

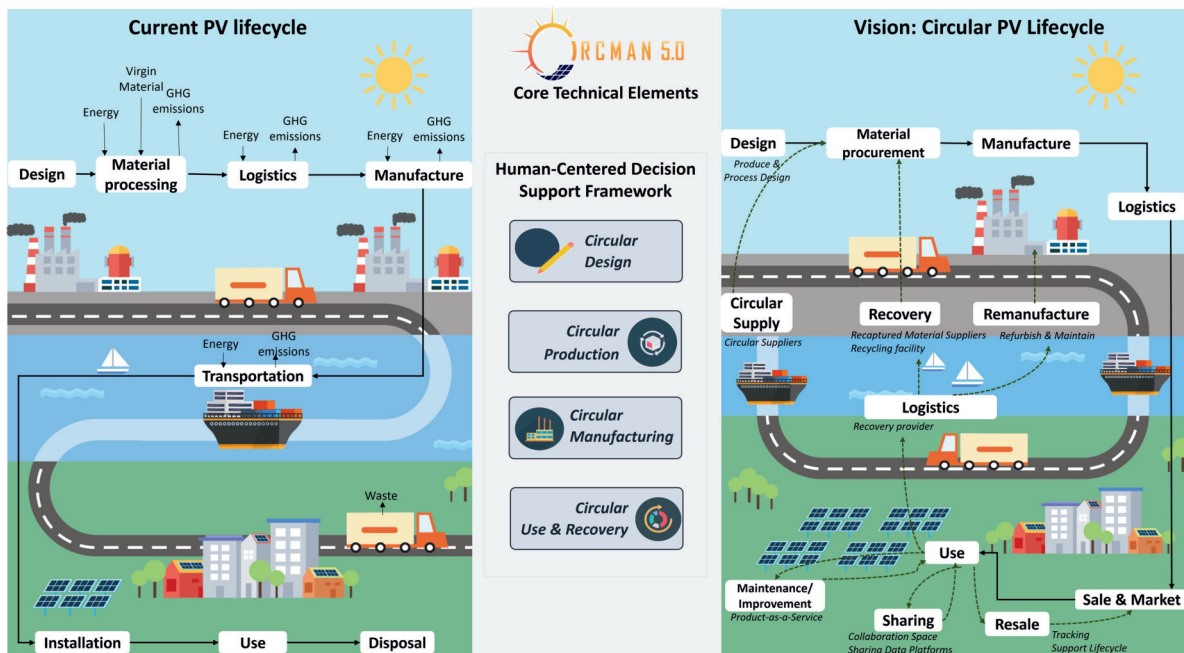


# CIRCULAR MANUFACTURING 5.0

**HUMAN-CENTRED AI-AIDED DIGITAL FRAMEWORK FOR CLOSED-LOOP PHOTOVOLTAIC (PV) PRODUCTS VALUE CHAINS**

**TOWARDS A CIRCULAR MANUFACTURING FOR THE PHOTOVOLTAICS (PV) INDUSTRY**

CIRCMAN5.0 focuses on circular design principles that shift away from the traditional "take-make-dispose" model, prioritizing reusability, reparability, and recyclability. Through this approach, we aim to foster sustainable practices that contribute to a more resilient and resource-efficient future



CIRCMAN5.0 is an innovative ecosystem of cutting-edge technologies designed to revolutionize the manufacturing of sustainable and circular photovoltaic (PV) products. It supports the entire modeling and simulation pipeline while evaluating the environmental sustainability of PV systems.



CIRCMAN5.0 HAS RECEIVED FUNDING FROM THE EU HORIZON EUROPE RESEARCH AND INNOVATION PROGRAMME CL4-2024-TWIN-TRANSITION-01-05 UNDER GRANT AGREEMENT NO.101178331.

**Project funded by**



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

Federal Department of Economic Affairs,  
Education and Research EAER  
State Secretariat for Education,  
Research and Innovation SERI

Swiss Confederation



# CIRCULAR MANUFACTURING 5.0

At its core, **CIRC MAN5.0** introduces a **Human-Centred AI-aided Digital Framework** tailored for the PV manufacturing industry. This transformative solution empowers value chain stakeholders to:

- Increase product circularity
- Reduce environmental impact
- Minimize material waste in products and processes
- Optimize manufacturing circularity

The **CIRC MAN5.0** framework seamlessly integrates advanced tools and methodologies, driving innovation and sustainability across the PV manufacturing sector.

## Technology

Aligned with the EU's guidelines on sustainable production, **CIRC MAN5.0** emphasizes a strategic approach to circularity at each stage of the product lifecycle, with key objectives focusing on:

- **AI-driven Modelling and Simulation Parametric Techniques** for product design
- **Machine Learning-Assisted Algorithms** for dynamic production reconfiguration
- **Cognitive Digital Twin Simulation Environment** for optimized manufacturing processes
- **Circularity and Life Cycle Assessment (LCA)** Framework
- **Human-in-the-Loop (HITL)** Recommendation Engine
- **Digital Product/Material Passport (DPP)**, enabled by Distributed Ledger Technologies

## Pilots



Showcasing **Product Design** by identifying and evaluating alternative raw materials to enhance circularity.



Highlighting **Production Planning and Manufacturing** through production line environmental assessments and the development of a circular digital registry.



Focusing on **Product Design and Manufacturing** with innovative organic PV circular design alternatives, including EoL (End-of-Life) disassembly strategies and AI-aided production processes.



Demonstrating the **End-of-Life Phase** of PV panels with optimized R-strategies tailored for multi-PV typologies.



CIRC MAN5.0 HAS RECEIVED FUNDING FROM THE EU HORIZON EUROPE RESEARCH AND INNOVATION PROGRAMME CL4-2024-TWIN-TRANSITION-01-05 UNDER GRANT AGREEMENT NO.101178331.

### Project funded by



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

Federal Department of Economic Affairs,  
Education and Research EAER  
State Secretariat for Education,  
Research and Innovation SERI

Swiss Confederation