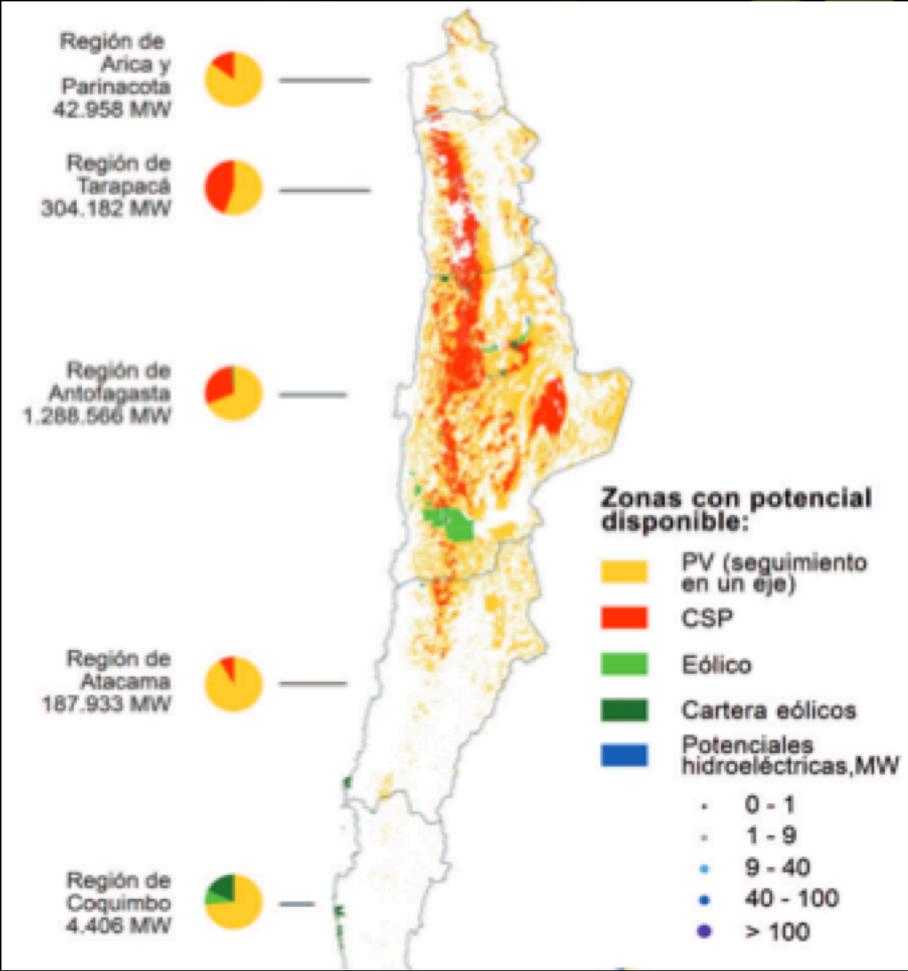
Chilean Solar Energy Potential

- Context: fossil fuels, climate change.
- Exceptional radiation conditions, low cloudiness index, low temperature, water scarcity
- Local mining activity (energy consumption, nitrates)
- More than 66000 km² feasible !!

