MONNOYEUR

08 JUNE 2023

Decarbonisation & Sustainability Day

Thursday 8th of june 2023

MONNOYEUR

Solar Energy Solutions

Erwin Theys

AGENDA

The Sun, a free energy source

01 Why Photovoltaïc panels?

02 Types of installations

03 Simulation Tools

04 Business cases

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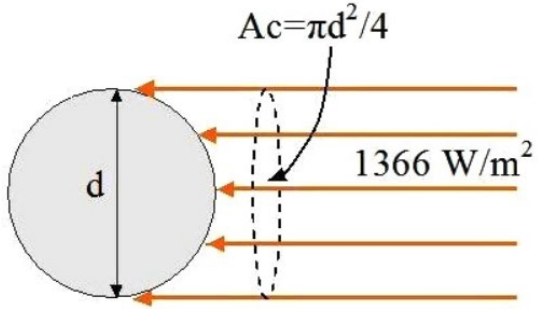
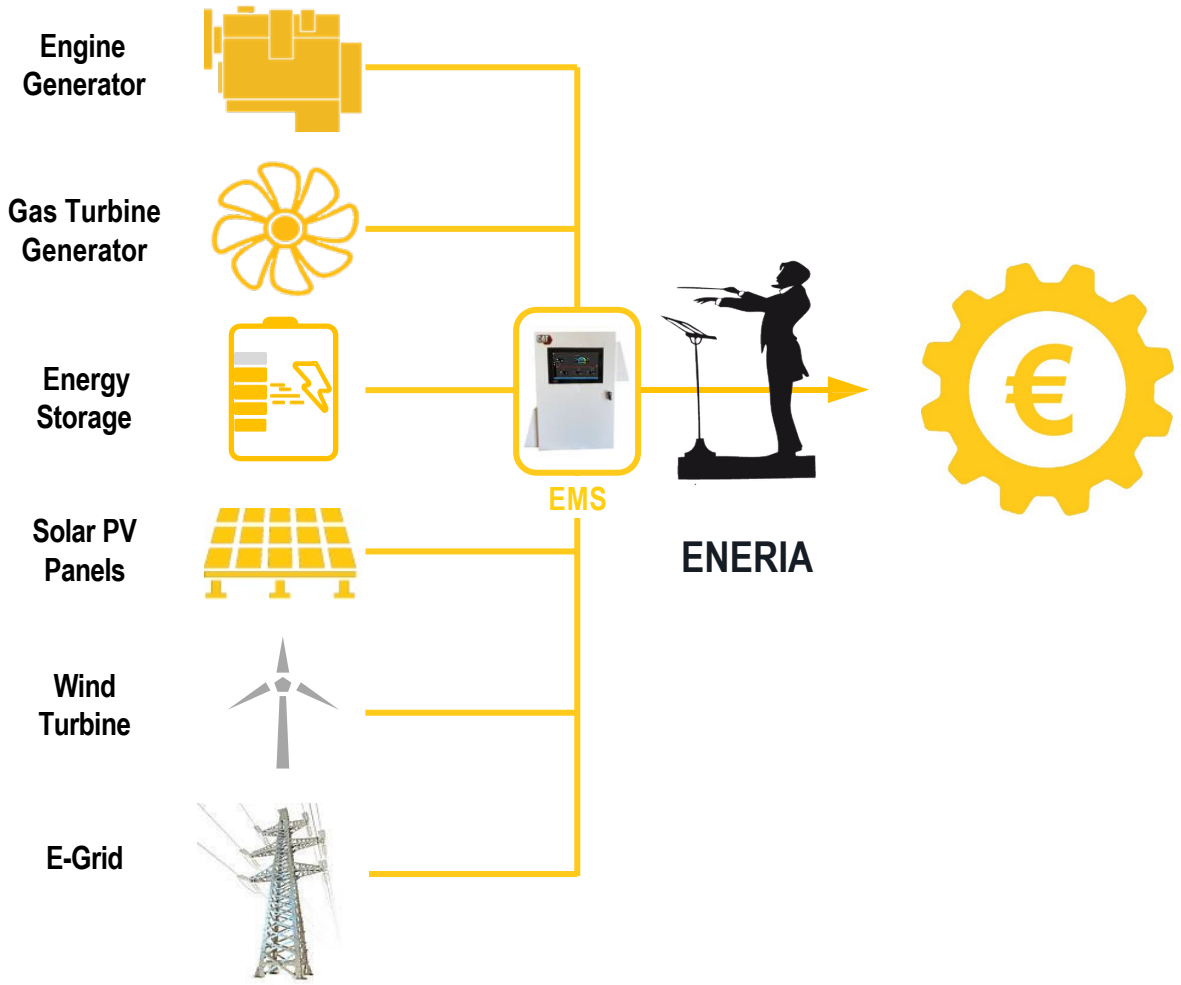
01 Why Photovoltaïc panels?

- Solar radiation is free of charge
  (according to NASA a global average of 1366 Watt / sqm
- Participate in the CO2 neutrality of electricity
- Added value on the land / property
- Insure a profitable energetic transition



Astronaut photograph ISS015-E-10469, courtesy NASA/JSC Gateway to Astronaut Photography of Earth.

