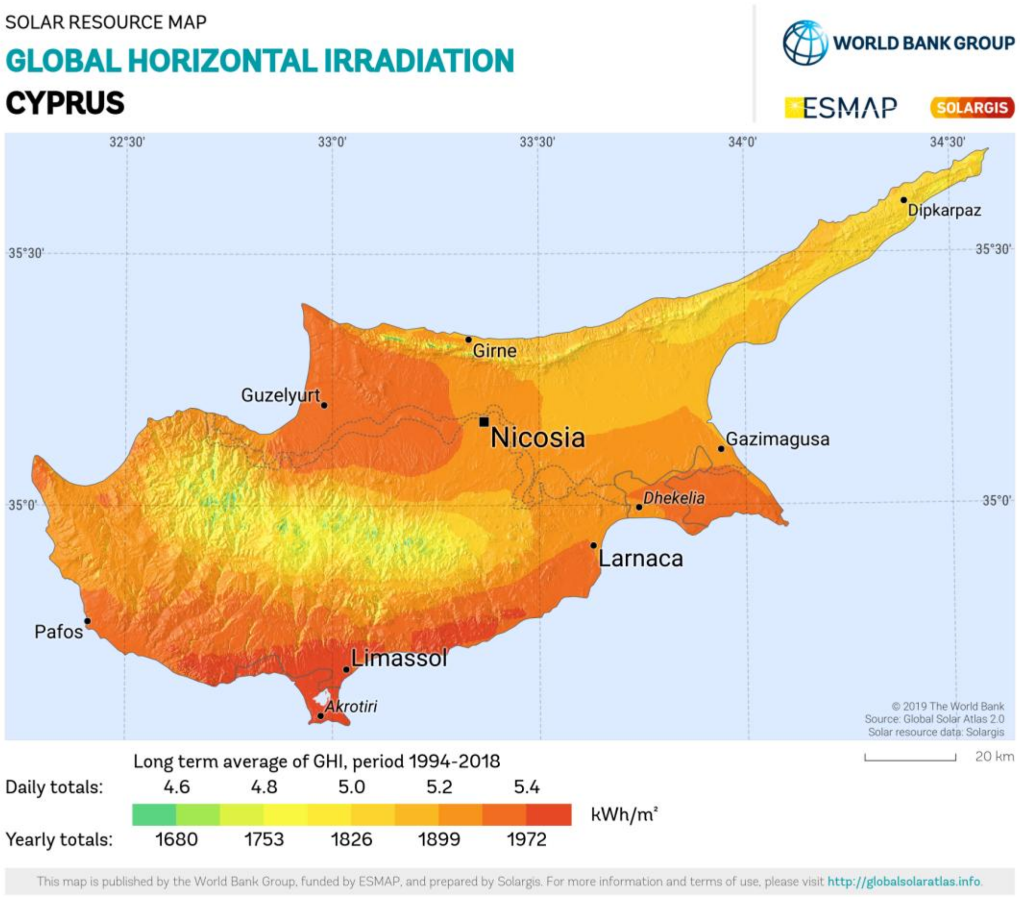
PV integration & applications

Funded by the European Union

GA No 101160258

Miguel Centeno Brito
Ciências ULisboa
17/06/2025

Solar energy in Cyprus



Cyprus has over 1.1 million m² of collector area.

This corresponds to approximately 770 MW_{th}.