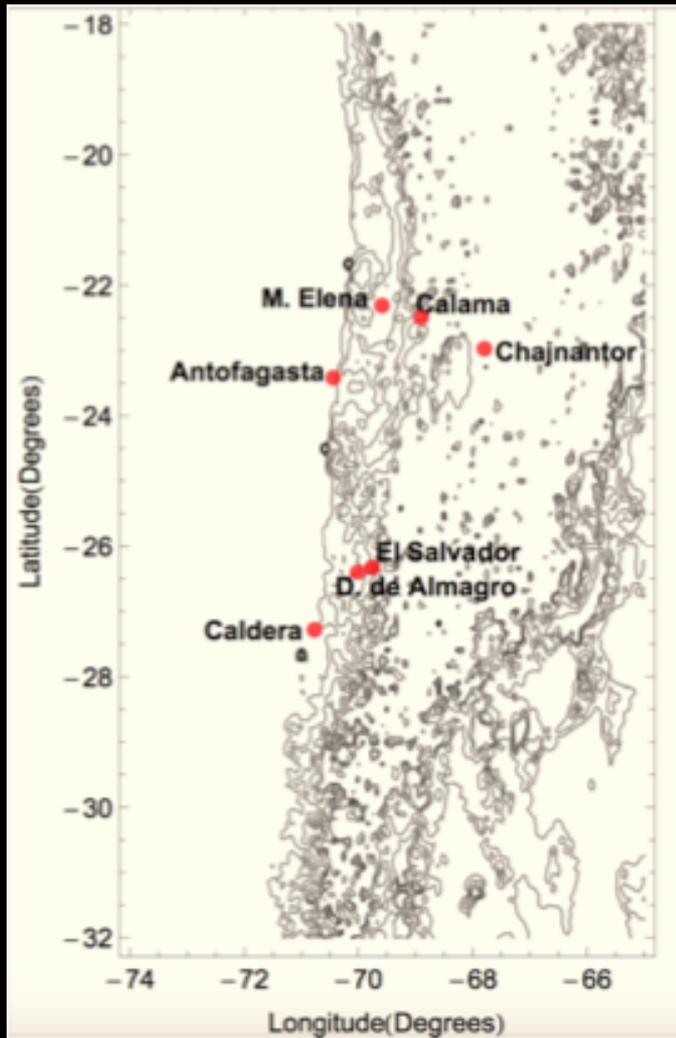


Chilean Solar Energy Potential

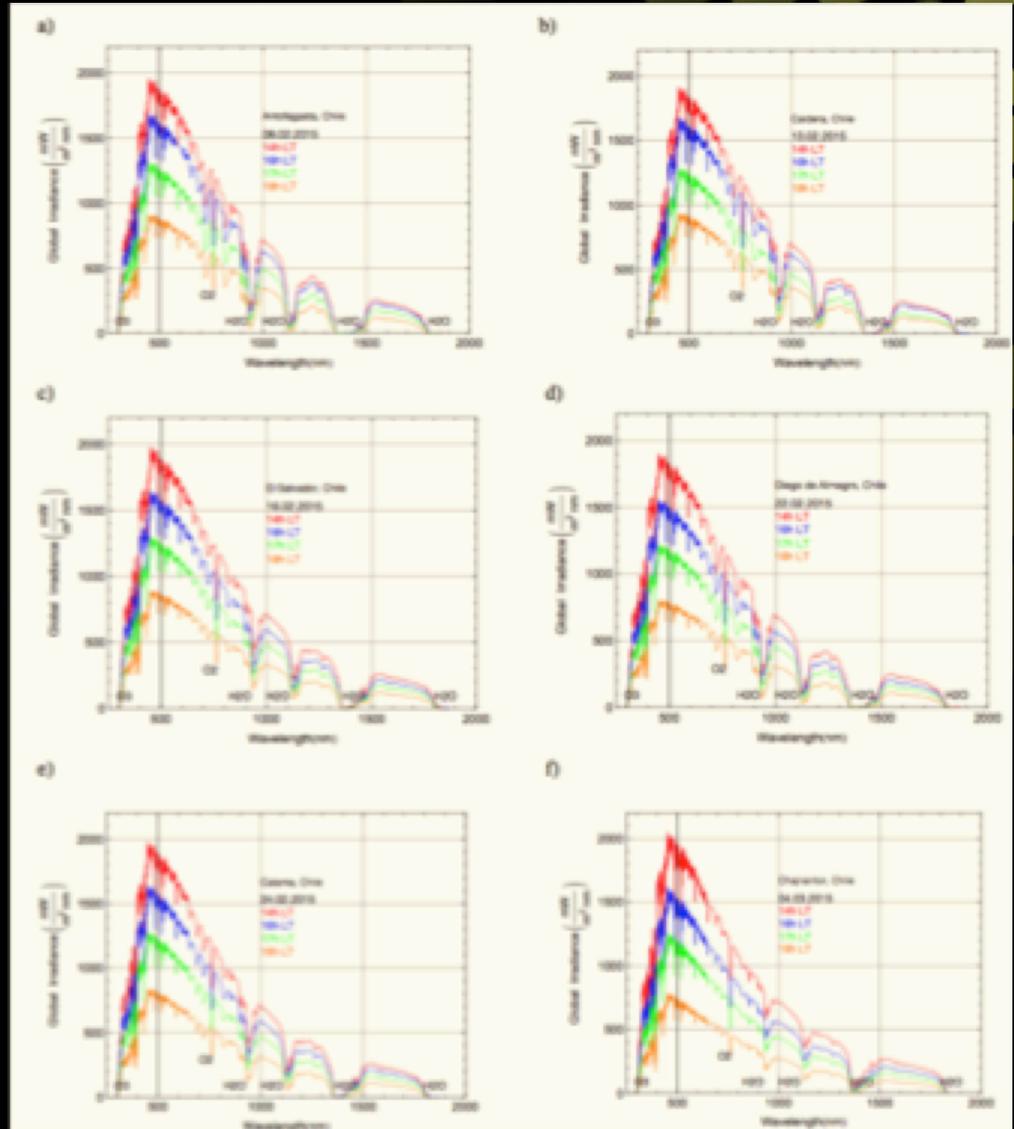
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