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MAX SOLAR POWER

Energy payback time for a high concentrated photovoltaic panel with optical micro-tracking

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MAX SOLAR POWER
HYBRID PHOTOVOLTAICS FOR EFFICIENCY RECORD USING INTEGRATED OPTICAL TECHNOLOGY
INNOVATIVE INDUSTRIAL PROCESS TO MANUFACTURE HIGHLY EFFICIENT HYBRID SOLAR MODULES
> 30% Solar PV record efficiency
+ 50% More energy than conventional modules
As easy to install and operate as conventional PV panels
16 Partners
10 Countries
10 590 511 € EU Funding
13 534 524 € Total Budget
Almost 26 Full-Time Equivalents
48 Months
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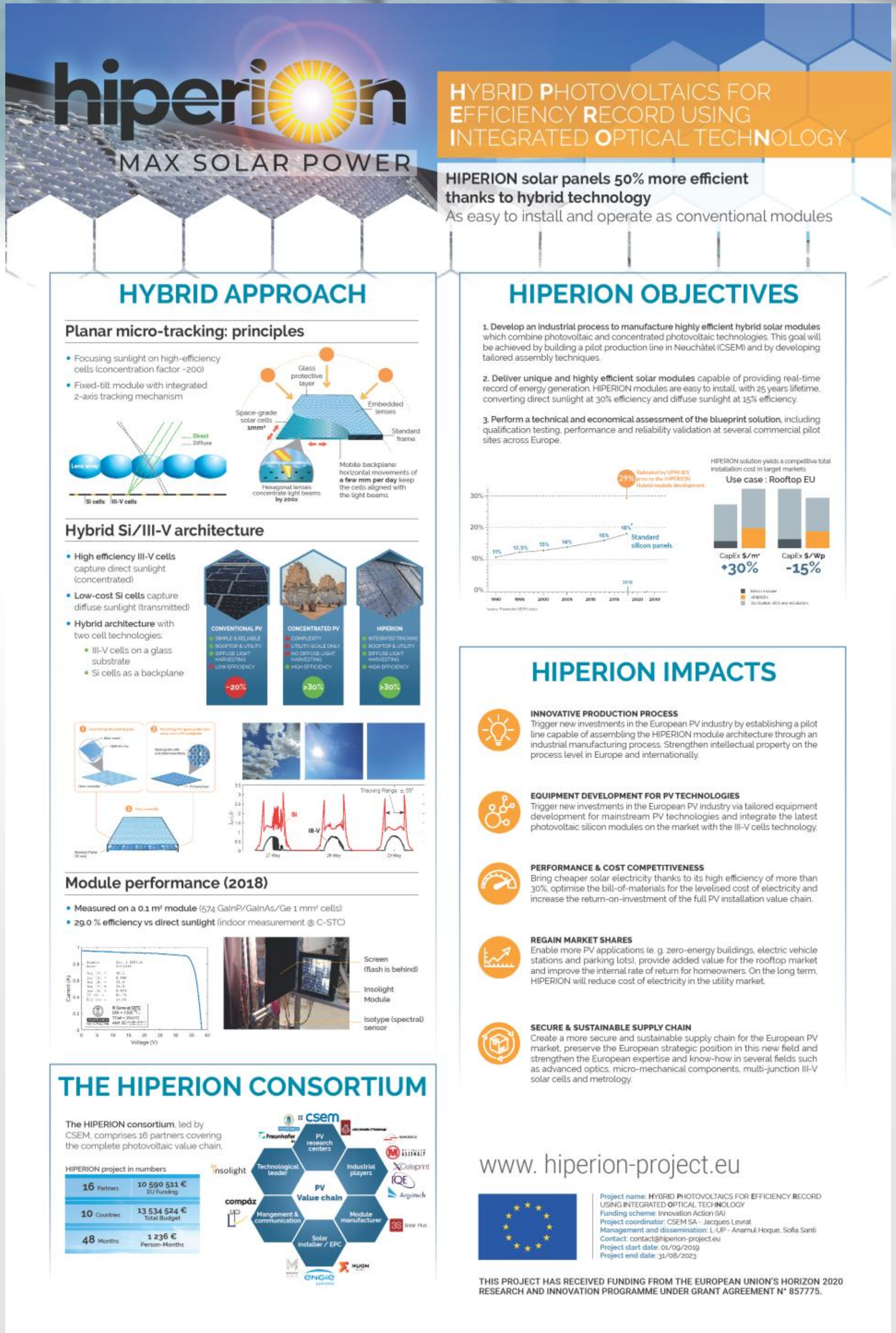
