Silbat
THE SILICON BATTERY

2023

KOREA EUREKA Day

Meet with **SPAIN**

Ignacio Luque-Heredia

CEO, Silbat Energy Storage Solutions

GOBIERNO DE ESPAÑA · MINISTERIO DE CIENCIA E INNOVACIÓN · CDTI INNOVACIÓN

Ministry of Trade, Industry and Energy · Eureka TURKIYE · beyond leading technology KIAT Korea Institute for Advancement of Technology · Keit Korea Evaluation Institute of Industrial Technology · KETEP Korea Institute of Energy Technology Evaluation and Planning

Electricity Storage is the next step in the evolution of Renewables

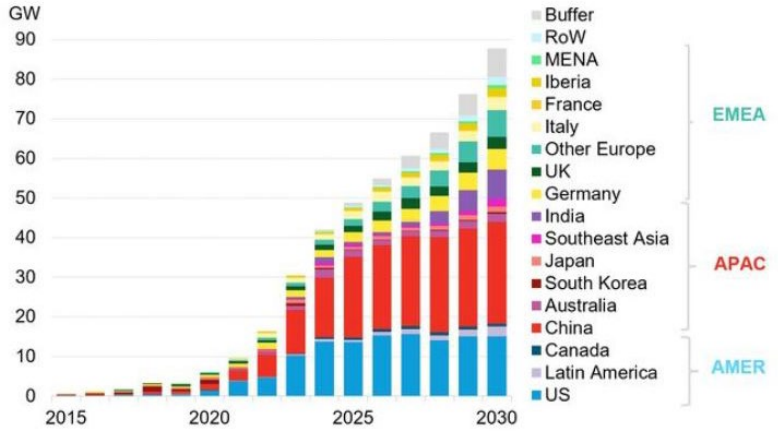
- According to the IEA, **by 2050,** if to meet Net Zero, **Renewables will provide 50% of the World's Energy Consumption,** mostly variable renewables (VREs) solar and wind.

- A **massive ramping up of electricity storage capacity is needed** to turn VREs fully dispatchable

508GW/ 1,432GWh

Global cumulative capacity by the end of 2030

Global gross energy storage capacity additions by key market



Source: BloombergNEF

Note: MENA = Middle East and North Africa. EMEA = Europe, Middle East and Africa. APAC = Asia Pacific. AMER = Americas. Countries ordered by regional group. Buffer = headroom not explicitly allocated to an application. RoW = rest of the world.

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Meet with SPAIN

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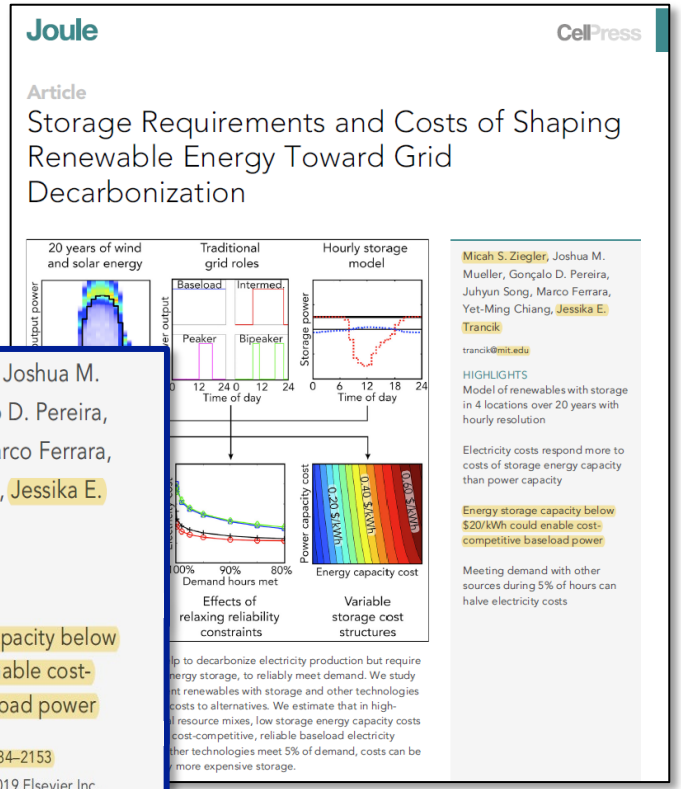

Micah S. Ziegler, Joshua M. Mueller, Gonçalo D. Pereira, Juhyun Song, Marco Ferrara, Yet-Ming Chiang, Jessika E. Trancik

trancik@mit.edu

Energy storage capacity below $20/kWh could enable cost-competitive baseload power