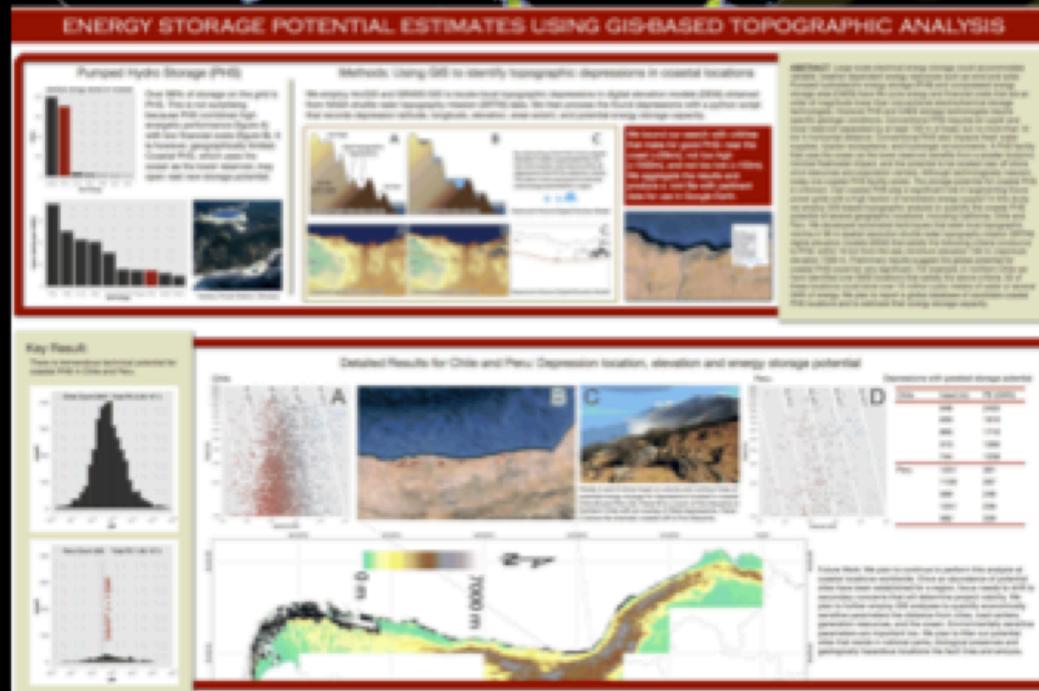
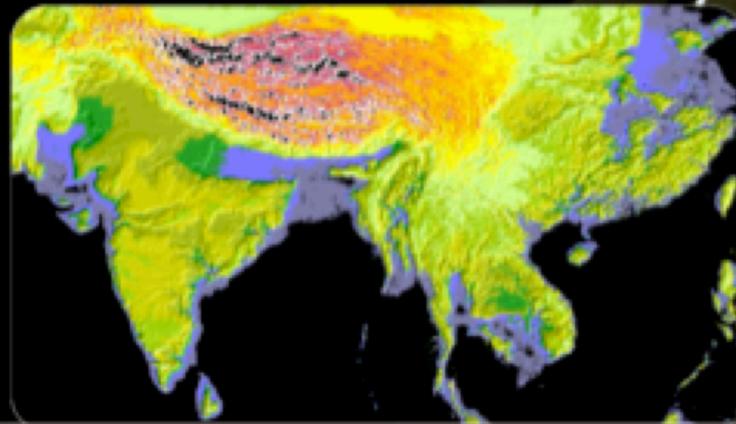
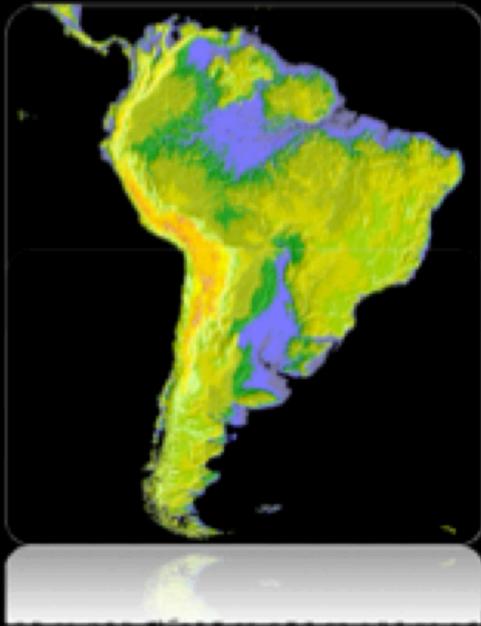
Chilean Solar Energy Potential