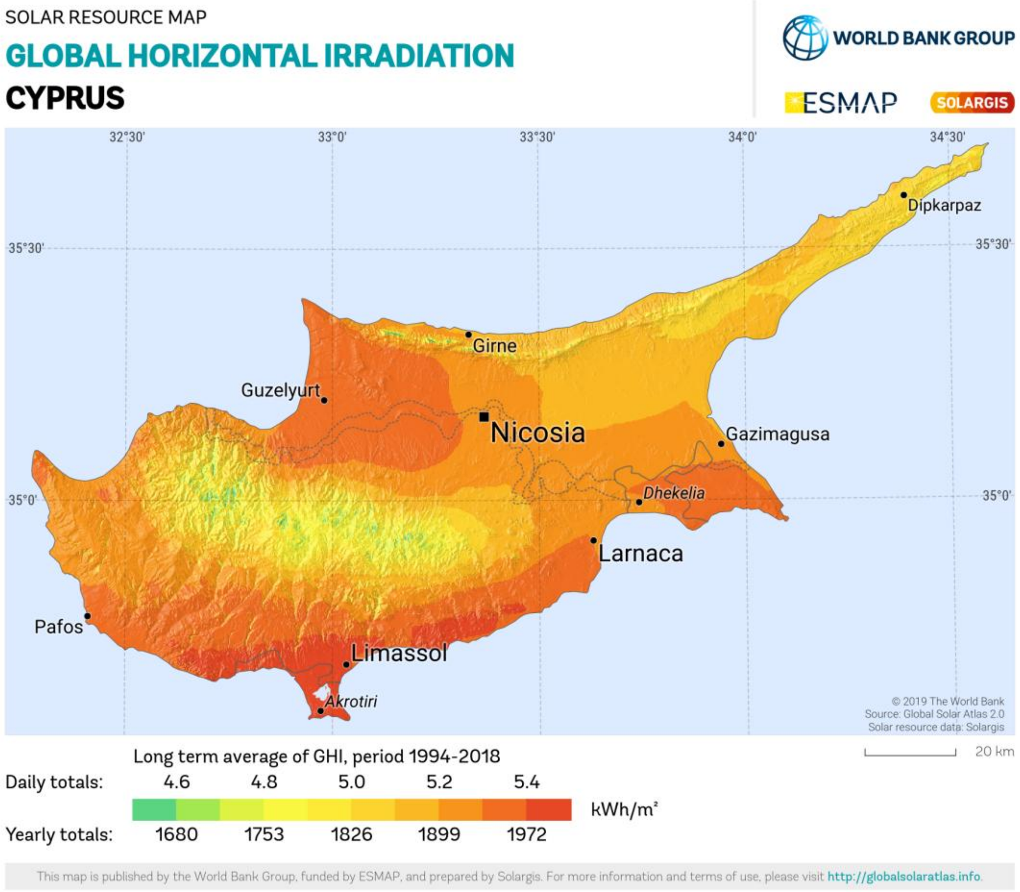
With 800–900 m² of solar thermal collectors per 1,000 inhabitants, it is one of the highest per capita users globally.

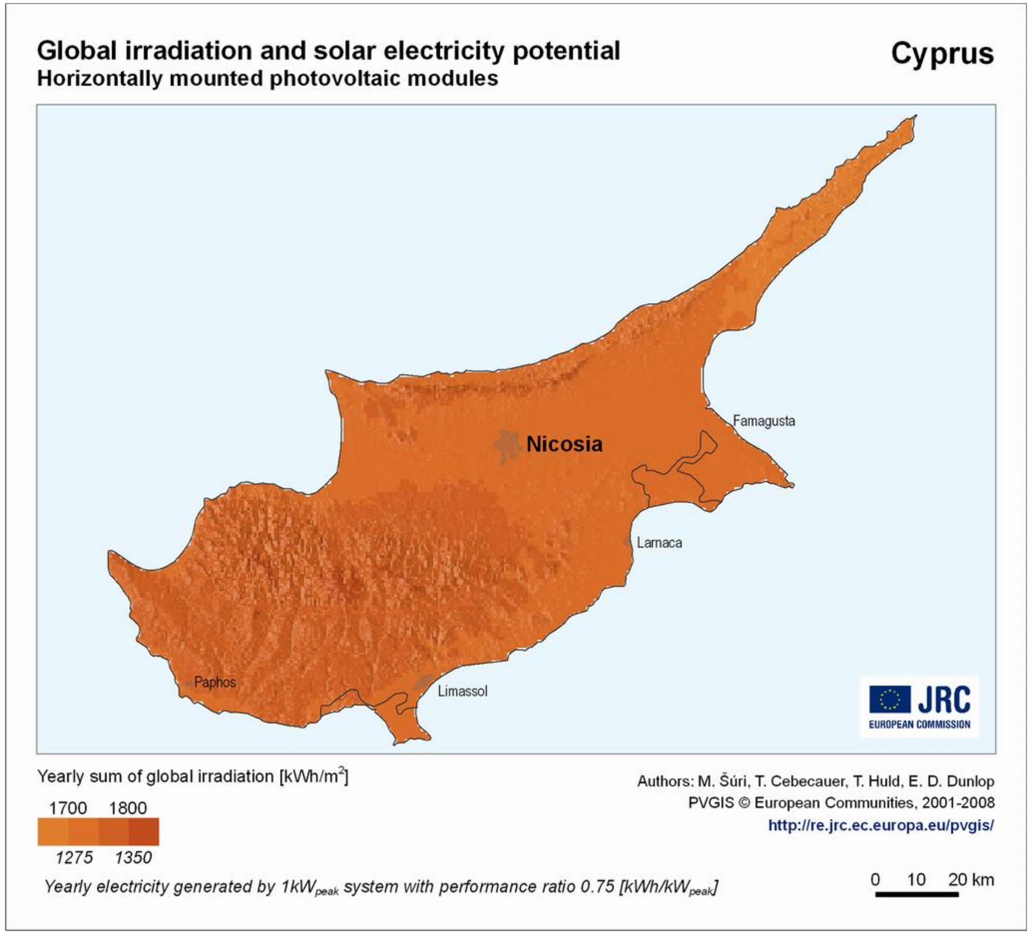
Over 90% of households in Cyprus use solar thermal systems for domestic hot water. More than 50% of hotels also use large-scale solar thermal systems.