01 Why does Eneria start with Photovoltaïc panels?



- Eneria wants to help you to make the energy transition profitable
- Eneria is a full scope technology provider and integrator
- From 2025, obligation in Flanders to install PV panels on min 10% of roof surface (for companies >1000 MWh consumption)
- Technical know-how for bigger installations (medium voltage, …) in-house

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02 Rooftop

- Most common and cheapest installation

- Typical tilt 10 to 12° to reduce windload
  Ideal tilt in Belgium: 20° in winter and 50° in summer

South – orientation
Highest production / panel

Flanders : obligation by the government to install by 2025 at least 10% of roof surface with solar panels (companies consuming >1.000 MWh/year)

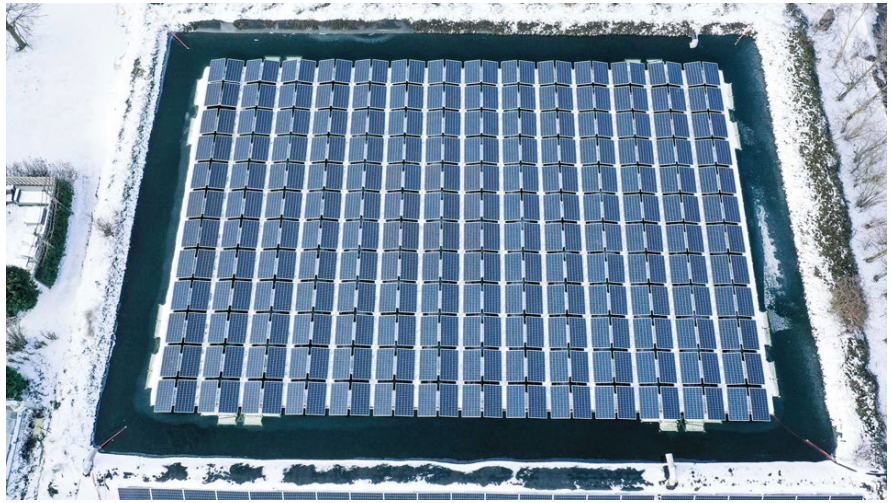
East/West – orientation
Less power production/panel
Better spread of production during the day
More panels/m² due to less shadow overlap

Ground

- Similar complexity as rooftop installation, but in average abut 20% more expensive
- Up to 1MWp / Ha, depending on terrain and orientation
- Normally permitted on marginal terrain or permit for agriculture terrain if animals are added.

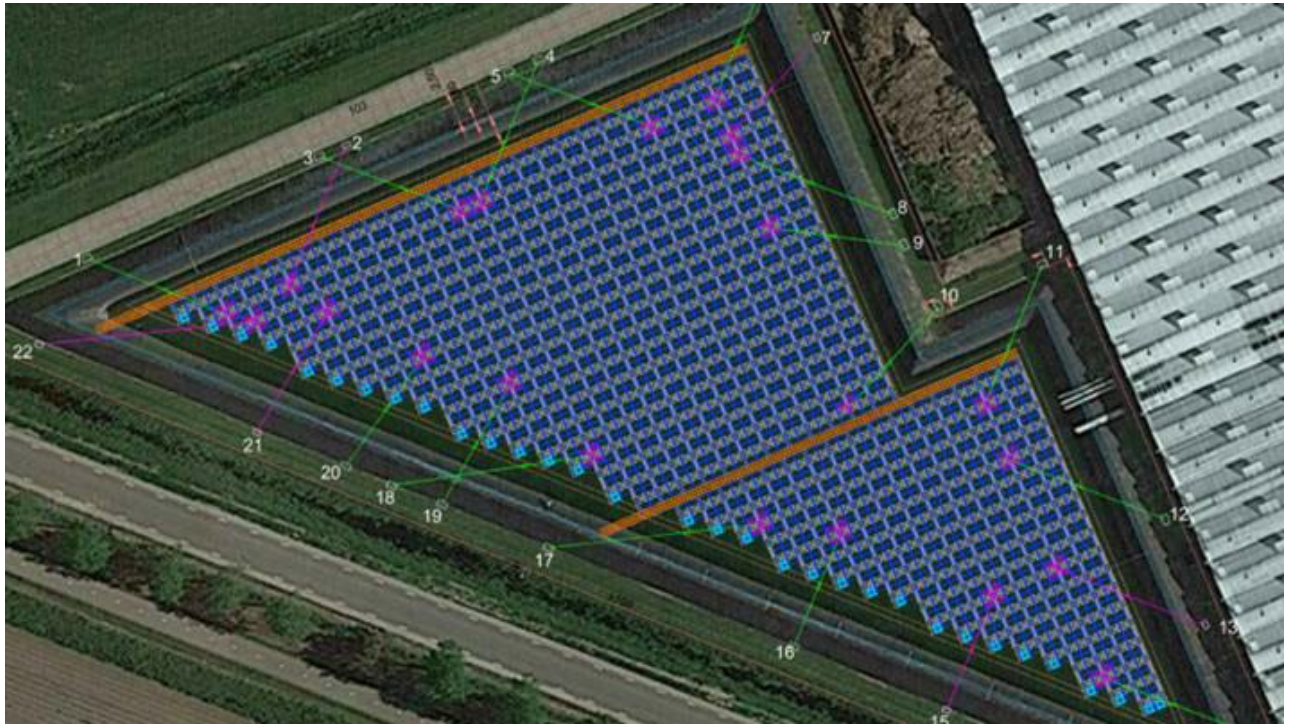
Floating

- Less water evaporation in summer times
- Less algae growth
- Higher efficiency due to cooling effect
- Without losing precious land surface