Solar Spectrum



Chilean Solar Energy Potential



Pump Storage

Grand Challenge 2033

Supply 30% of the electricity consumption in SA

200.000 MW

~ 6.000 km² (3ha/MW)

0.8% of the Chilean territory

5% of the Atacama desert

6 times the current Chilean electricity consumption



Chile 100 % Solar Today

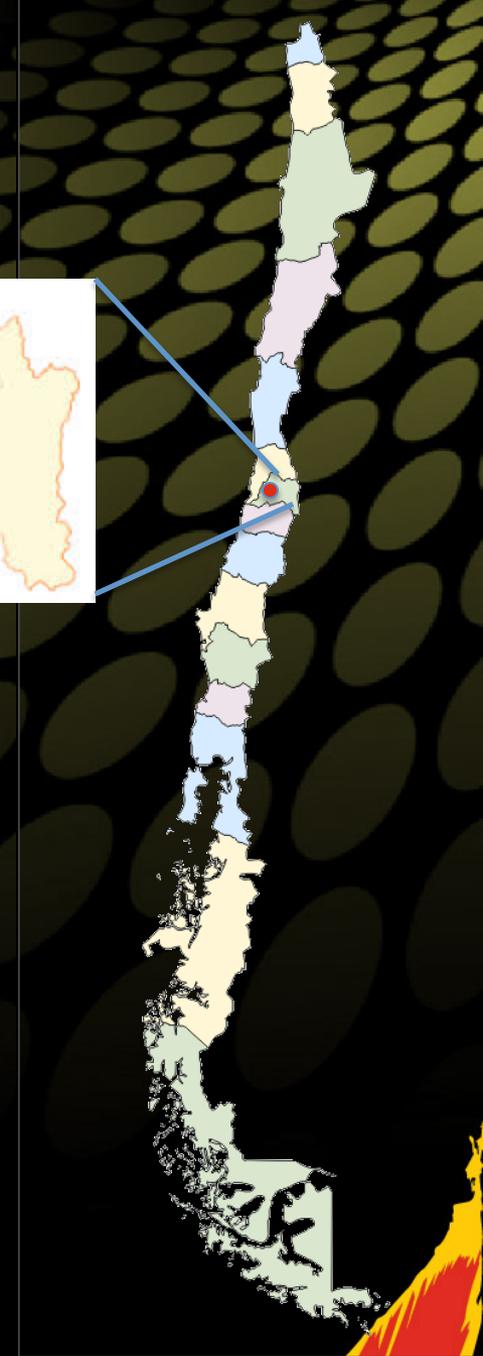
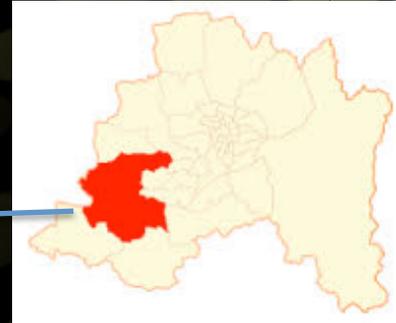
Yearly consumption
70,000 GWh