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MAX SOLAR POWER
HYBRID PHOTOVOLTAICS FOR EFFICIENCY RECORD USING INTEGRATED OPTICAL TECHNOLOGY
HIPERION solar panels 50% more efficient thanks to hybrid technology
As easy to install and operate as conventional modules
HYBRID APPROACH
Planar micro-tracking: principles
Hybrid Si/III-V architecture
Module performance (2018)
HIPERION OBJECTIVES
HIPERION IMPACTS
INNOVATIVE PRODUCTION PROCESS
EQUIPMENT DEVELOPMENT FOR PV TECHNOLOGIES
PERFORMANCE & COST COMPETITIVENESS
REGAIN MARKET SHARES
SECURE & SUSTAINABLE SUPPLY CHAIN
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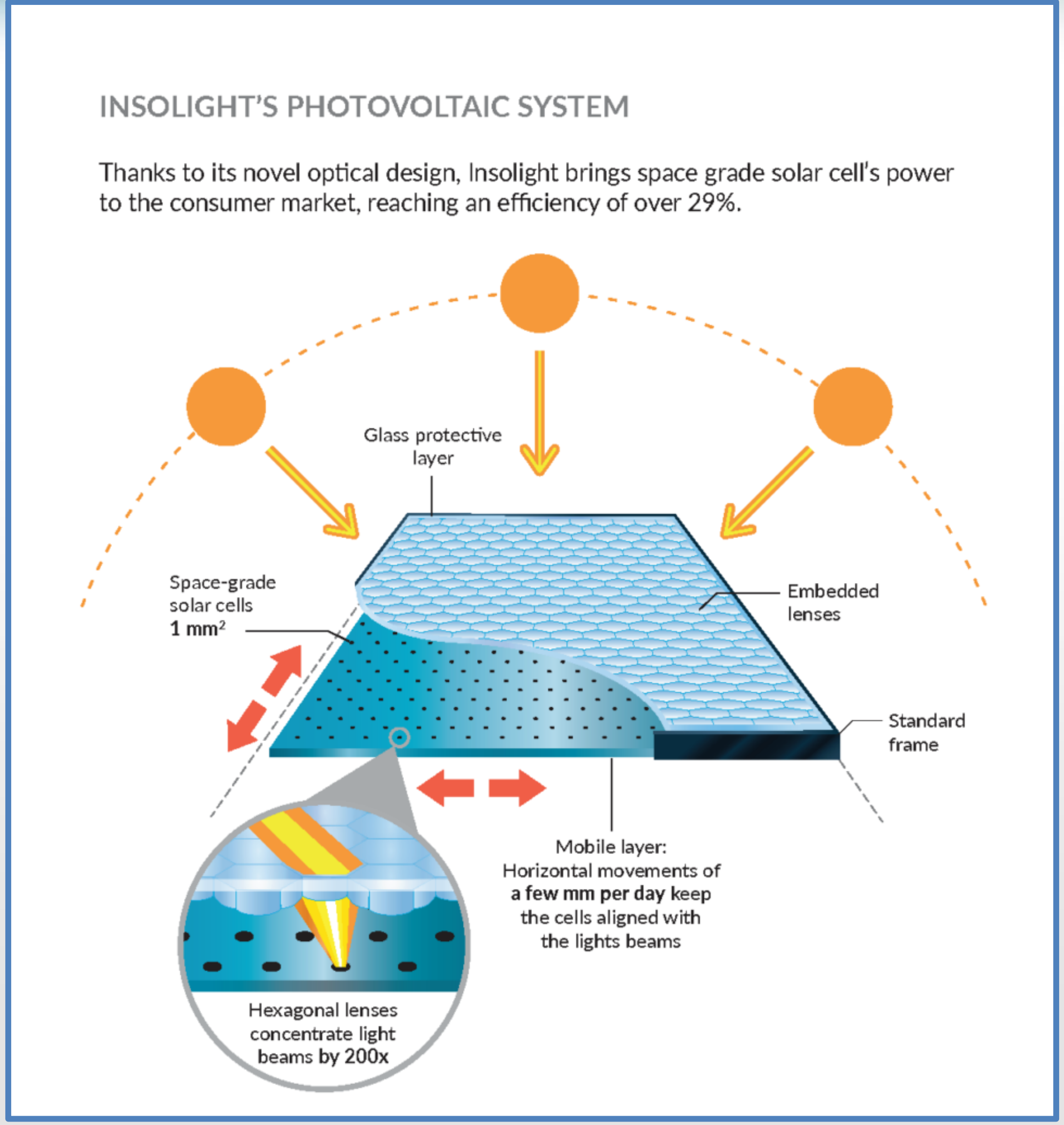
Goal and scope definition



