PEPPERONI

Co-funded by the European Union

Pilot line for European production of perovskite/silicon tandem modules on industrial scale

pepperoni-project.eu

PEPPERONI | Project overview

This project is co-funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.

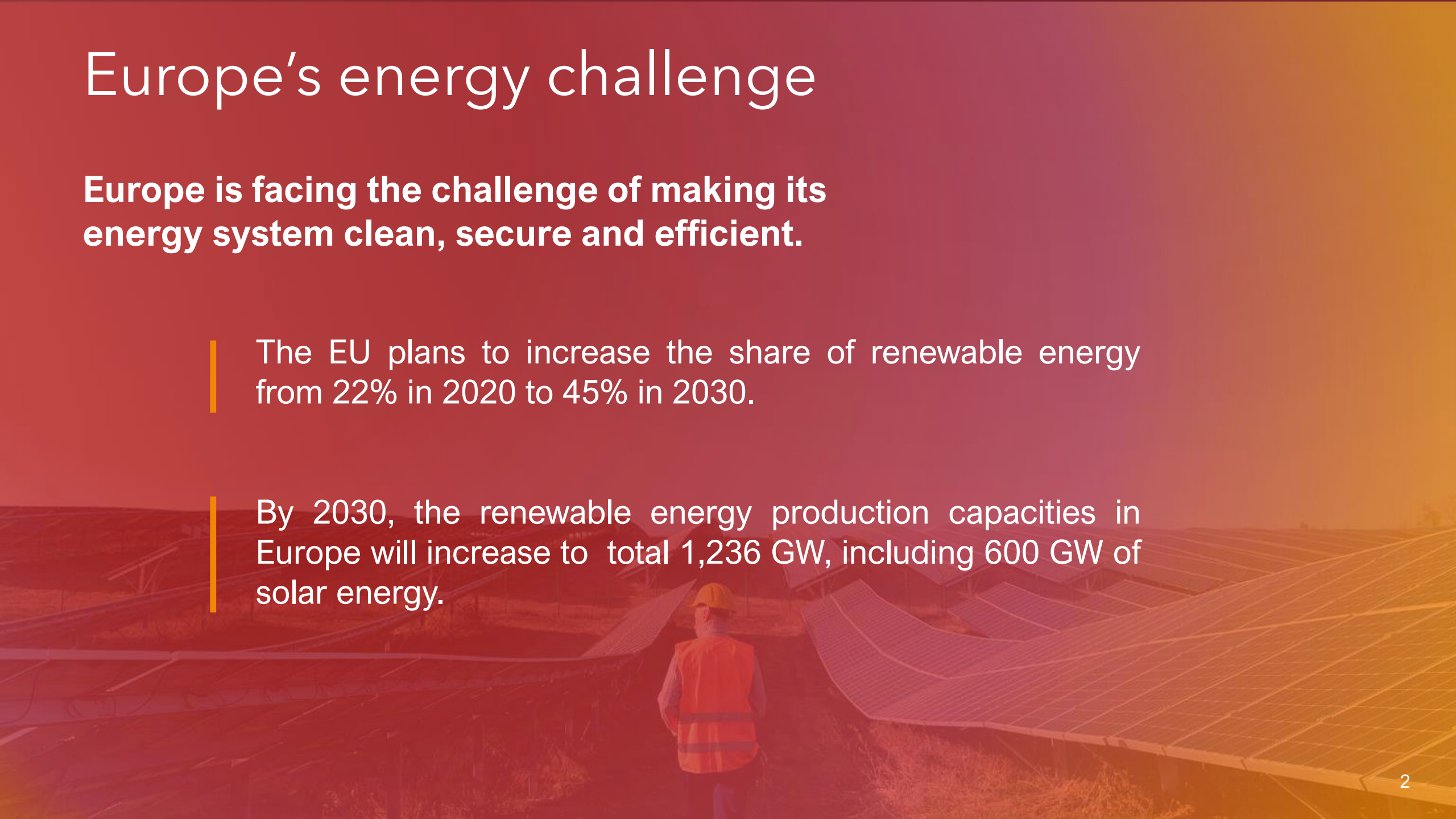
The project is also supported by the Swiss State Secretariat for Education, Research and Innovation (SERI).

Europe’s energy challenge

Europe is facing the challenge of making its energy system clean, secure and efficient.