30.000 MW

~ 1,000 km² -- (3ha/MW)
Melipilla

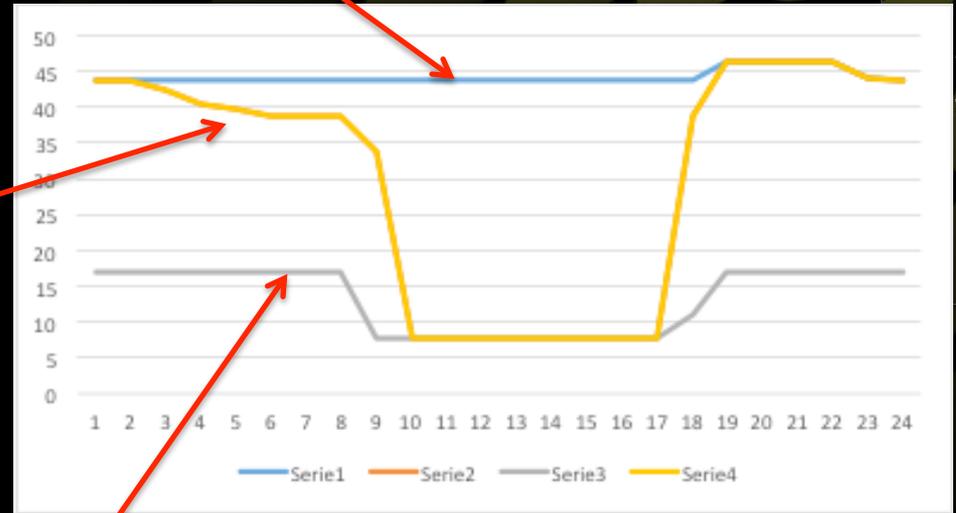
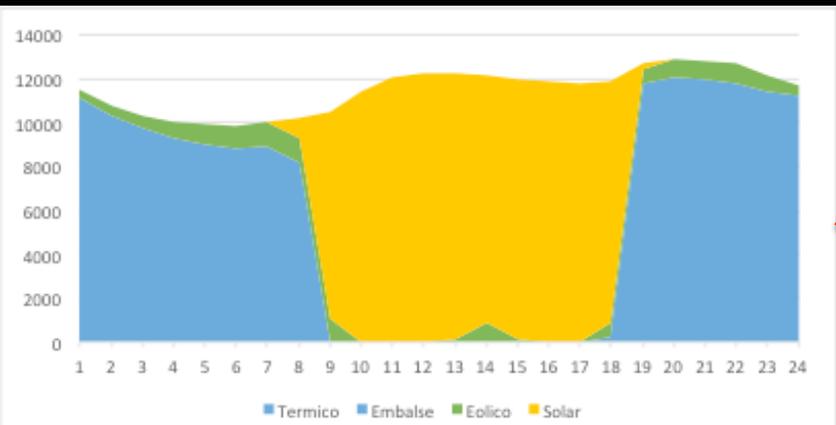
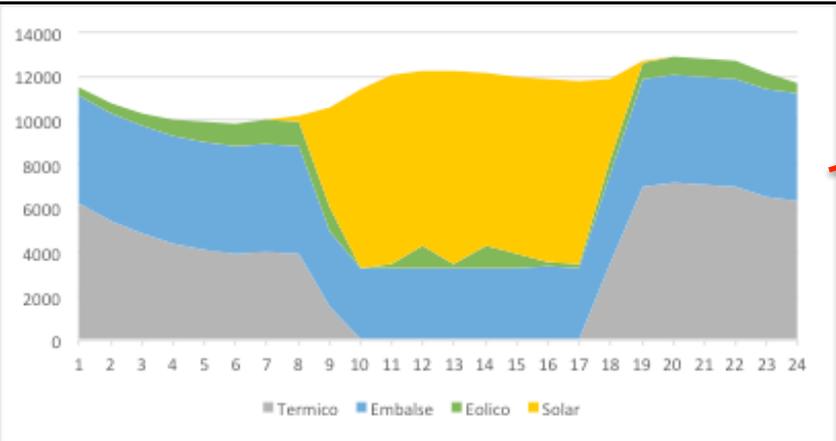
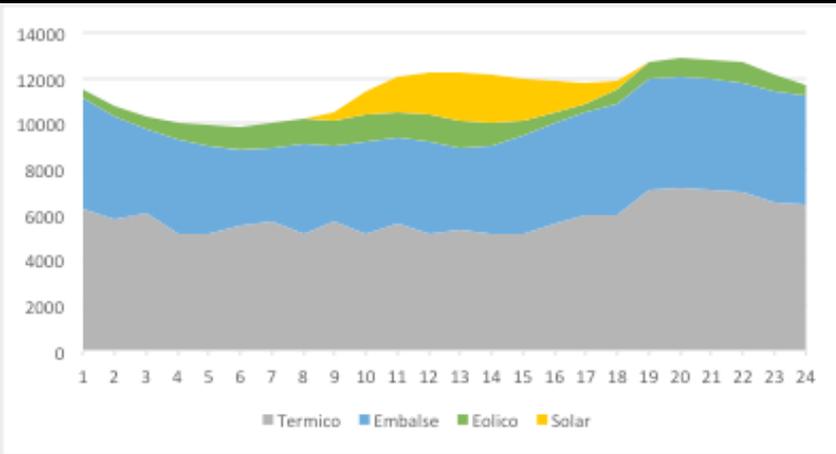
0.14% of the Chilean territory