The functional unit (FU)

The FU is defined **as 1kWh** of generated electrical energy over the lifetime of the module

Life time 25 years

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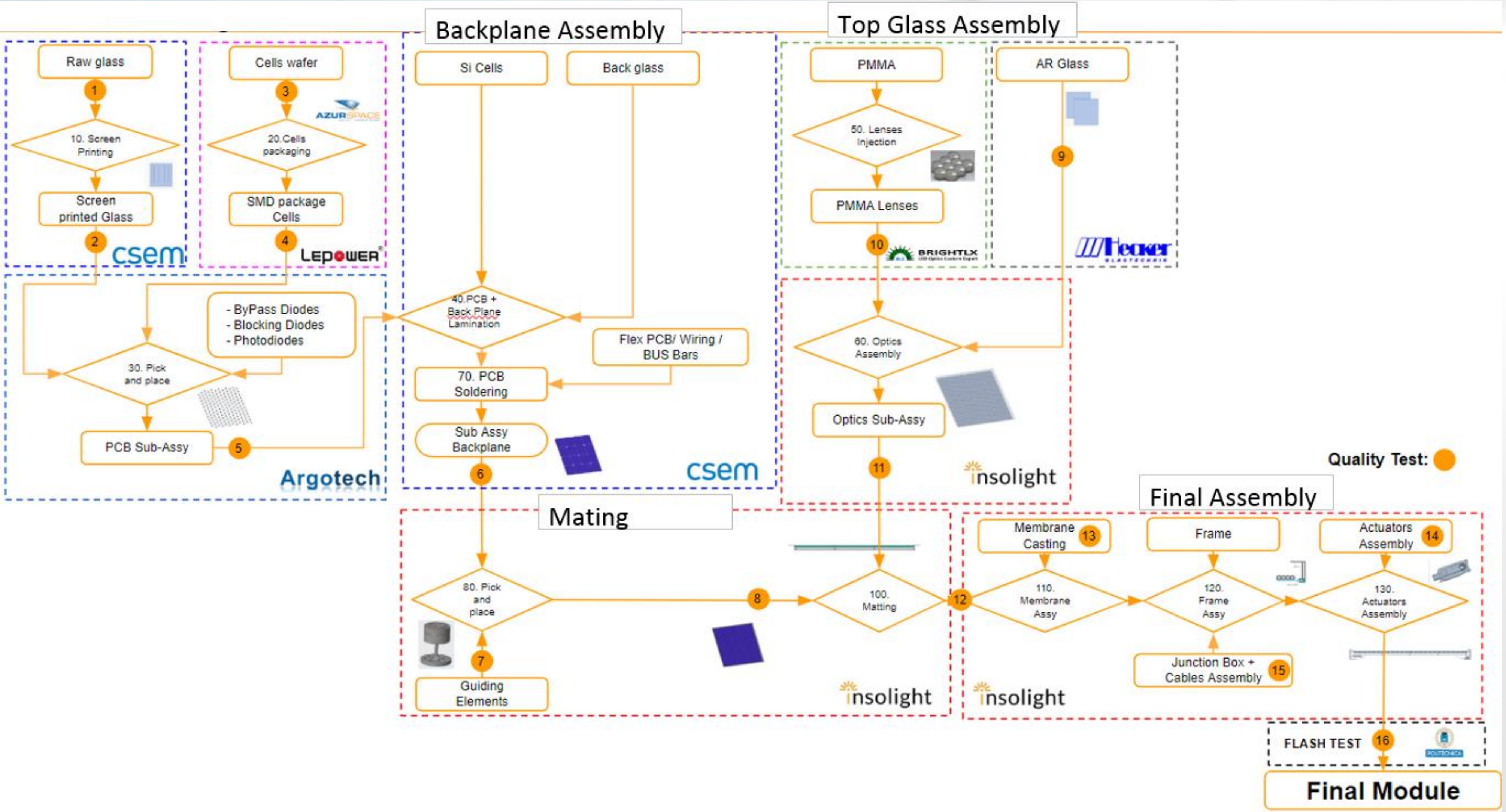
System Boundary