Ziegler et al., Joule 3, 2134–2153
September 18, 2019
https://doi.org/10.1016/j.joule.2019.06.012

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- …however, PH cost is $90/kWh in average and weather and orography constrained

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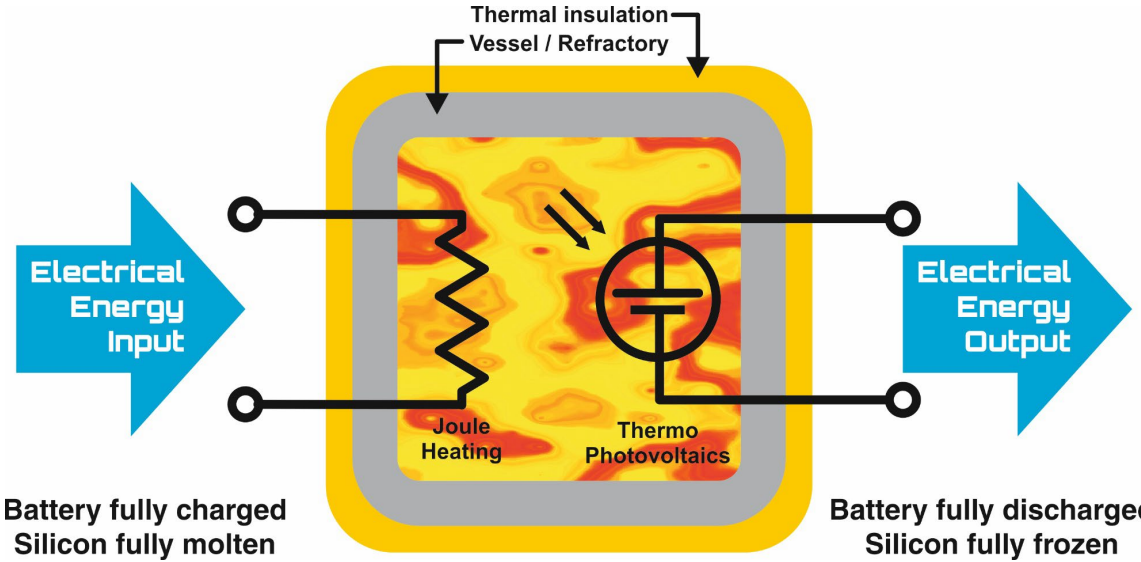
- …however, PH cost is $90/kWh in average and weather and orography constrained
- Li-Ion batteries portable/dense but only for <10hrs
- Ultimately, **all current storage technology are way far from the $20/kWh threshold**

We solve the problem!
The Melting Silicon Battery

Electricity stored as Latent Heat in melting Silicon and withdrawn through TPV



Operation at constant temperature, 1414C, the melting temperature of Silicon

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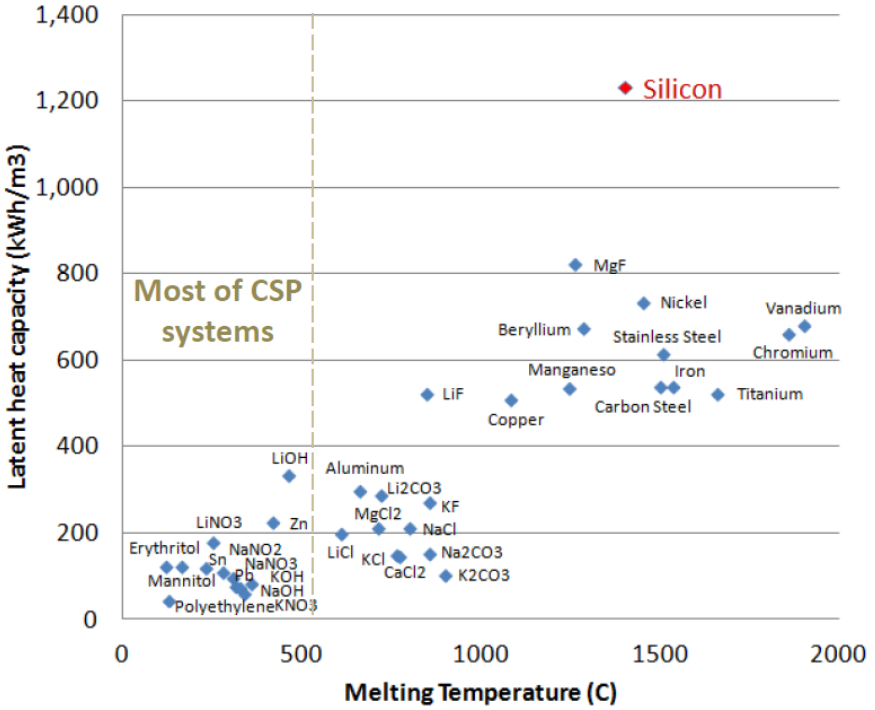
BUT Why Silicon?