Special attention to:

- Anchoring : special study on flexible anchoring due to wind, water level changes, …
- Not damaging liner with anchoring cables
- Certification of used plastics
- All components need to hold the BS6920 Certificate. This regard the suitability of nonmetallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water.

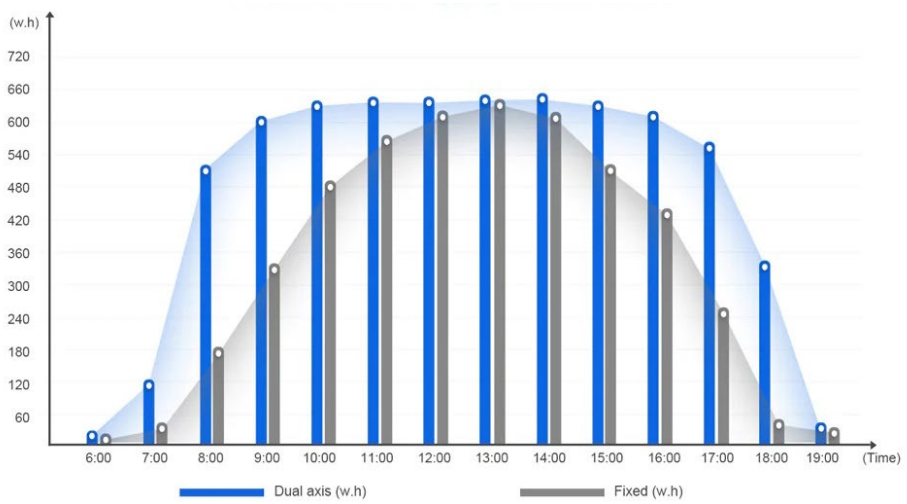


Solar tracker

Ideal for confined/marginal spaces

25-40% more energy production with same installed power + wider production graph during the day (combination of South + East/West)

Build-in intelligence for high wind protection



Carpark

DolExpo – France

- 10 Carports installed
- Total : 5998m²
- 1867 kWp – 4148 panels
- Reclaim parking lot
- Car protection
- Less airco consumption in summer times for electric cars

Carpark

Montlhéry – France

- 2 Carports installed
- Total : 500m²
- 100 kWp – 250 panels
- Reclaim parking lot
- Car protection
- Less airco consumption in summer times for electric cars