1% of the Atacama desert



Chile 100 % Solar Today

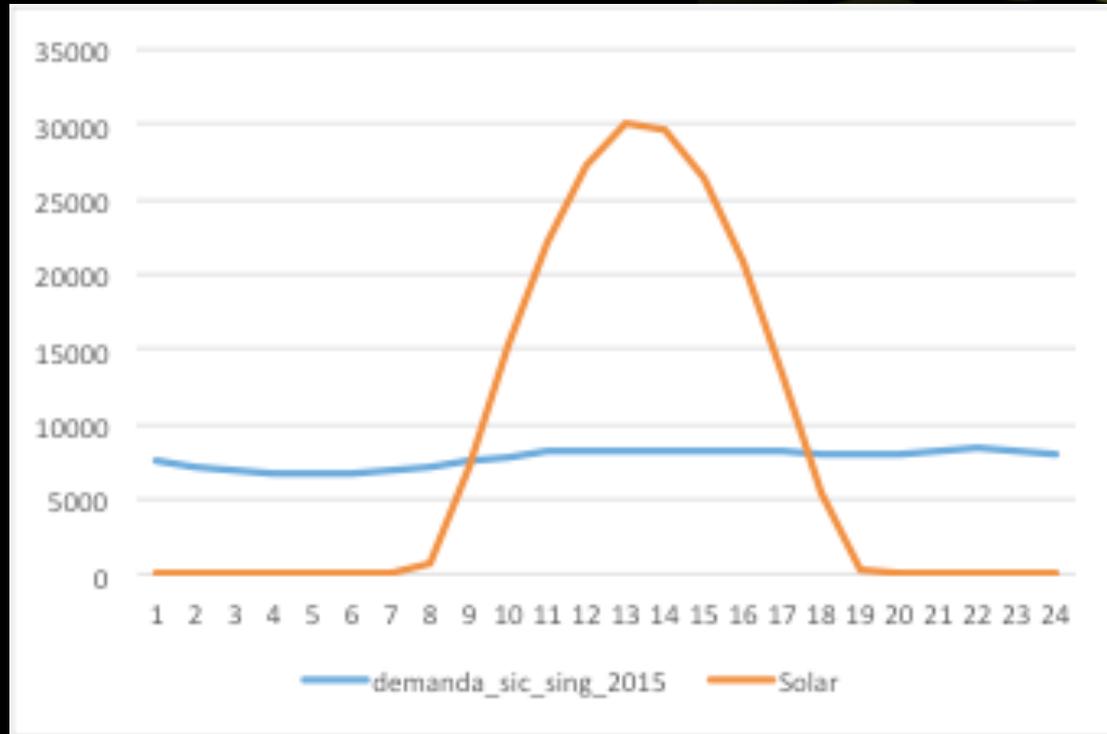
Market design challenge



Source: elaboración propia CE, U Chile

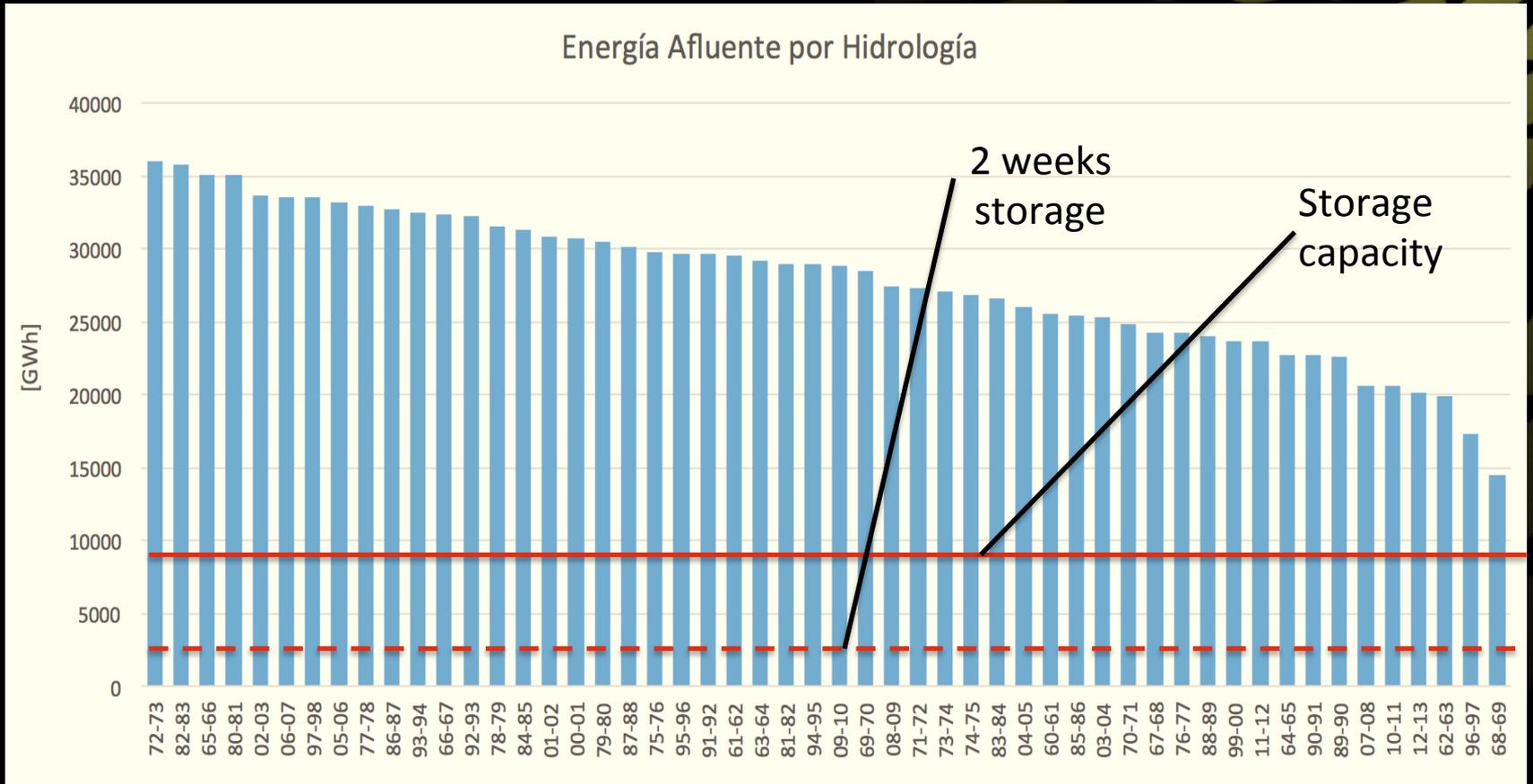
Chile 100 % Solar Today

Storage challenge

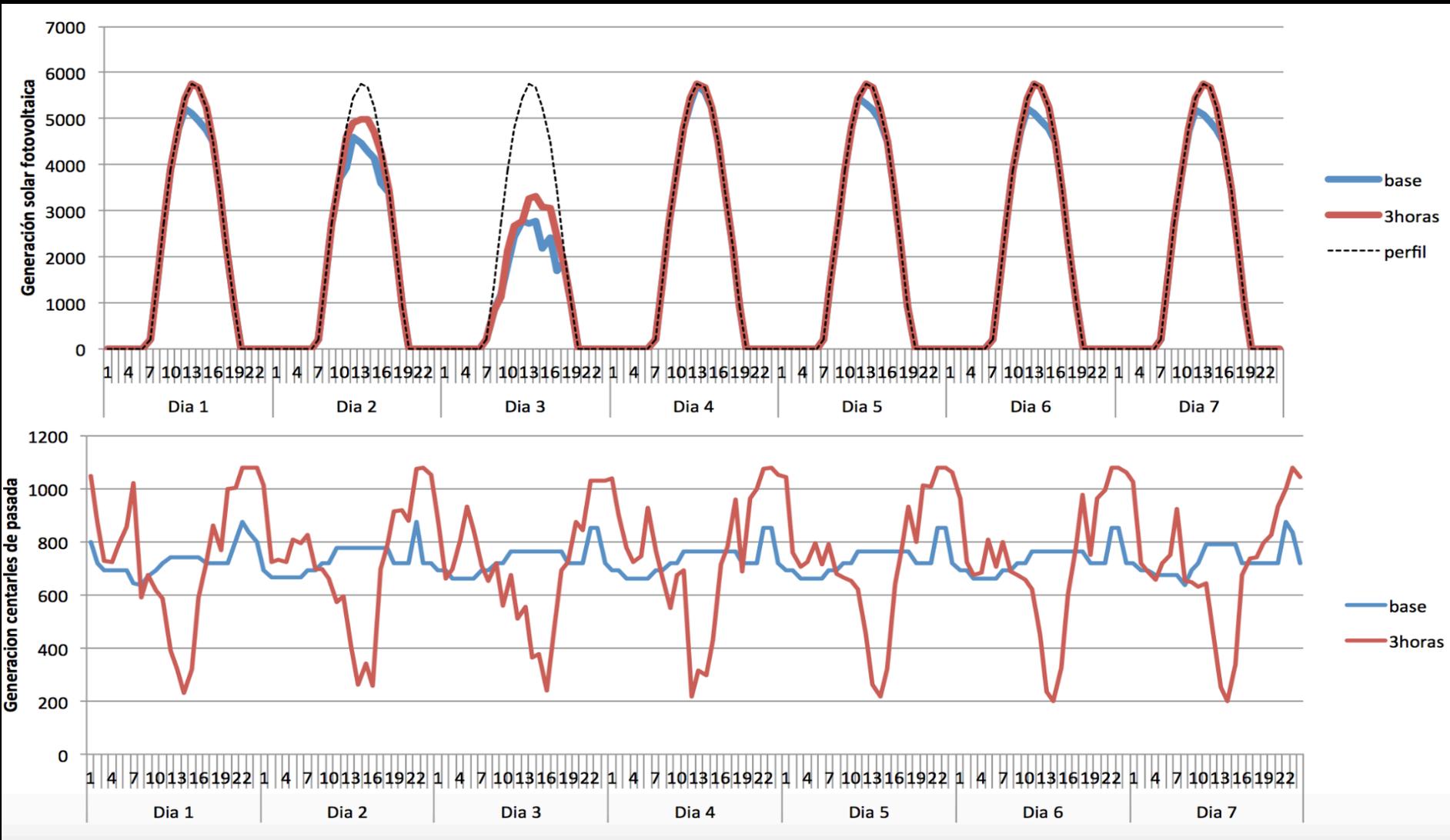


186 GWh/day load