- Melting point 1414C with **extremely high Latent Heat of Fusion (1154kWht/m³)** – 2nd highest after Boron



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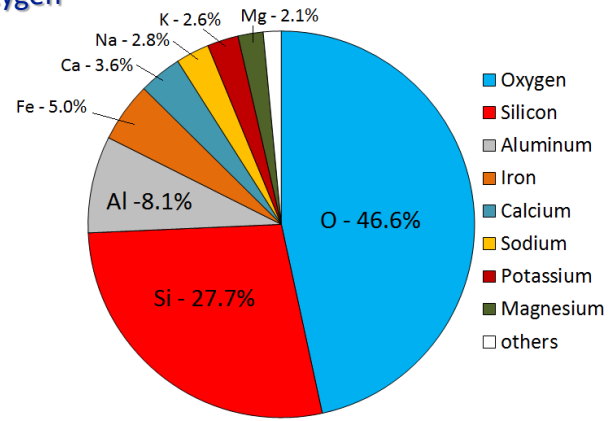

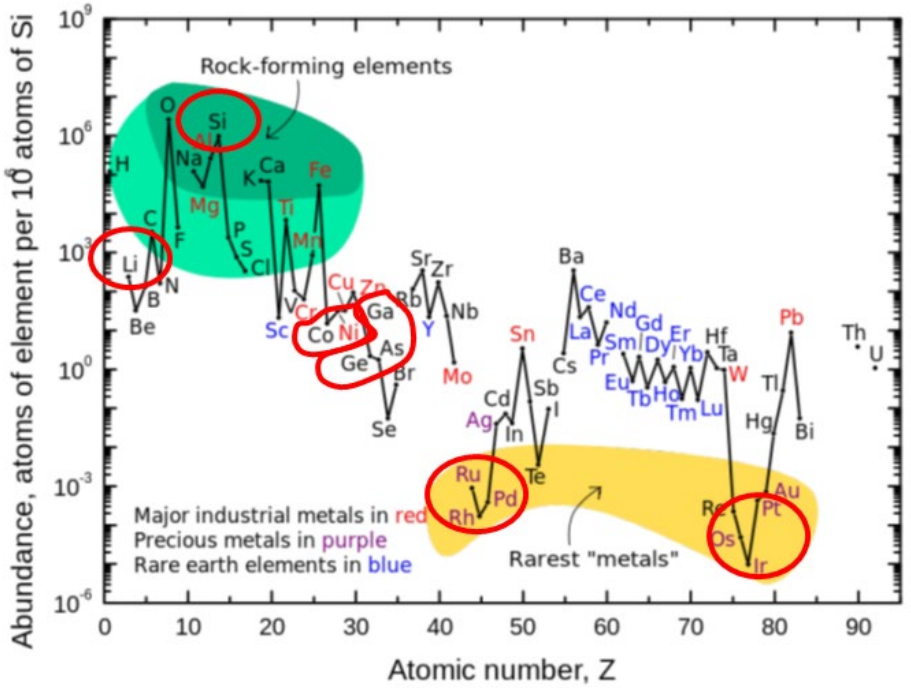