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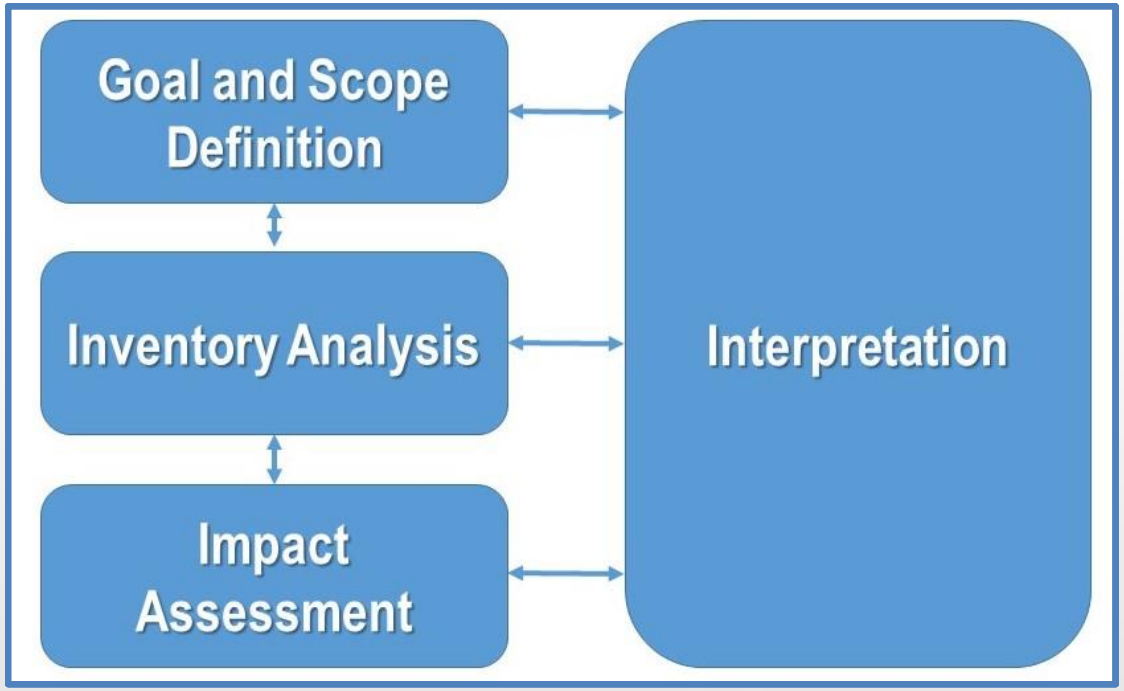
Life Cycle Assessment - LCA



According to ISO 14040, the framework for LCA includes the following stages:

- Definition of goal and scope
- Life cycle inventory (LCI) analysis
- Life cycle impact assessment (LCIA)
- Interpretation

LCA system Boundaries

LCA of Gen2 for EU and out of EU supply chain; waste scenario, CO2 kg eq/kWh over the lifespan

Function Unit: Full HCPV module

Software/ Database: SimaPro version 9.00.49 and Ecoinvent 3.7 database

Ecoinvent system model: APOS, market

Simapro Methodology: **IPCC(International Panel on Climate Change) 2022** *This method lists the climate change factors of IPCC with a timeframe of 100 years and expressed the LCA results in terms of kg* CO_2*-eq;*

Data: Collected by Insolight Based on GEN2

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ENVIRONMENTAL PROFILE FOR GEN2 FOR UPGRADED DATA

Total carbon footprint of GEN2 module was estimated as 155 kg CO_2 eq.

