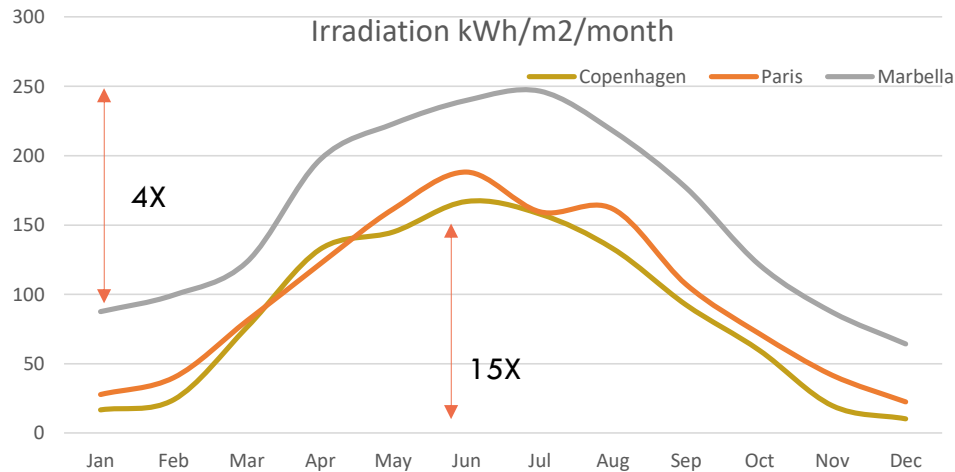


An aerial photograph of a rural landscape at sunrise. The scene is bathed in a warm, golden light, with long shadows cast across the fields. In the foreground, a large white house with a dark roof is visible. A road winds through the landscape, and several other houses are scattered in the middle ground. The background shows rolling hills and a large body of water, possibly a lake or reservoir, reflecting the bright light of the sun. The overall atmosphere is peaceful and serene.

PHOTONCYCLE AIMS TO CHANGE THE WAY ELECTRICITY IS
GENERATED, STORED, CONSUMED AND PAID FOR. OUR MISSION
IS TO BUILD A SPACE-EFFECTIVE, AUTONOMOUS ENERGY SYSTEM
POWERED BY THE SUN, ENABLED BY INNOVATIVE TECHNOLOGY,
AFFORDABLE FOR MANY

ROOFTOP PV PART OF FUTURE ENERGY SOLUTION



Source: European Commission Photovoltaic geographical information system

- PV challenging to integrate at scale into the electrical grid in temperate climates
- Large scale fluctuations in production during the day based on cloud cover and solar position requiring significant back up capacity for grid stability
- Battery technology suitable to manage short term fluctuations
- Also a significant seasonal variation in PV generation throughout Europe but less than 5% variation from one year to the next.
- In Northern and Central Europe, irradiation in June is typically 1.5 times higher than in December
- Even in Marbella on the southern tip of Spain, July irradiation is almost 4 times greater than December irradiation
- As heating is decarbonised throughout Europe combined with a growing share of PV in the energy mix, there is a need for more system flexibility and electricity generation in the winter months to balance supply and demand

Supply/demand profile of a household in Denmark with 20 kW PV



Source: Thema consulting modelling for Photoncycle

EU'S ROOFTOP PV STRATEGY WILL CREATE MAJOR CHALLENGES



'Ambitious but realistic' | EU in solar strategy targets to add 600GW and impose PV rooftop mandate



- EU plans to impose a rooftop PV mandate on newbuild residential houses by 2029 as part of RePowerEU
- The European Parliament voted to impose a requirement for PV on roof for all buildings that are undergoing major renovations from 2032
- The EU countries which have the largest rooftop PV footprint like the Netherlands and Germany experience growing curtailment during peak production periods in the summer partly due to massive new installation of PV panels which has dropped 30% in price in 2023
- The Netherlands which has the highest rooftop PV penetration in Europe, and which saw an 28% growth in installation in 2022, curtailment increased by 300% to almost 4000 events in 1H 2023 due to limited capacity in the distribution grid
- This problem is likely to get worse as more households are installing PV on the roof in response to elevated energy prices, lower panel costs and to reduce their climate footprint
- In addition, electricity prices on sunny days in the summer are likely to go to zero due to oversupply as new PV projects come online, so even if projects are dispatched, value of energy is likely to be very low
- Batteries with their low storage capacity cannot fully fix this problem A 20 kWh battery will be full in one hour of peak production from a 20 kW rooftop



Residential PV curtailment rising in Netherlands

Dutch utility Liander said this week that the number of curtailment events for residential PV systems more than tripled in the first half of this year, and urged owners of rooftop arrays to expand electricity consumption during peak hours.