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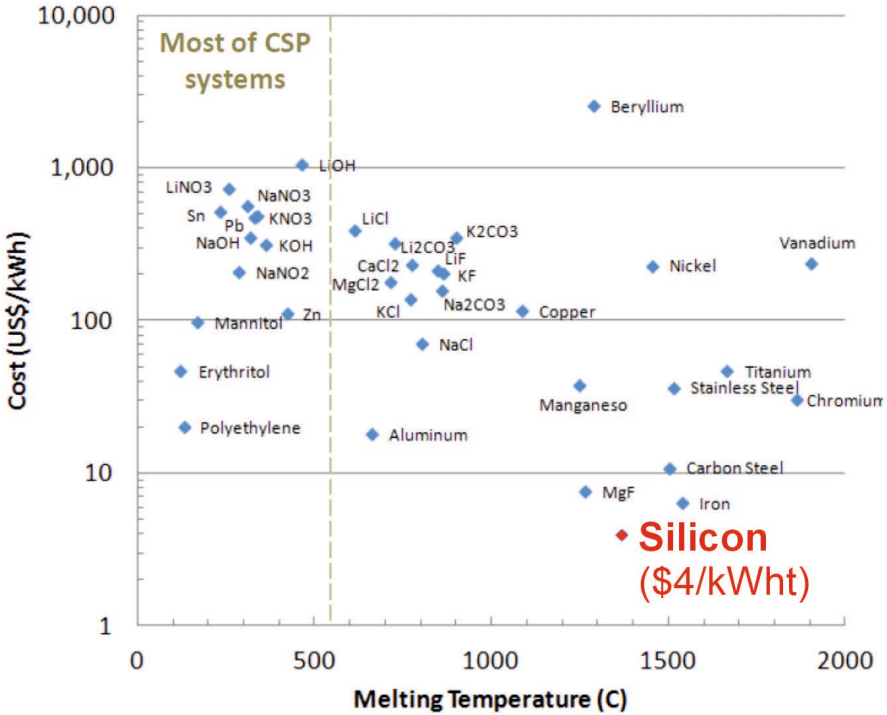
- **Energy-related CAPEX floor $10/kWh!**



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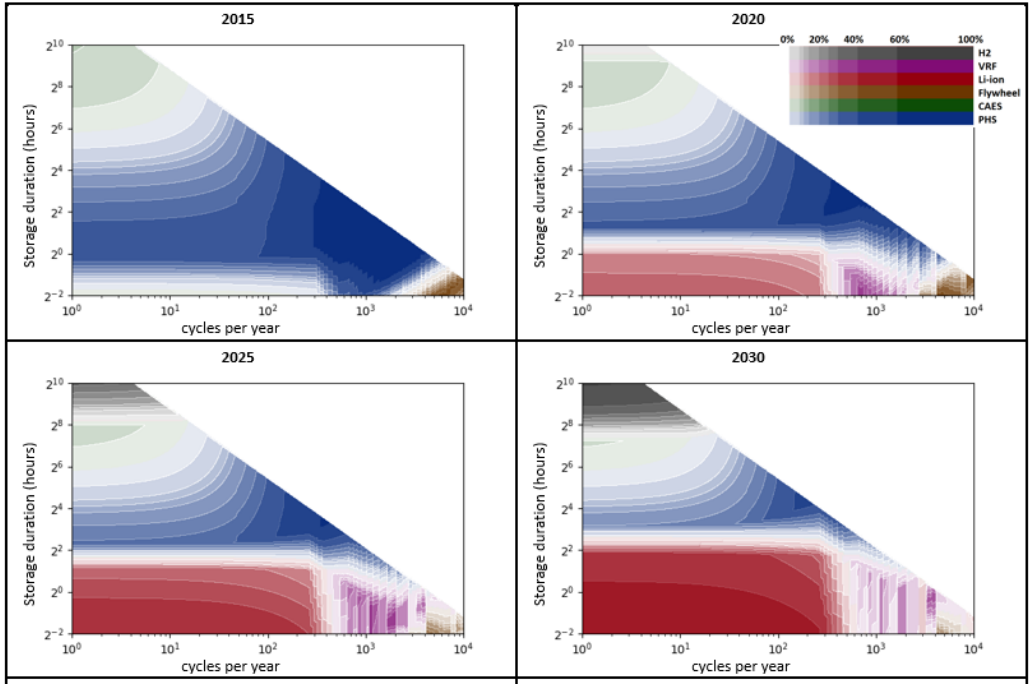