The EU plans to increase the share of renewable energy from 22% in 2020 to 45% in 2030.

By 2030, the renewable energy production capacities in Europe will increase to total 1,236 GW, including 600 GW of solar energy.



PEPPERONI 's approach

Developing next generation solar cells & modules

- PEPPERONI aims to 'spice up' cost-efficient industrial silicon (Si) cells with a perovskite top cell.
- PEPPERONI will help advance this perovskite/silicon tandem PV technology towards market introduction.

PEPPERONI Key facts

Budget

18.85 million euro

Duration

01.11.2022 – 31.10.2026

Network

17 partners from 12 countries

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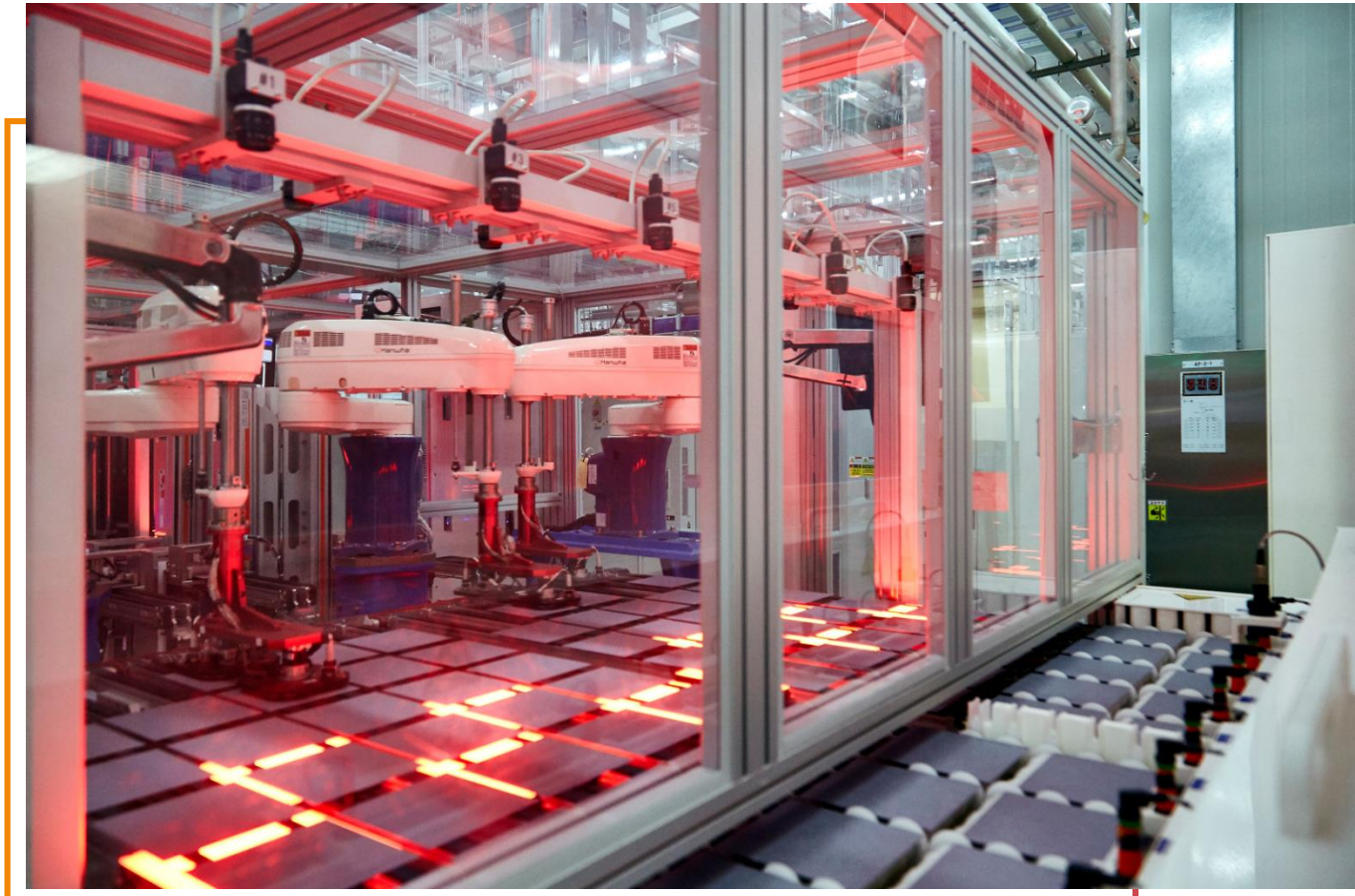
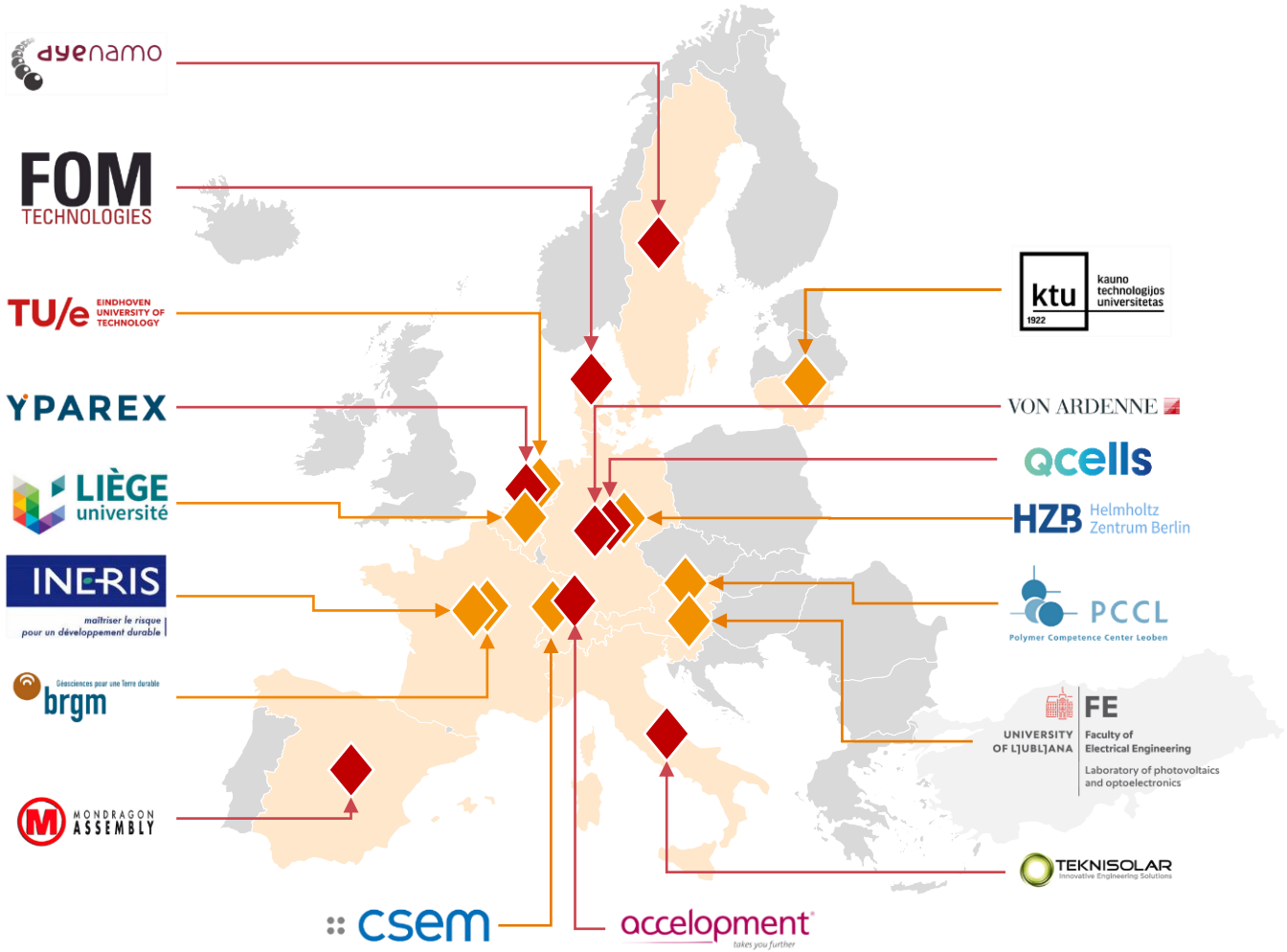


PEPPERONI Partners



Research

6 × R&D in materials & manufacturing
3 × R&D in environmental, economic & social aspects