JULY 13, 2023 EMILIANO BELLINI

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Renewables March 15, 2023

Why booming rooftop solar may ultimately be doomed

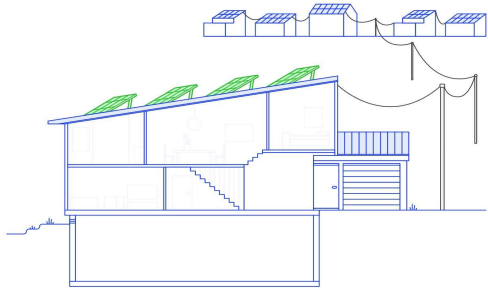
The European rooftop solar industry is booming, but significant market reform will be needed for there to be a business case in 10-20 years' time.

By Nick Ferris

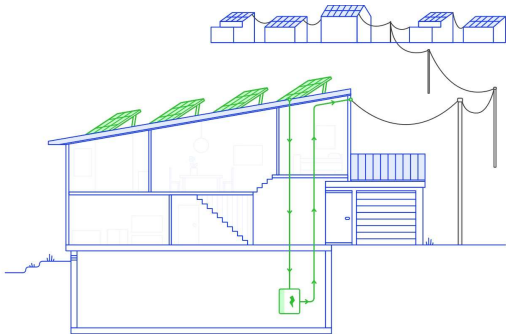


The European rooftop solar industry is booming. Skyrocketing electricity prices over the past year have led to a considerable opportunity for households and businesses looking to generate renewable solar power to use themselves and sell any excess back to the grid. Rooftop solar added 25GW in the EU in 2022, 8GW more than in 2021, says the industry group SolarPower Europe.

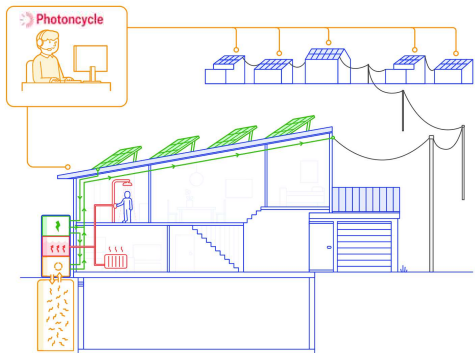
SEASONAL STORAGE NEEDED FOR FULL UTILISATION OF PV