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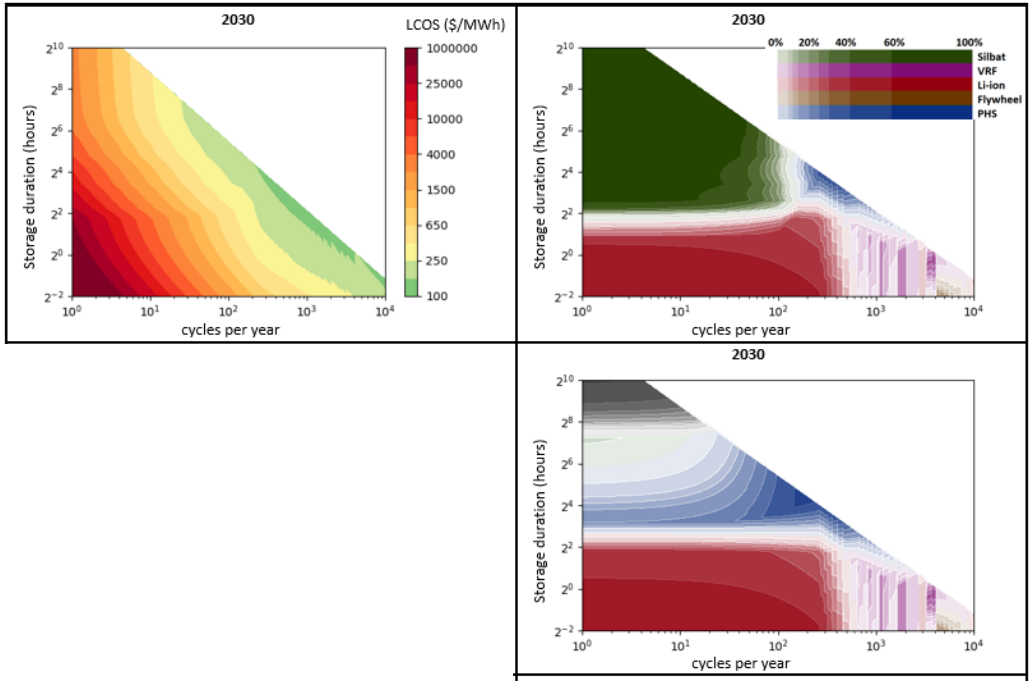


The Unique Value Proposition

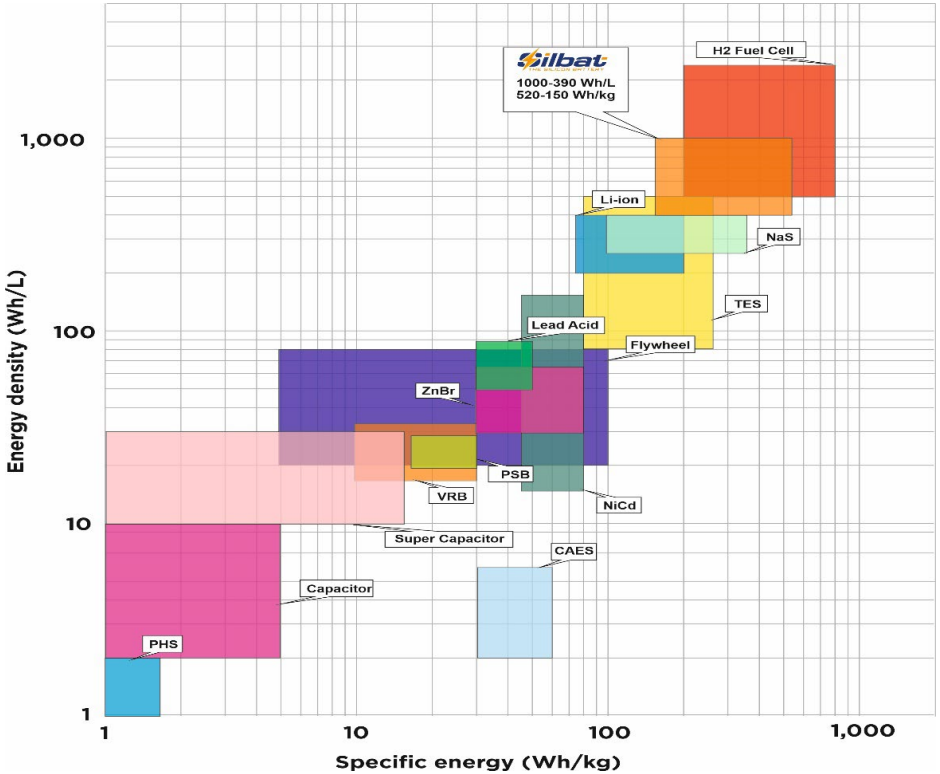
Meet with SPAIN

Dirt Cheap! (<$20/kWh)

It could really enable the
100% RE paradigm

Highest Energy Density

Only comparable to
pressurised/liquified H_2
Superior to comercial Li-Ion batteries



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30yrs. life-time with low O&M
vs. Li-Ion ~5-10yrs. life-time

Silent Operation & Quick Start
Solid-state conversión and
no moving parts

Highest Energy Density
Only comparable to
pressurised/liquified H_2
Superior to comercial Li-Ion batteries

Highly Abundant & Widely Found Raw Meterials
>1000X more than Li-Co-Ni-Mn
in mainstream Li-Ion batteries