Industry/SME

4 Equipment suppliers
2 Materials suppliers
1 Service provider
1 Large module manufacturer

PEPPERONI Interdisciplinary approach

Covering the full value chain of PV innovation

RESEARCH

Environmental, economic, social

INERIS — maîtriser le risque pour un développement durable

brgm — Géosciences pour une Terre durable

LIÈGE université

Materials / solar cell manufacturing

ktu kaunas university of technology 1922

HZB Helmholtz Zentrum Berlin

University of Ljubljana

csem

PCCL Polymer Competence Center Leoben

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

INDUSTRY

Equipment suppliers

FOM TECHNOLOGIES

TEKNISOLAR Innovative Engineering Solutions

MONDRAGON ASSEMBLY

VON ARDENNE

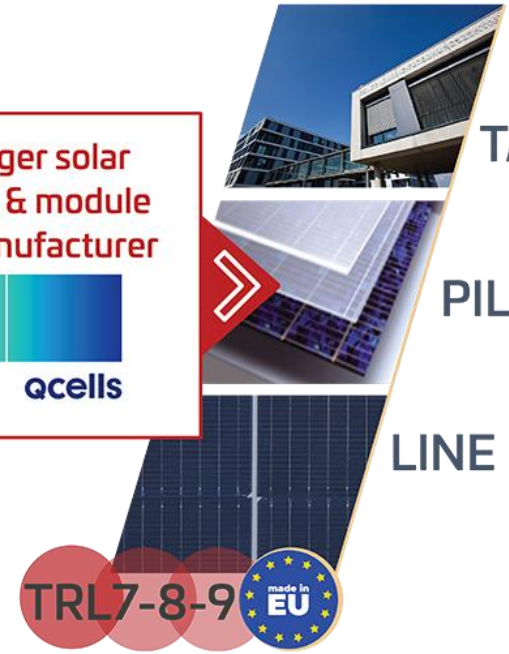
Materials suppliers

YPAREX

dyenamo

Larger solar cell & module manufacturer

qcells



TANDEM

PILOT

LINE

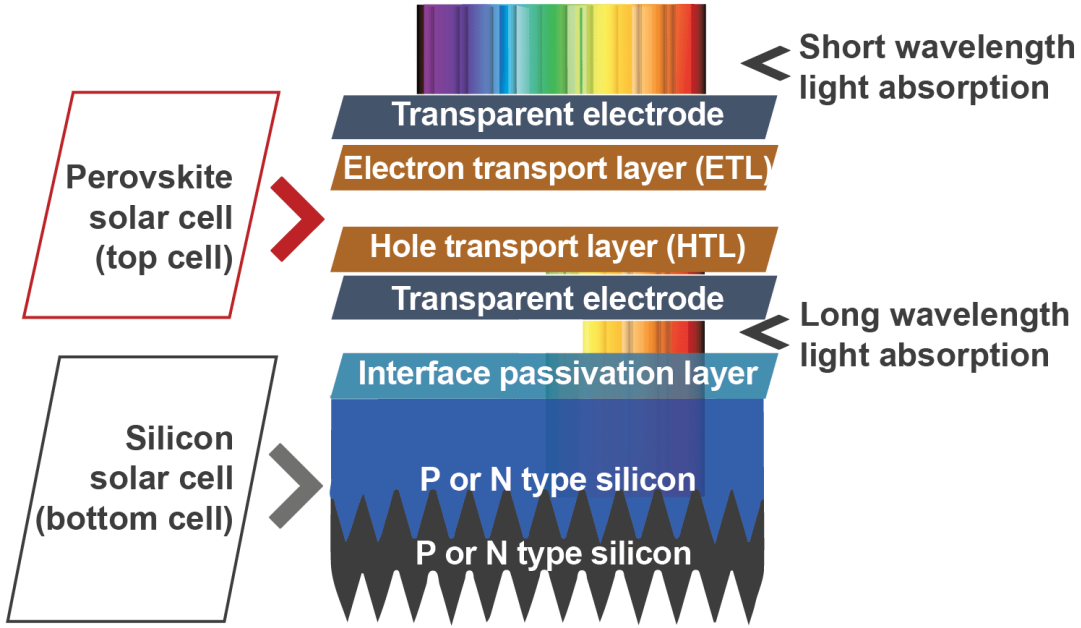
TRL7-8-9

made in EU

PEPPERONI Tandem technology

Boosting efficiency with perovskite

- The best ratio of performance over manufacturing costs – perovskite/Si tandem.
- Perovskite takes advantage of the solar spectrum that typical Si materials cannot efficiently utilise.