35% self
consumption



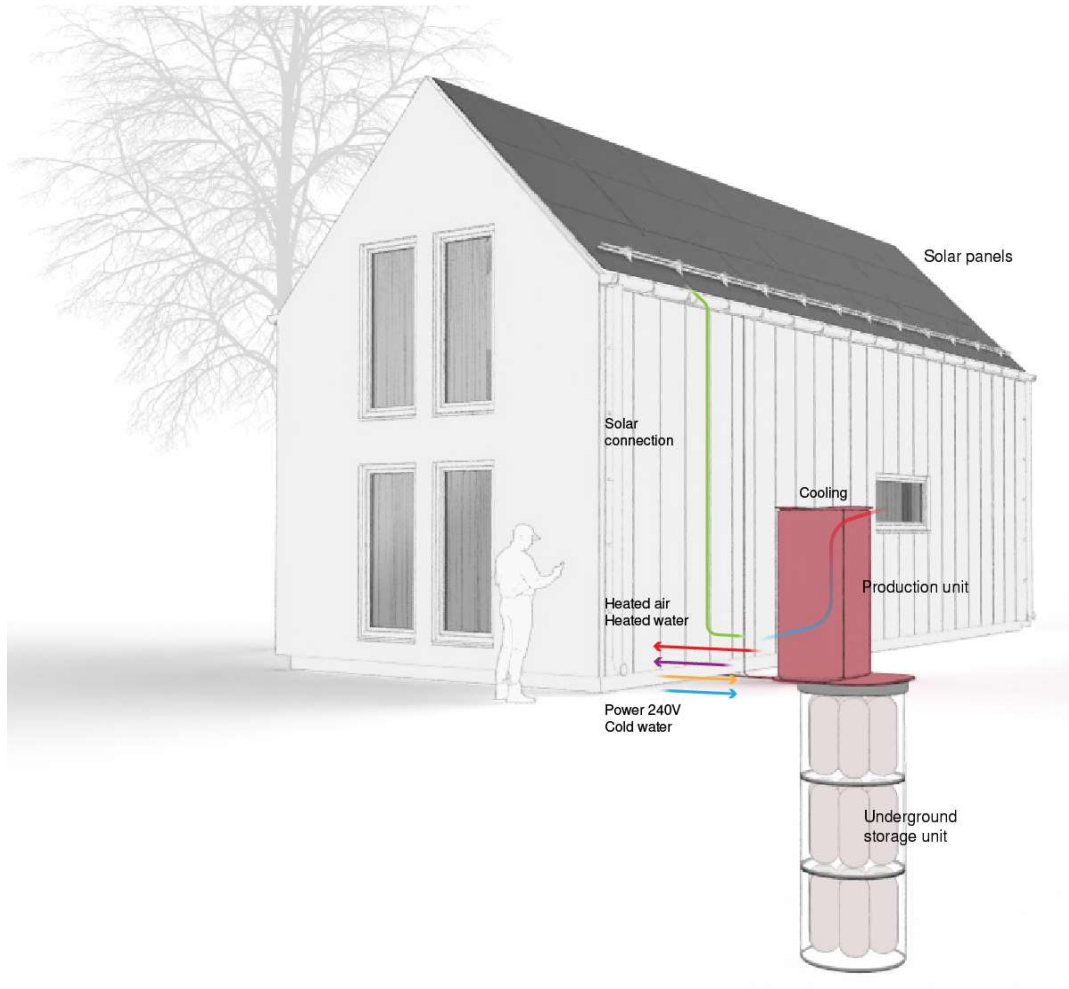
50% self
consumption



100% self
consumption

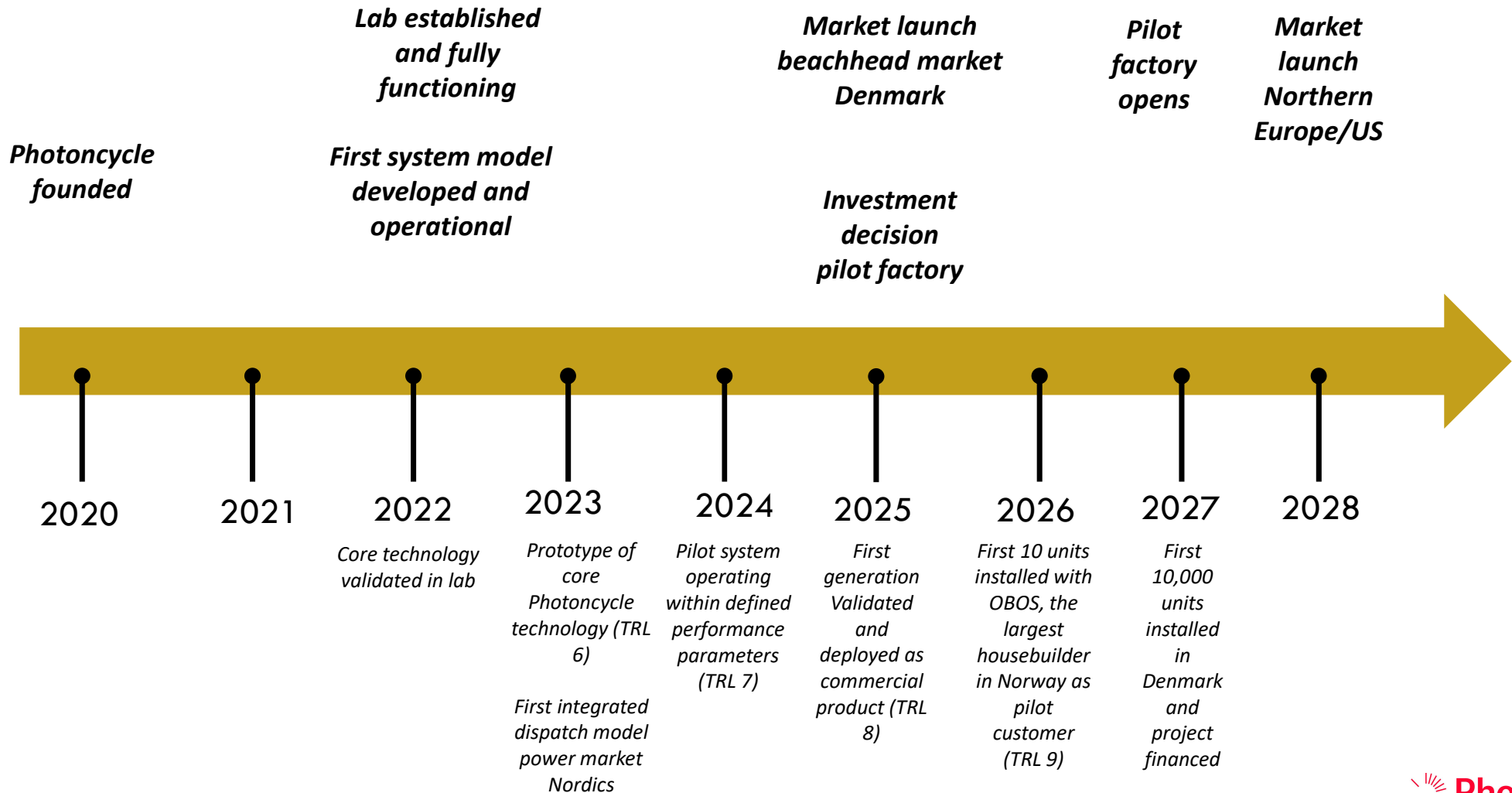
- A house with a 100 m² roof can produce approximately 20,000 kWh a year of electricity meeting energy demand in a household in Northern Europe and approximately 30,000 kWh in Southern Europe
- However a weakness with current PV only system in Central/Northern Europe is that only approximately 35% of electricity generated in a system of 20 kW is consumed by the household. Balance has to be sold to the grid due to supply/demand mismatch.
- As more PV comes on line producing at the same time mainly during the day in the summer, hourly prices when PV is producing will approach zero reducing value of grid export
- With a 20 kW battery which is able to match supply and demand better over the day through hourly storage of energy, approximately 50% of electricity produced can be consumed and balance sold to grid for variable price
- Due to the significant seasonal demand/supply mismatch 100% of generated electricity can only be consumed in house if there is large scale storage of energy
- Large scale storage allows for sale of energy to grid at attractive prices and can help balance the energy system

PHOTONCYCLE OFFERS COMPLETE ENERGY SYSTEM



- Rooftop PV and grid used to generate electricity
- Electricity used directly to meet household needs or stored in a 20 kW battery
- When battery full, surplus electricity run through an electrolyzer with water to produce green hydrogen, power to X
- Hydrogen absorbed in solid at room temperature with energy density approximately 20 times higher than a lithium battery. Technology enables seasonal storage of renewable energy. 10,000 kWh can be stored in a 3 m³ storage unit
- When energy is required, the solid is heating to 130 C and run through a fuel cell to produce electricity and heat
- Process heat cycled through hot water tank to meet heating requirements in additional to heat pump to maximise available heat/kWh electricity
- Photoncycle will provide central monitoring of the energy balance, system performance and optimise dispatch of grid services to maximise revenues
- Professor Hauback the Chief Scientist in the hydrogen department at IFE (Institute of Energy Technology) has done an independent due diligence of the Photoncycle technology and development status with a report finalised in August 2023

DEVELOPMENT TIMELINE: MARKET LAUNCH 2025



Annex 1
Photoncycle
design concept