About us

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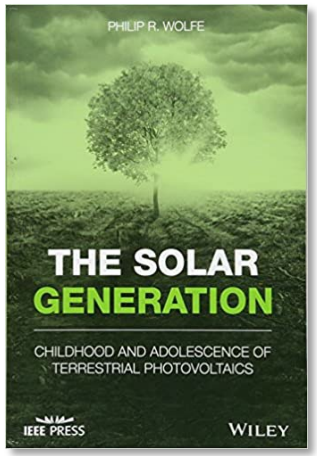
Meet with SPAIN

POLITÉCNICA
Instituto de Energía Solar

INSTITUTO DE ENERGÍA SOLAR
Innovation in photovoltaics since 1979



One of the world's pioneering research institutions that have given birth to modern-day photovoltaics is credited by IEEE's recent history of PV's early days

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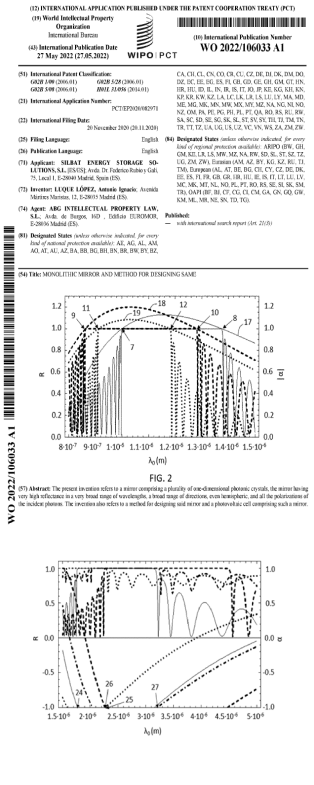

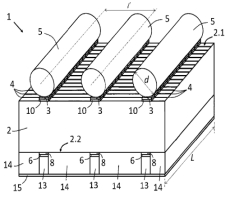

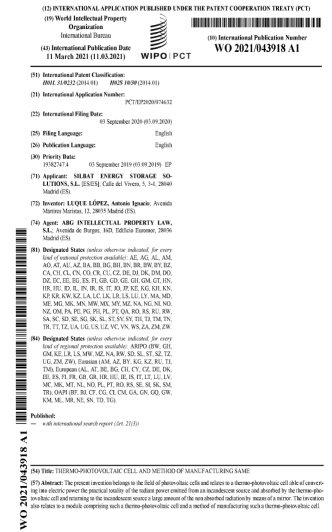

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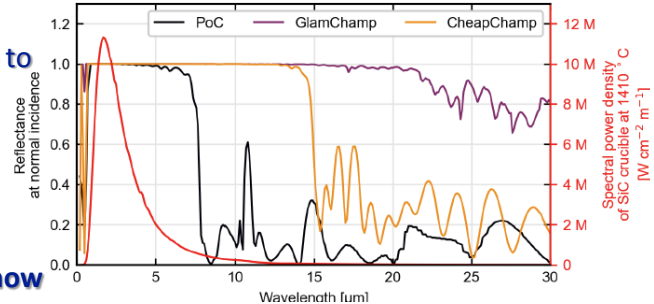
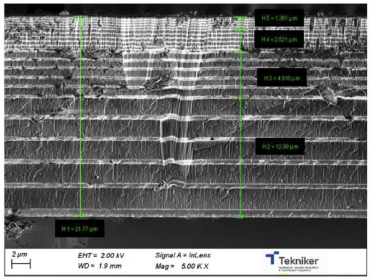
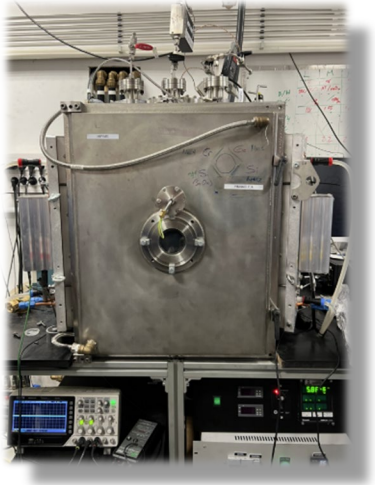
- **Advanced theory and built and validated POCs and demos now reaching TRL5**
  - New high-temp. ultra-high reflectivity insulators







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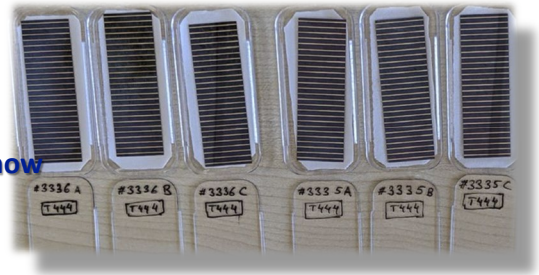