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Simulation Tools

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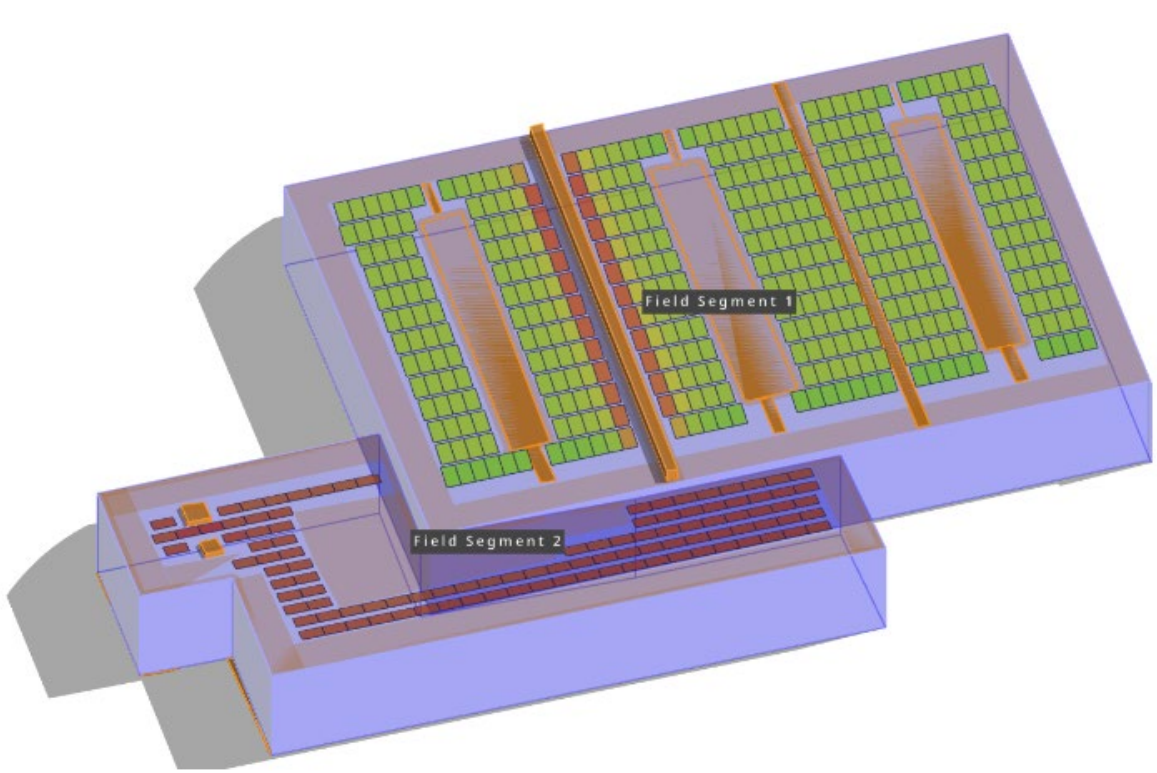
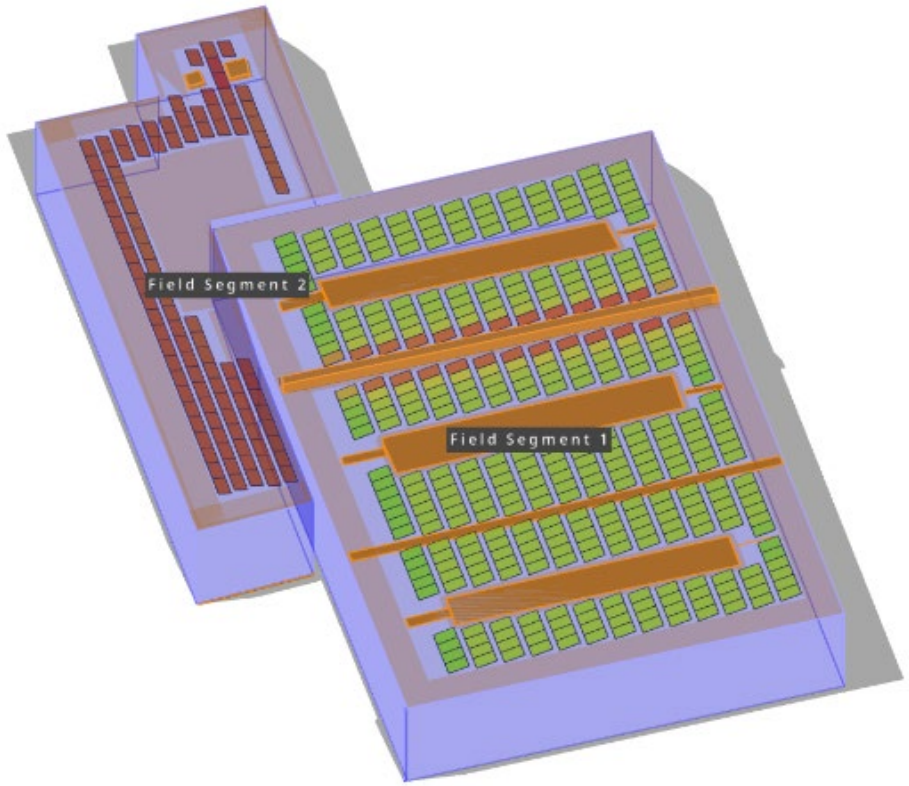


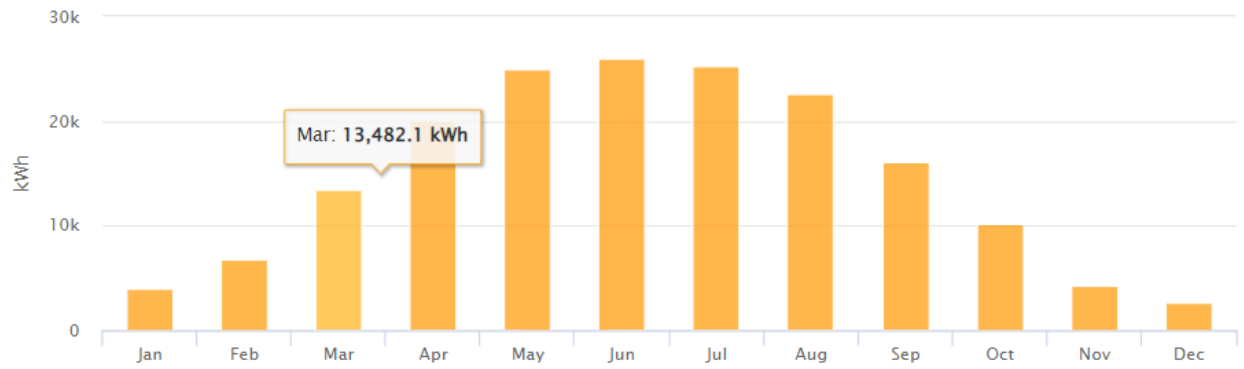


Solar Access by Month

Description	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
Field Segment 1	82%	90%	95%	98%	98%	98%	98%	98%	96%	92%	84%	84%
Field Segment 2	99%	99%	99%	99%	98%	98%	98%	98%	99%	99%	99%	99%
Solar Access, weighted by kWp	**84.2%**	**91.5%**	**96.0%**	**97.9%**	**98.2%**	**98.1%**	**98.0%**	**97.9%**	**96.5%**	**93.1%**	**85.5%**	**85.5%**
AC Power (kWh)	**4,040.5**	**6,782.3**	**13,482.1**	**20,161.2**	**25,025.6**	**25,969.0**	**25,198.7**	**22,611.4**	**16,051.2**	**10,134.3**	**4,292.5**	**2,586.4**