120 GWh/day storage
1,671 GWh 2 weeks storage

Hydro contribution



New operation strategies

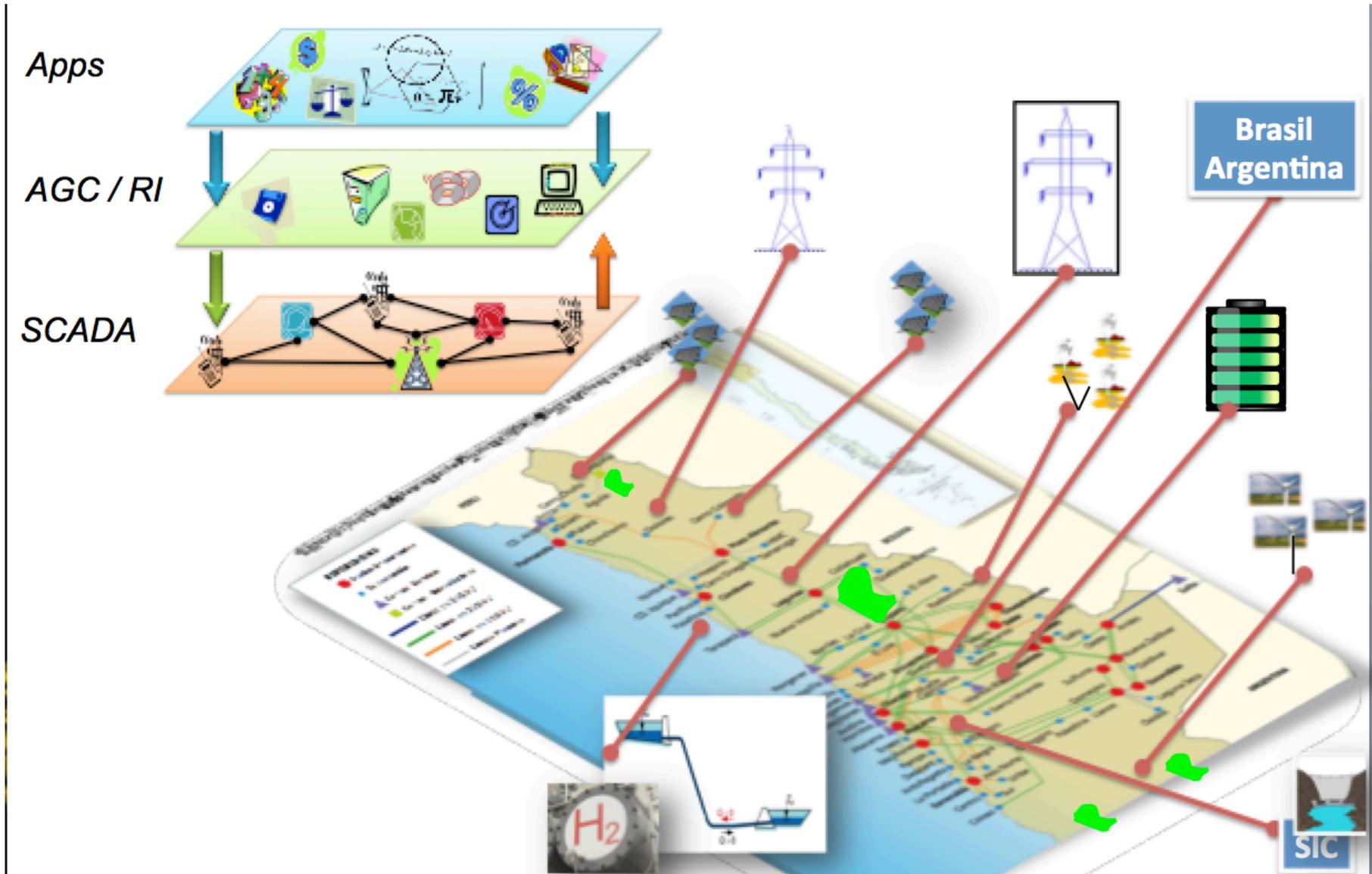


Recortes de PV		
base	36.826	11%
3horas	21.653	7%

SIC – SING
2025

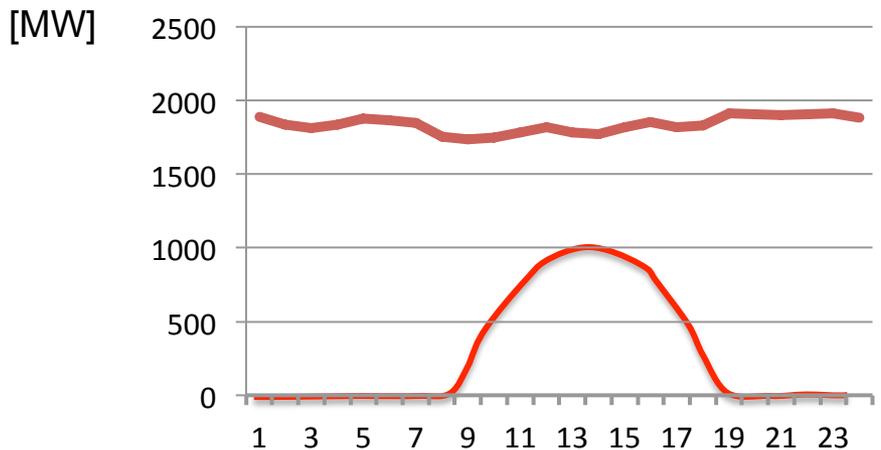
Costos de Operación	
base	\$ 50.600.952
3horas	\$ 47.116.177
Diff	6,89%