PV cells produced decisive contribution to the environmental load of the module: 51.2 kg CO_2 eq. (33,1 %), due to large amount of the material covering 0.22 m^2 area of the module.

For GEN 2 module, the biggest load is generated by PV cells (51.2 kg CO_2 eq., 33.1%), structural elements (junction box) (33.8 kg CO_2 eq. 21,9 %), top glass (11.9 kg CO_2 eq., 7.73%) and frame (8.73 kg CO_2 eq., 5.65%).

Recycling of PMMA reduced environmental load by 25% (38.5 kg CO_2 eq.) and amount of kg CO_2 eq./ kWh.

For location Madrid

155kg CO_2/470 kWh/25 = 13.2 g CO_2/kWh (life span 25years)

For location Lyon:

155 kg CO_2/344 kWh/25 = 18.0 g CO_2/kWh (life span 25years)

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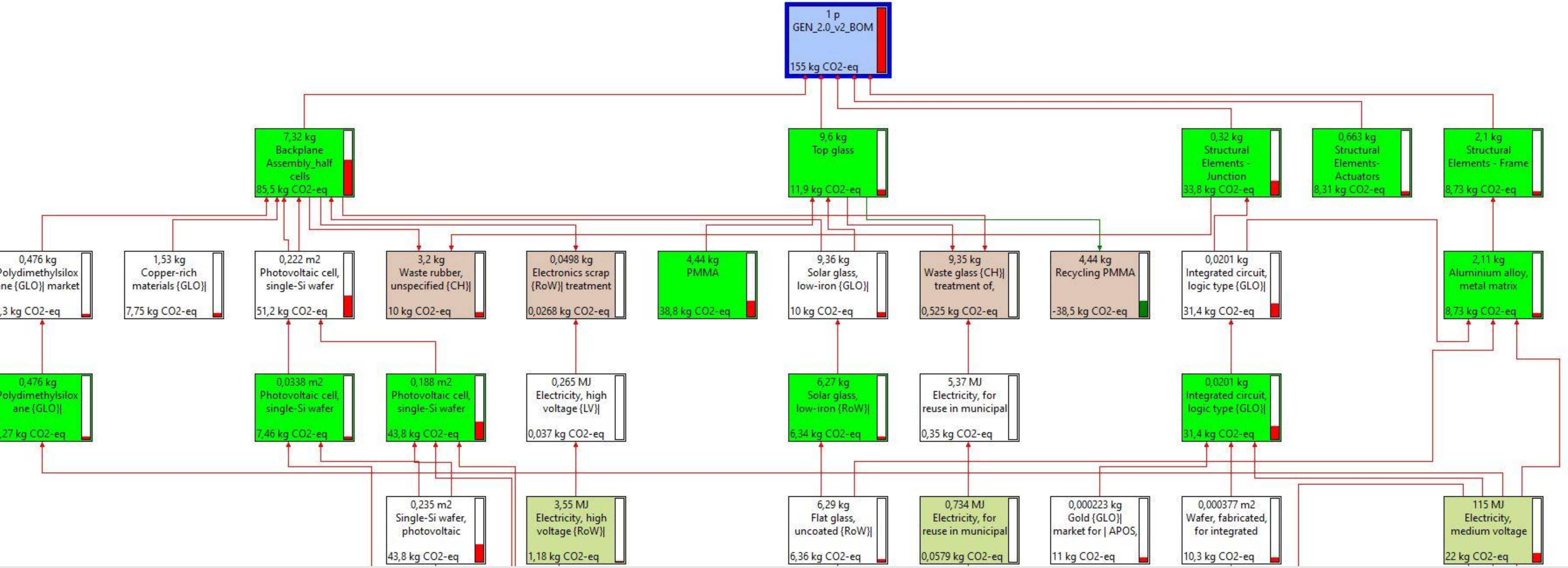
PROCESS TREE