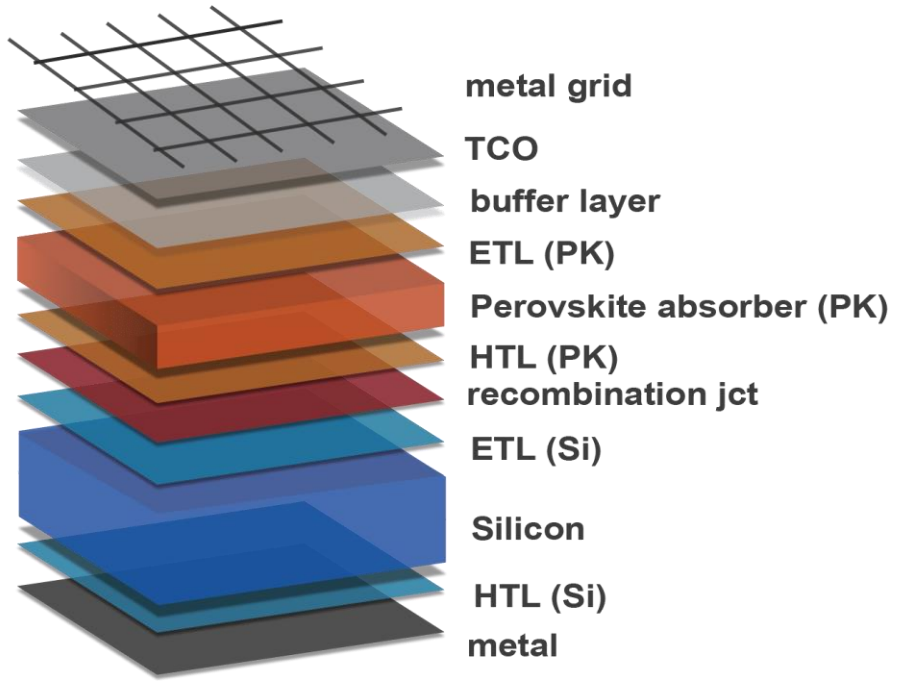
Q.ANTUM technology

A silicon bottom cell used in PEPPERONI based on technology that is already produced at a gigawatt scale.

PEPPERONI 's solar cells

Industry ready building blocks

- Front electrode – transparent & conductive
- Contact & buffer layers – high transparency & low surface recombination
- Perovskite absorber – pinhole-free with high quality on wafers
- Recombination junction – optimal electrical & optical coupling
- Silicon bottom cell – front side morphology optimisation & perovskite deposition process



PEPPERONI aims to identify the best approach to produce highly efficient and durable tandem cells.
Maximise the tandem PCE, stability and production yield in a pilot line.

PEPPERONI Implementation

Work organisation building blocks

Technology development

- Tandem cell process integration
- Module integration
- Manufacturing tools
- Materials improvement & scalability

Technology assessment

- Indoor testing & outdoor monitoring
- Economic, environmental & societal analysis

Tandem cell & module pilot line

- Features innovative equipment, processes & materials
- Upgrade of the R&D line of Qcells in Thalheim, Germany