Simulation Tools

Monthly Production



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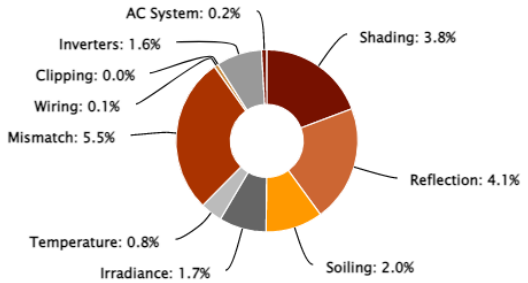
Month	GHI (kWh/m²)	POA (kWh/m²)	Shaded (kWh/m²)	Nameplate (kWh)	Grid (kWh)
January	24.2	29.0	24.4	4,529.7	4,040.5
February	38.0	42.6	38.9	7,339.6	6,782.3
March	73.9	79.6	76.4	14,552.9	13,482.1
April	112.4	116.8	114.3	21,897.2	20,161.2
May	144.4	146.6	143.9	27,596.9	25,025.6
June	152.8	153.5	150.7	28,952.5	25,969.0
July	147.6	149.5	146.6	28,095.7	25,198.7
August	131.2	135.0	132.2	25,307.5	22,611.4
September	90.6	97.1	93.6	17,854.4	16,051.2
October	57.6	63.9	59.5	11,233.6	10,134.3
November	25.8	30.3	25.9	4,834.2	4,292.5
December	15.8	18.4	15.8	2,941.4	2,586.4

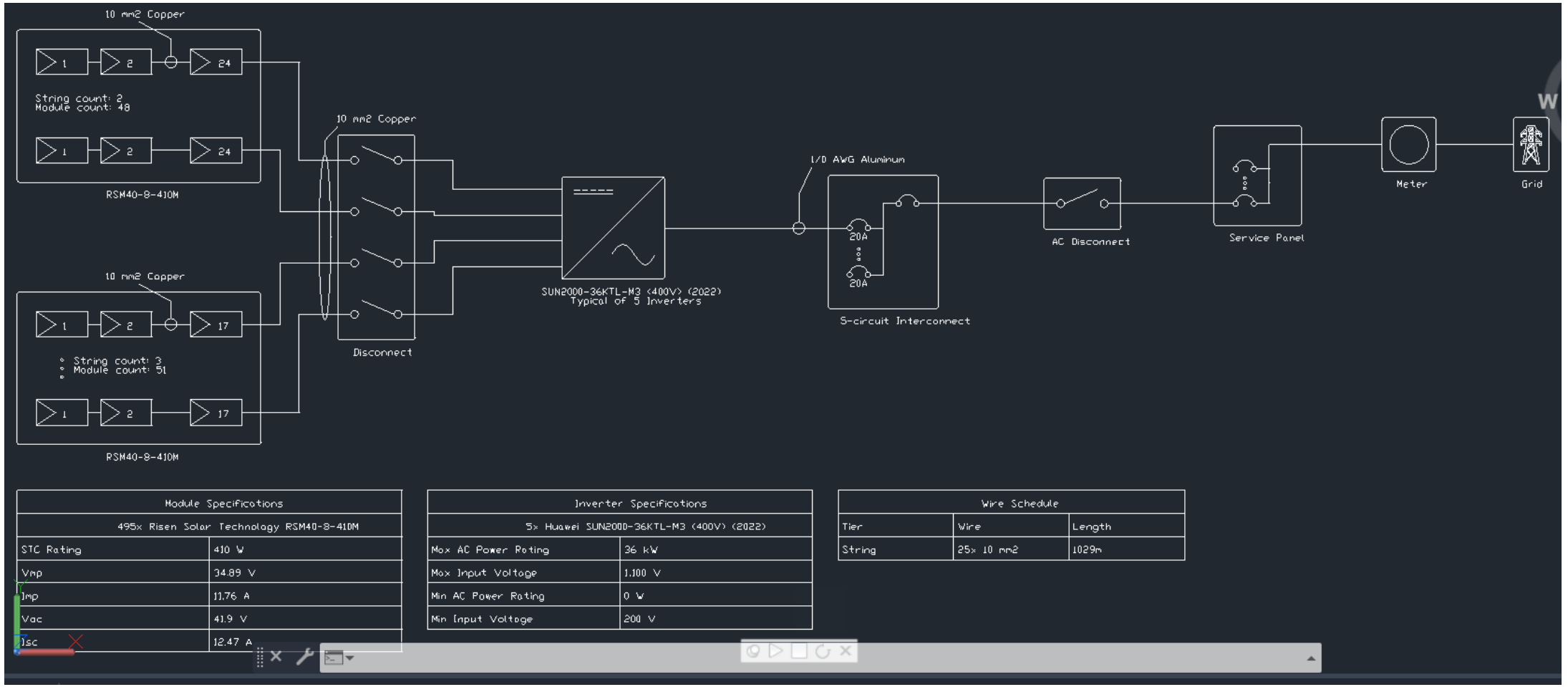
Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,014.5	
	POA Irradiance	1,062.2	4.7%
	Shaded Irradiance	1,022.0	-3.8%
	Irradiance after Reflection	980.4	-4.1%
	Irradiance after Soiling	960.8	-2.0%
	Total Collector Irradiance	**960.9**	**0.0%**
Energy (kWh)	Nameplate	195,147.7	
	Output at Irradiance Levels	191,922.5	-1.7%
	Output at Cell Temperature Derate	190,431.3	-0.8%
	Output After Mismatch	180,037.1	-5.5%
	Optimal DC Output	179,784.1	-0.1%
	Constrained DC Output	179,782.9	0.0%
	Inverter Output	176,906.4	-1.6%
	Energy to Grid	**176,590.2**	**-0.2%**
Temperature Metrics			
	Avg. Operating Ambient Temp		13.4 °C
	Avg. Operating Cell Temp		18.6 °C
Simulation Metrics			
	Operating Hours		4591
	Solved Hours		4591