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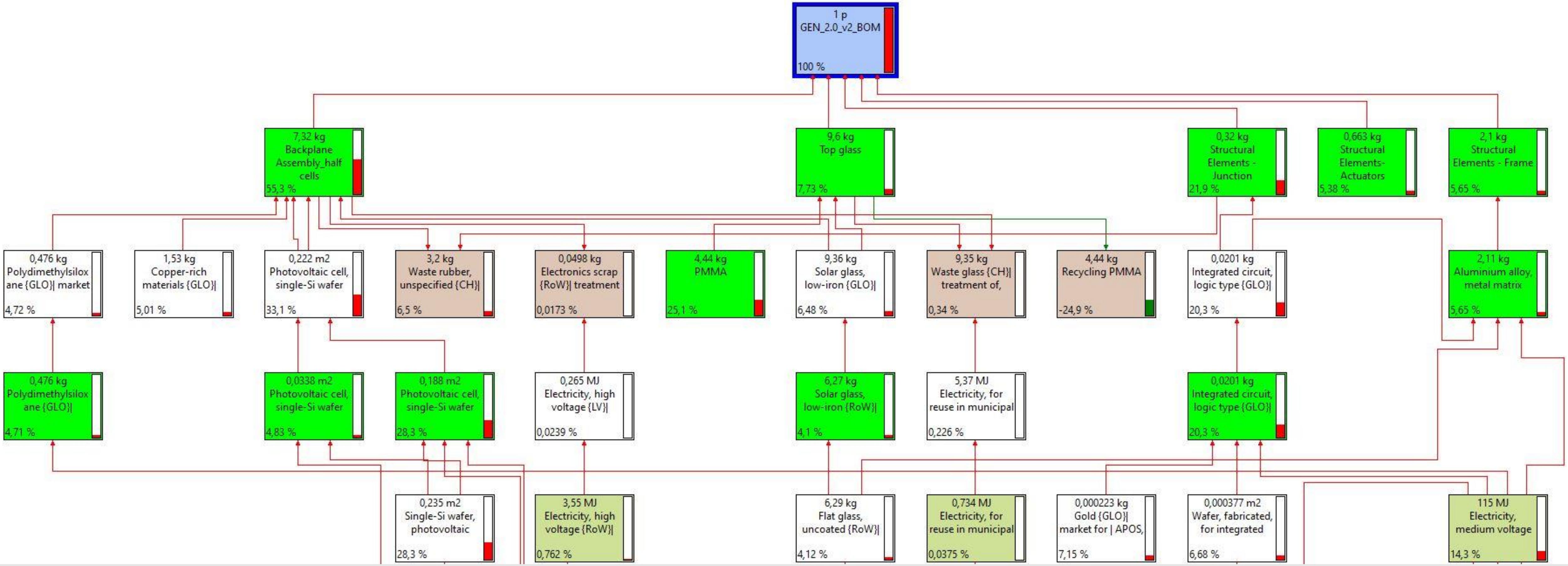
PROCESS TREE



ENERGY PAYBACK TIME

The energy payback time of the HCPV module was calculated by using the Cumulative Energy Demand (CED) method.

$$EPBT = \frac{CED_{mat} + CED_{manuf} + CED_{trans} + CED_{infs} + CED_{EOL}}{((\frac{E_{agen}}{\eta_G}) - CED_{O\&M})}$$

CED_{mat}: CED (in MJ) to produce the materials comprising the PV system, CED_{manuf}:CED (in MJ) to manufacture the PV system, CEDt$_{rans}$: CED (in MJ) to transport the materials during the life cycle, CED_{inst}: CED (in MJ) to install the system, CED_{eol}: CED (in MJ) for end-of-life management, E_{agen}: mean annual electricity generation (in kWh$_{electric}$), $CED_{o\&m}$: CED (in MJ) for operation and maintenance, and η_G: grid efficiency, primary energy to electricity conversion at the demand side (kWh$_{electric}$ MJ).