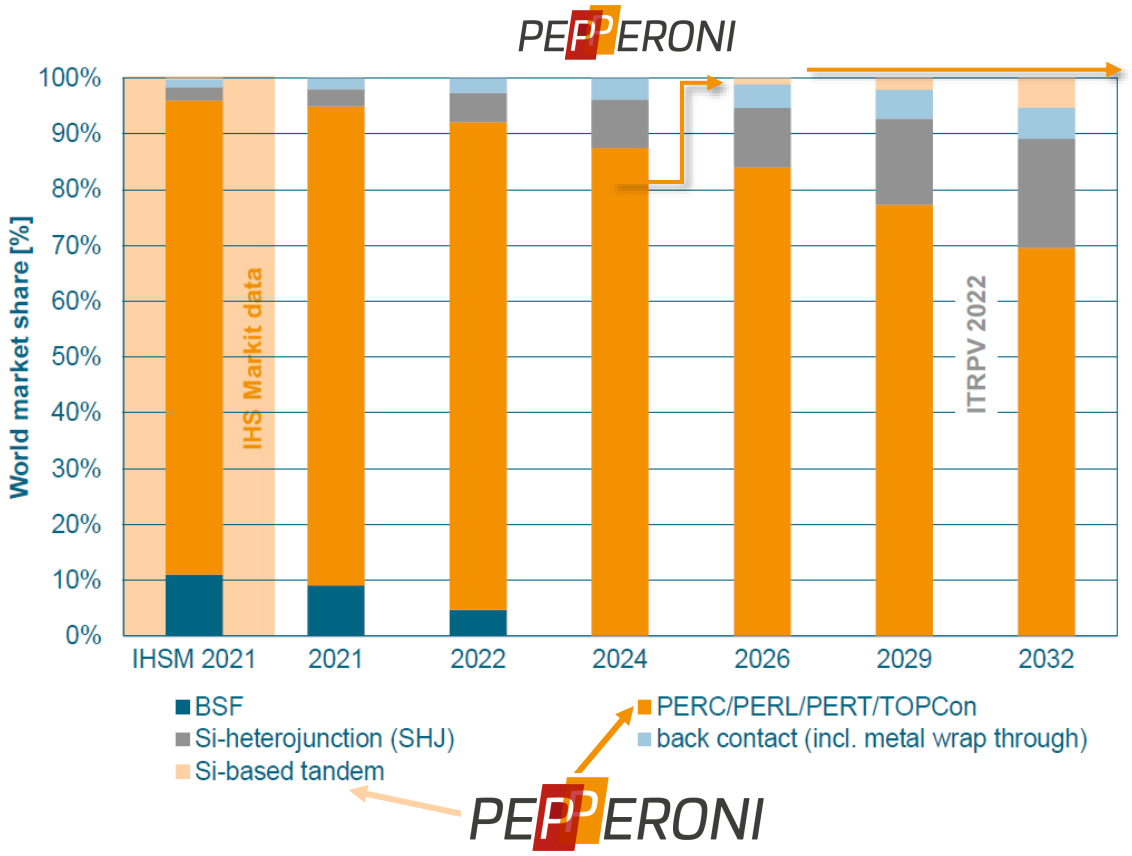
Coordination & outreach

- Project coordination & innovation management
- Communication, dissemination & exploitation

Silicon based PV technologies roadmap

Increasing market stake for perovskite/Si tandems

- Si-based tandem cells expected to appear in mass production after 2024.
- Si-based tandem modules with module effectiveness of more than 26% expected after 2026.



PEPPERONI will

- Increase cell and module performance and optimize manufacturing processes for tandem technology.
- Speed up the market uptake.

Source: ITRPV. *International Technology Roadmap for Photovoltaic - 2021 results.* (2022)

PEPPERONI 's development roadmap

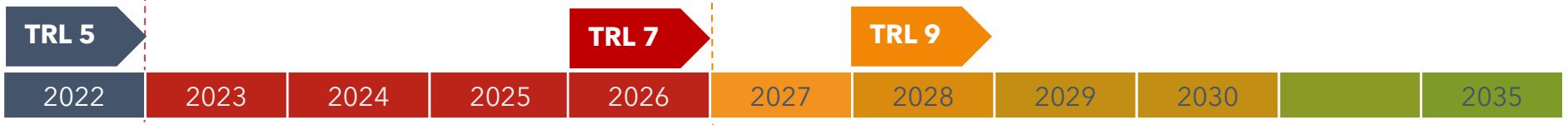
Advancing tandem technology readiness level




Pilot line

GW-scale production line

R&D line



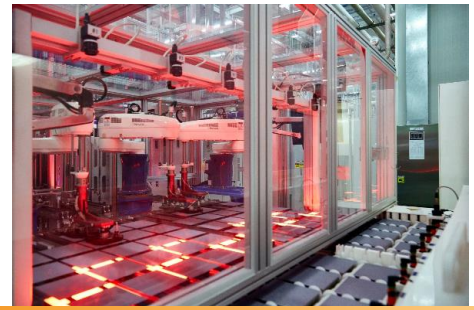
PEPPERONI

TRL 4-5
technology
validated in the lab

TRL 7
operational prototype
tandem cell & module pilot line

PEPPERONI 's development roadmap






Pilot line **GW-scale production line**

R&D line

TRL 5 **TRL 7** **TRL 9**

2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | | 2035

PEPPERONI

TRL 4-5
technology
validated in the lab

TRL 7
operational prototype
tandem cell & module pilot line

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