Intervention levels: flexibility

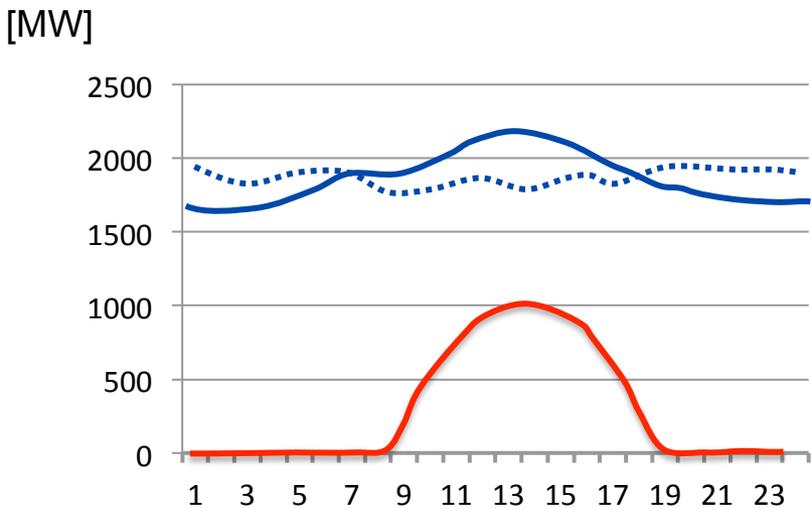


Demand Response in the mining industry

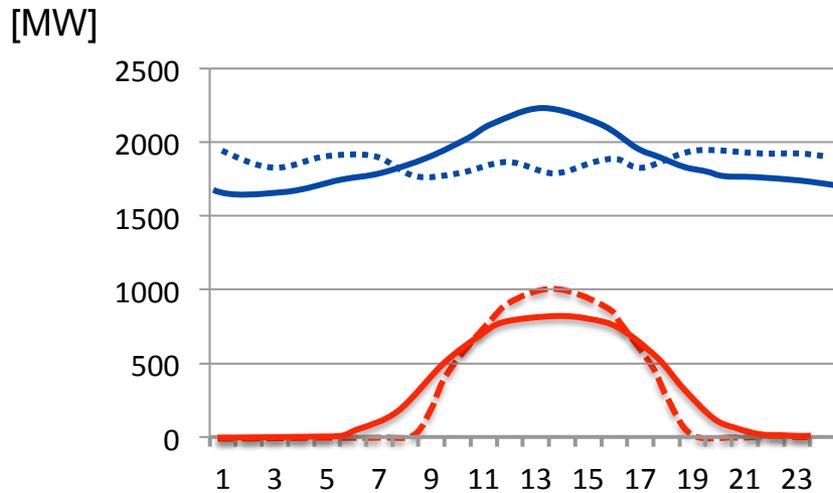
Normal operation in SING



Demad side efforts



Demand side + Renewable energy efforts



Organiza:



Universität Stuttgart
IER Institut für Energiewirtschaft und
Rationelle Energieanwendung

Colabora:



Gracias al apoyo de:



Con el patrocinio de:



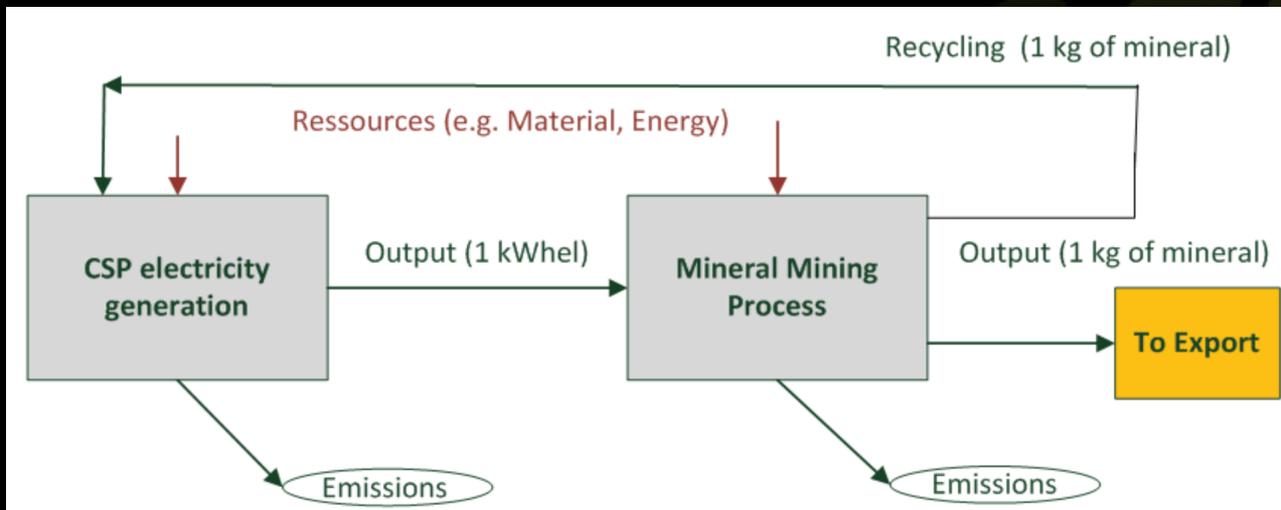
CENTRO DE ENERGÍA

UNIVERSITÄT STUTT GART

ADVANCED MINING TECHNOLOGY CENTER

«Solar Mining Chile»

Based on the working hypothesis, the main objective of the project is to acquire a scientific, technical, environmental and economic foundation to **develop a roadmap for Solar Mining Chile**. It is aimed to identify and characterize the steps that are necessary to evolve from the current mining situation, which strongly relies on fossil fuels, to a synergetic integration of solar energy into the mining industry.





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