The average η_G for Western Europe is approx. 0.31.

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ENERGY PAYBACK TIME

The EPBT for the GEN2 module is in the range of **2.55** and **3.44** years, depending on the location and the related insolation factors (Madrid: 470 kWh/m^2, Lyon: 344 kWh/m^2).

In the literature EPBT is in the range from 0.9 to 3.3 for different locations and irradiations. Impact of microinverters on EPBT is in the range of 2-3% which is similar as in the literature.

Pilot Portugal - MUON

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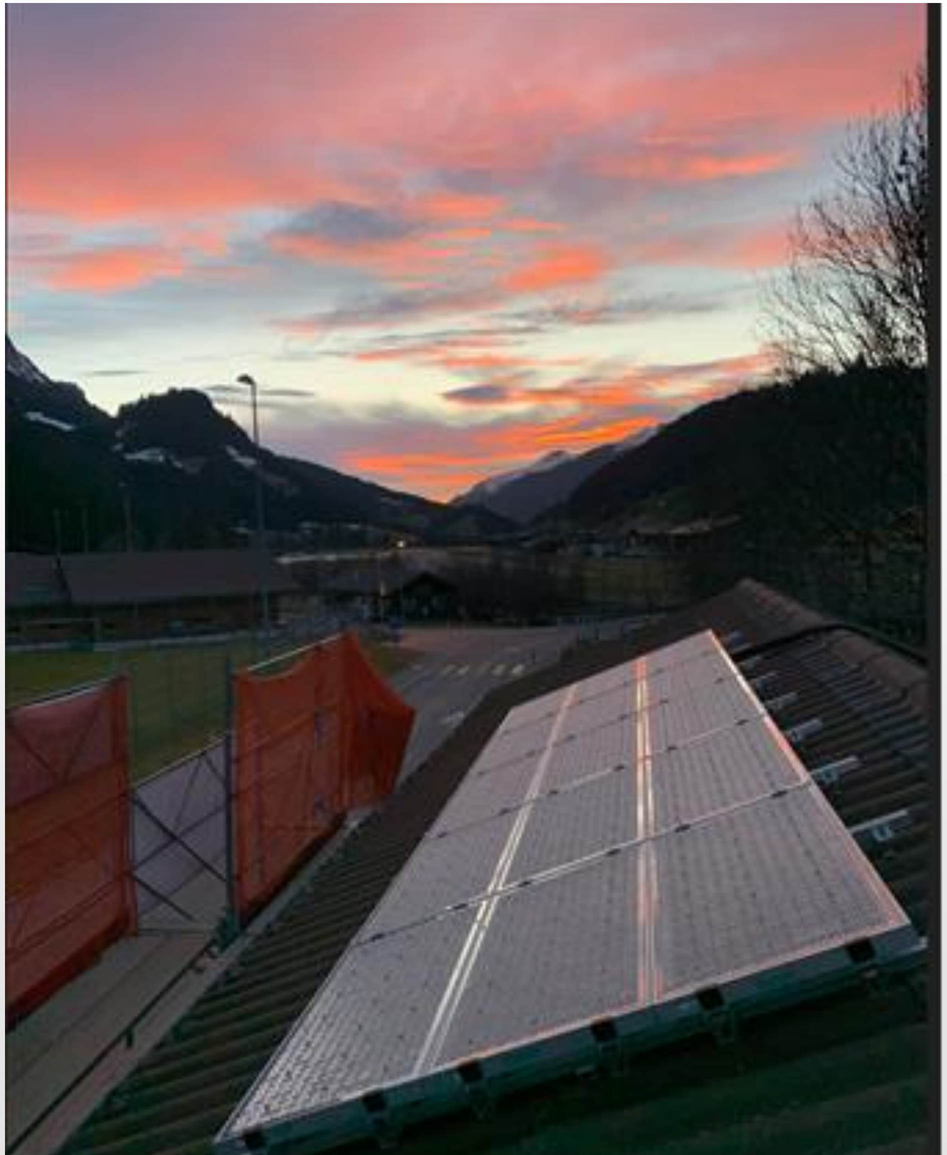
Pilot Switzerland - 3S



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