Simulation Tools



Module Specifications	
495x Risen Solar Technology RSM40-8-410M	
STC Rating	410 W
Vmp	34.89 V
Imp	11.76 A
Voc	41.9 V
Isc	12.47 A

Inverter Specifications	
5x Huawei SUN2000-36KTL-M3 (400V) (2022)	
Max AC Power Rating	36 kW
Max Input Voltage	1,100 V
Min AC Power Rating	0 W
Min Input Voltage	200 V

Wire Schedule		
Tier	Wire	Length
String	25x 10 mm2	1029m

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Business case : Ecological

PV panels can help you to reduce CO2 footprint

Reduce the purchase of CO2 emission rights EEX (± 80€/ton CO2)

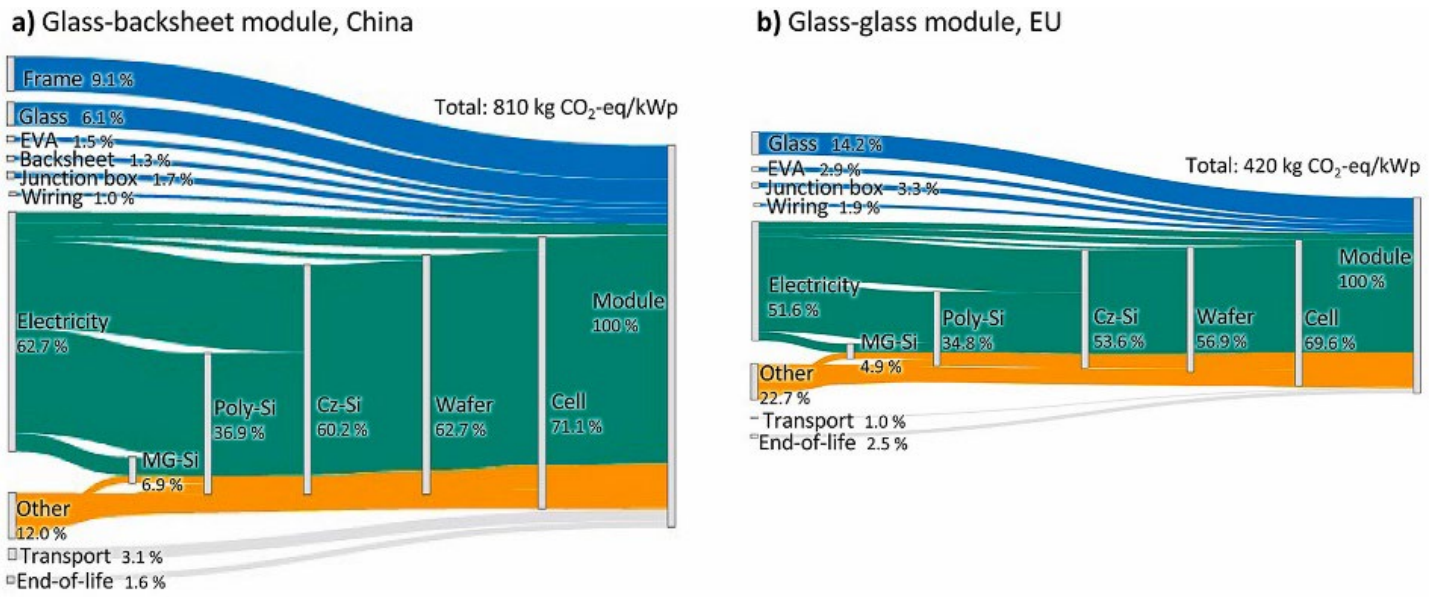
Flemisch electricity grid = average 273gr CO2/kWh