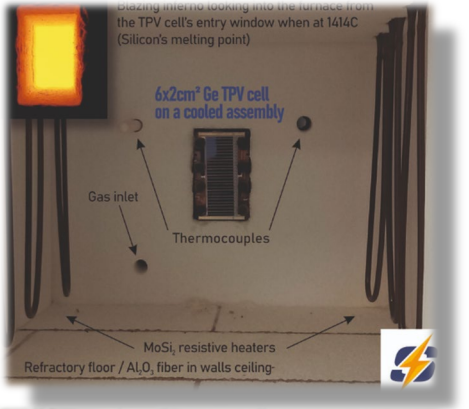

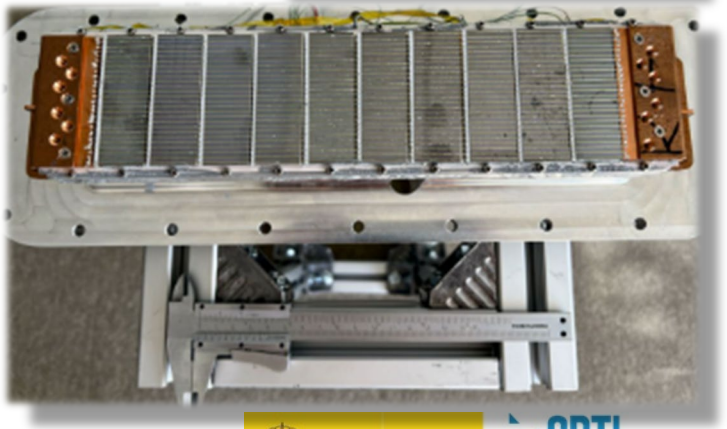

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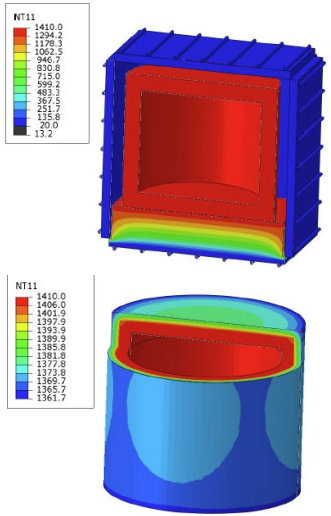
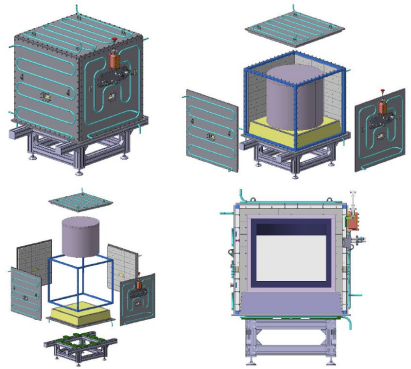
  - Full demonstrator (2X):
    - ✓ microwave heating, high reflectivity insulation
    - ✓ resistive heating, low conductivity insulation



Meet with **SPAIN**



Korea Eureka Day 2023

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SUPPORTED BY eit InnoEnergy

InnoEnergy is supported by the EIT, a body of the European Union

Baker Hughes

Soltec POWER HOLDINGS

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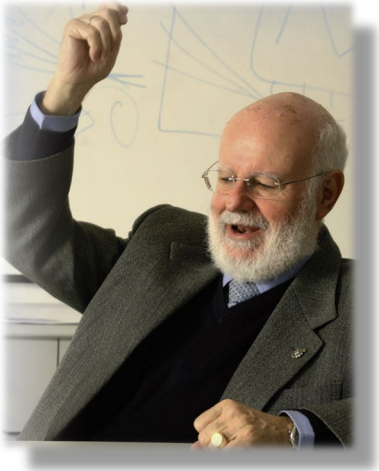

Arguably one of the fathers of modern photovoltaics. Internationally multi-prized researcher and entrepreneur. Founder of PV manufacturer Isofoton, among the world's top 10, 2000-2010, and inventor of the bifacial solar cell and intermediate solar cells, among others. Founder, director and current honorary president of IES-UPM