Data: Veka 2020

To compensate CO2 emission of the production of the PV panels by making green electricity:

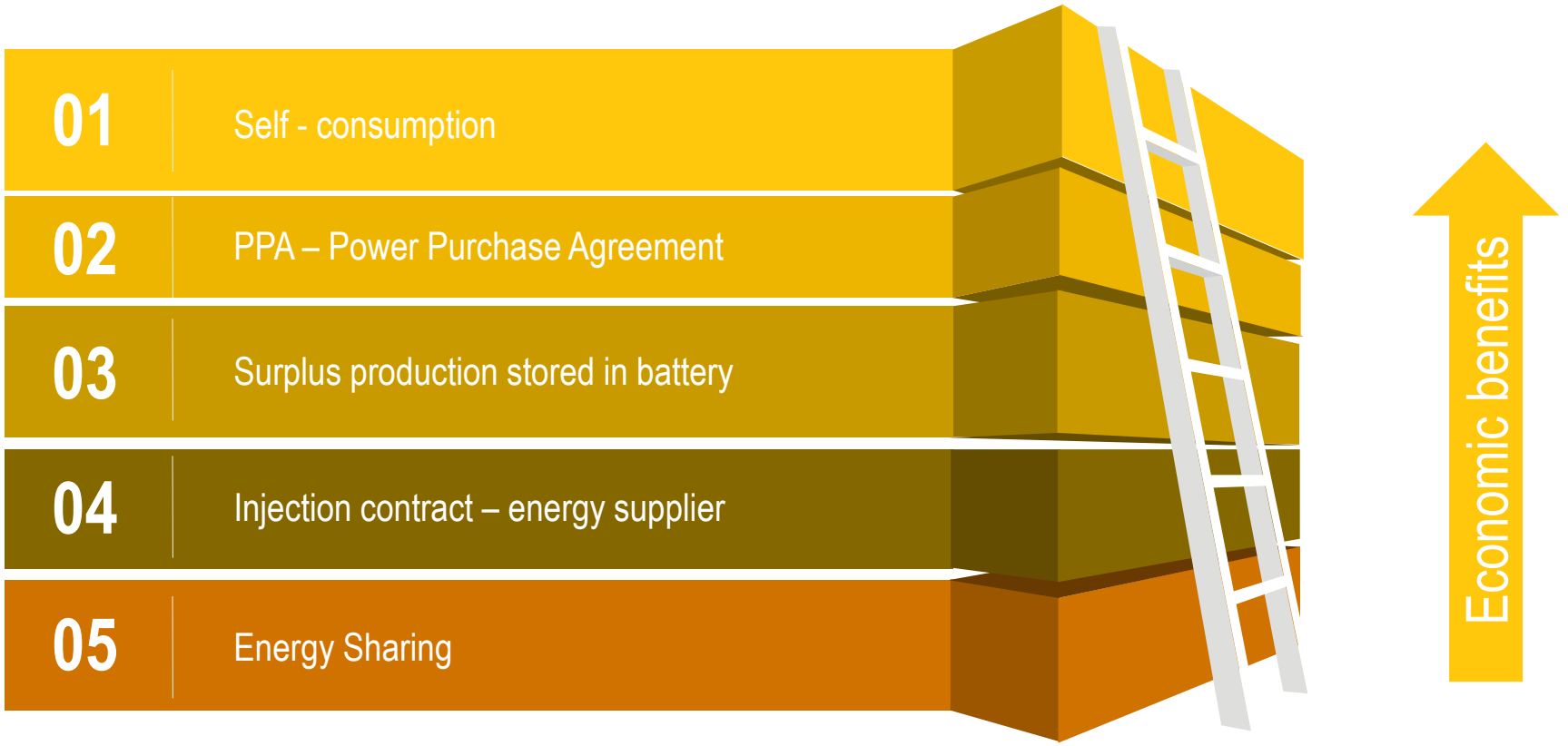
	Glass-backsheet	Glass-glass	
China	3,4	3,2	year
EU	2,0	1,8	year

CO2 emissions for the production of the panels (including transport, ….)



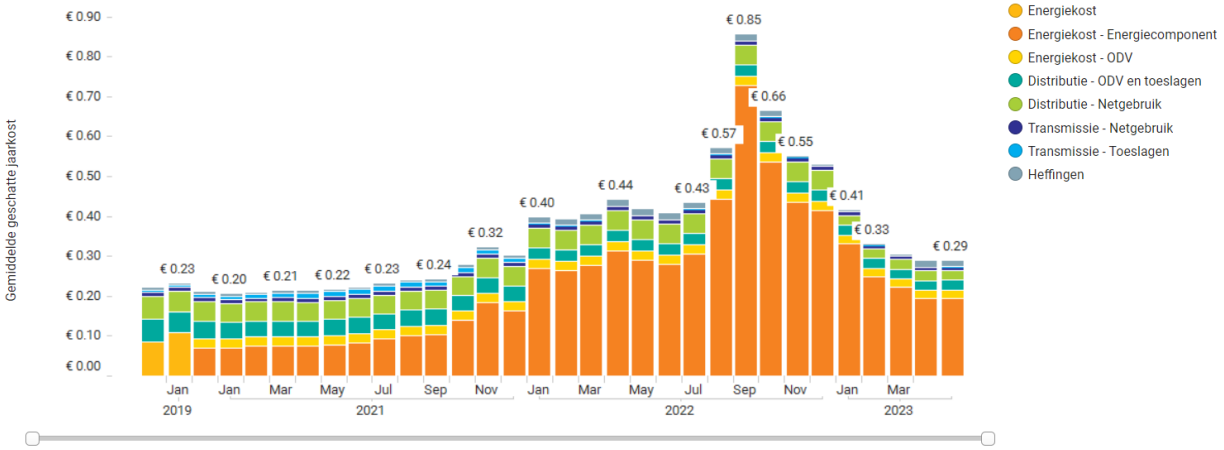
https://www.sciencedirect.com/science/article/abs/pii/S0927024821003202

Business case



Business case : Ecological

01 Self - consumption



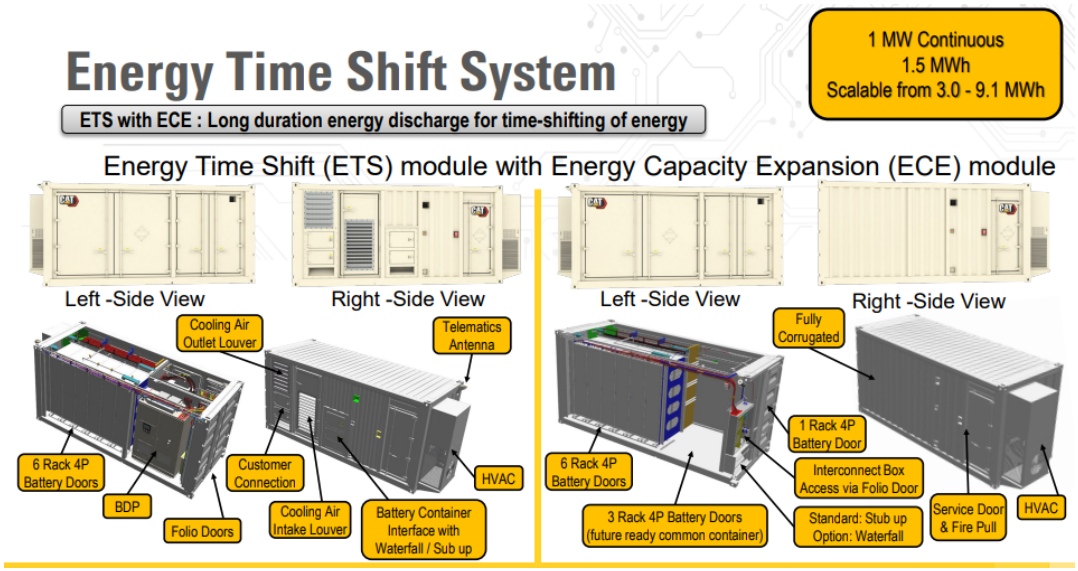
VREG 05/2023

- Due to high energy cost, the most beneficial is to consume all electricity produced.
- Saves on full scope cost: energy, distribution transmission and taxes.
- Keep in mind that PV panels do not help a company to reduce capacity pricing (in contradiction to private users)

02 PPA – Power Purchase Agreement

- A Power Purchase Agreement (PPA) is a power offtake agreement between two parties.
- A green electricity producer and an buyer of this electricity (consumer or trading company)
- A PPA is in general a long-term contract (10-15years) and includes:
  - Amount of electricity to be supplied
  - Negotiated price
  - Who's responsible for what risks
  - Penalties for not honoring the contract
- Buyer also needs a contract with normal supplier in case no PV production
- It removes partial the risk of fluctuations in the electricity markets, enabling investments.

03 Surplus production stored in battery

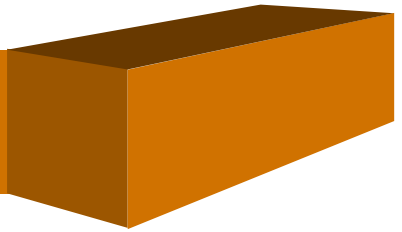


- Surplus energy produced can be stored in batteries (see break-out session on battery storage)
- Typical for companies: energy produced in the summer over the weekend
- All energy stored to be used time-shifted = 100% scope cost, so no distribution costs, … to be paid.

04 Injection contract – energy supplier

- 05/2023: 38 €/MWh – 111,7€/MWh (mijnenergie.be)
- Low return on investment
- The easiest way by reselling without any hassle or additional investment

05 Energy Sharing



- Legally possible between 2 companies with different electricity suppliers since 01/01/2023
- Legislation unclear : Energy sharing needs to be at “cost”, but not defined how to calculate
- Only energy component. Net distribution cost still needs to be payed
- Electricity suppliers charged an additional admin fee which is not defined by law

KEY TAKEAWAYS

01 More profitable than ever

02 Full scope technology provider and system integrator

03 Specialized installations like floating PV, medium voltage, …

04 Legislation in Flanders

Remember, the cheapest energy is the one not consumed