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Engineering Team


Jorge Jiménez, PhD


Marius Zehender, PhD


Rafael Molinero


Alejandro Benito


Rishabh Golchha

Meet with SPAIN


Prof. Antonio Luque
(Arguably) One of the fathers of modern photovoltaics


Ignacio Luque, PhD
Seasoned entrepreneur in PV


Javier Celma
Baker Hughes
Sr. Vice President Origination


Pedro Riera
EIT InnoEnergy
Investment Director


Javier Bustos
GFM
Director


Iván Soto
Soltec
Head of Corporate Venturing

Board of Directors

Scientific Advisory Board


Iván Fernández, PhD
Expert in magnetron sputtering PVD


Fabián Plaza, PhD
Expert in high temperature engineering and materials


Prof. Ignacio Rey-Stolle
Expert in III-V PV cells

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ESTEYCO

nano4ENERGY

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ADVANCED THERMAL DEVICES S.L.

GFM FOTOVOLTAICA

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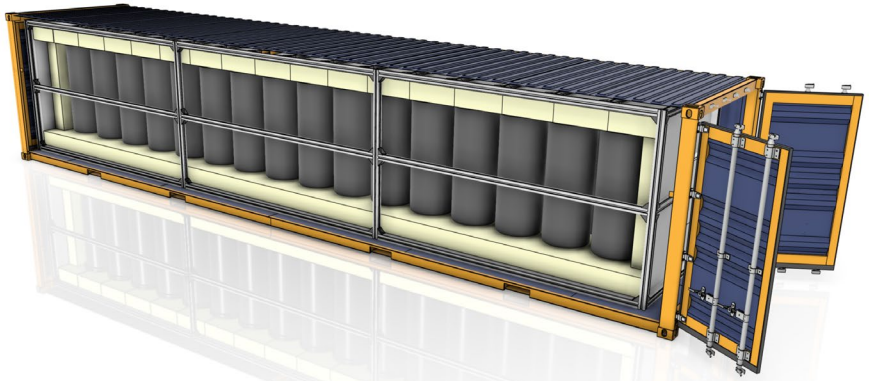
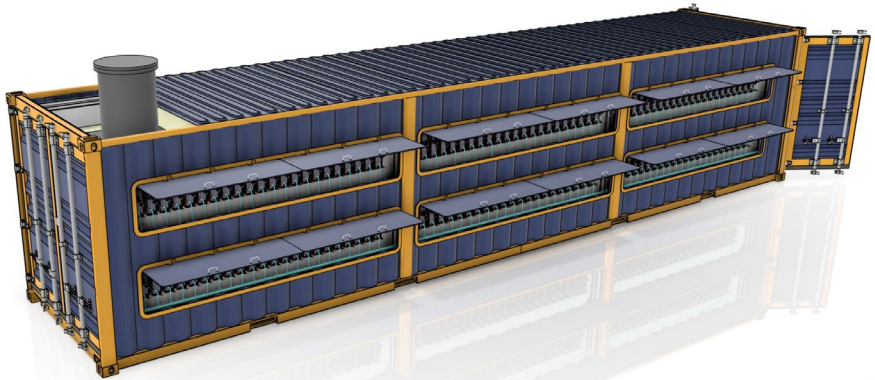
CDTI

Heading to

Meet with SPAIN

- **TRL9: A modular, portable, containerized product**





Heading to

Meet with SPAIN

- **TRL9: A modular, portable, containerized product**

Heading to

- **TRL9: A modular, portable, containerized product**

- Our plans are to be **in the market by 2026**
- According to McKinsey, **by 2030 LDES will have a cumulative market of $200-500bn**

LDES total addressable market and cumulative capex investment by year

	2025	2030	2035	2040
GW Cumulative installed power capacity[1]	~30–40	~150–400	~ 900–1,700	~1,500–2,500
TWh Cumulative installed energy capacity[1]	~1	~5–10	~35–70	~85–140
Cumulative capex investment[1], USD bn	~50	~200–500	~1,100–1,800	~1,500–3,000

Partnering with Korea!

Meet with

- **Technology & industrial partners**
  - Thin film coatings
  - Sputter deposition
  - MOCVD
  - PV cell manufacturing
  - Power electronics assemblies
  - Refractories (SiC, graphite)
  - Thermal insulators
  - Metal grade silicon feedstock

- **Funding in our next rounds**

Meet with SPAIN

2023 KOREA EUREKA Day

Thank you!

Ministry of Trade, Industry and Energy
Eureka TÜRKİYE
beyond leading technology KIAT Korea Institute for Advancement of Technology
Keit Korea Evaluation Institute of Industrial Technology
KETEP Korea Institute of Energy Technology Evaluation and Planning
GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA E INNOVACIÓN CDTI INNOVACIÓN