Solar thermal is a winner in Cyprus.

What about photovoltaics?

Solar energy in Cyprus





Solar energy in Cyprus

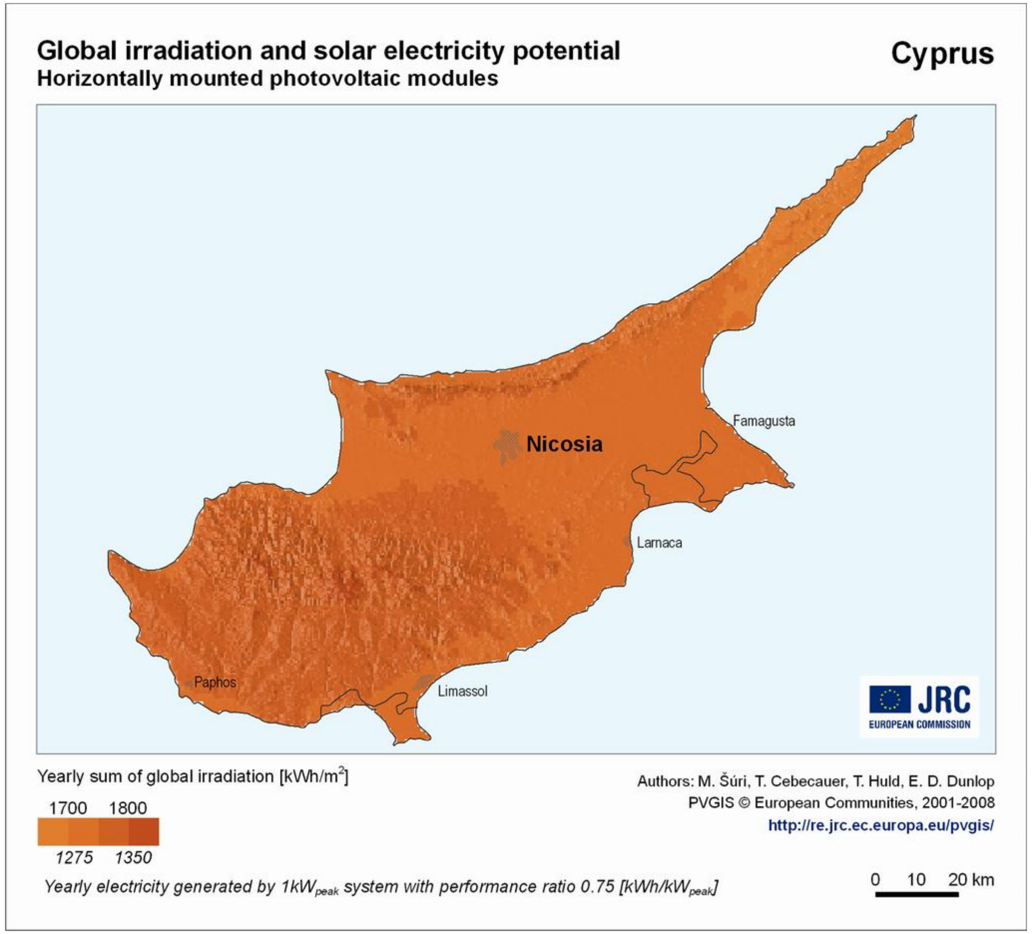
Daily irradiation: **5 kWh/m²/day**

Assuming 20% efficiency: **200 W/m²**

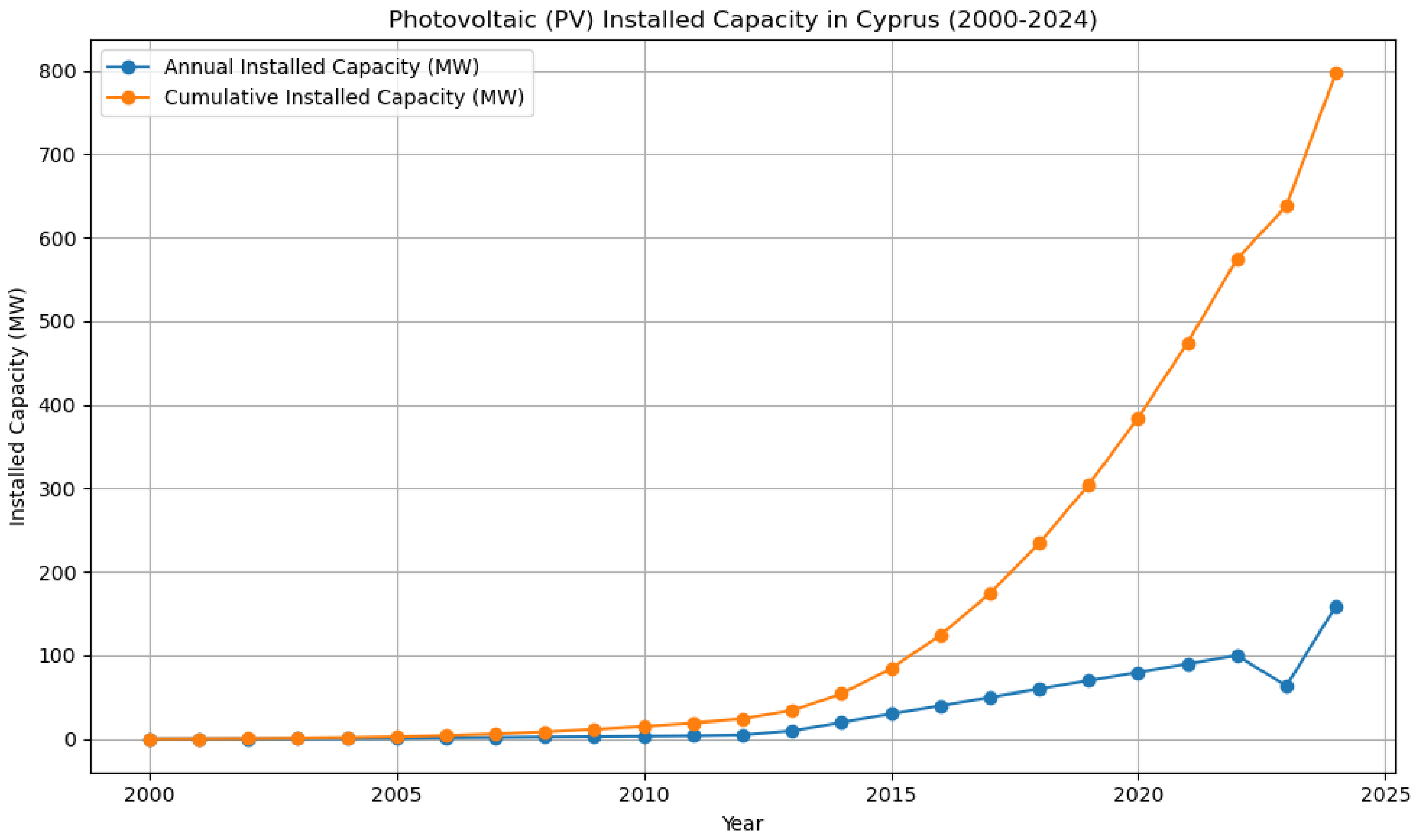
Installed capacity: **5 m²/kWp**

Daily PV generation: **1 kWh/m²/day**

or **5 kWh/kWp/day**



PV in Cyprus



Photovoltaic (PV) Installed Capacity in Cyprus (2000-2024)
Annual Installed Capacity (MW)
Cumulative Installed Capacity (MW)
Installed Capacity (MW)
800
700
600
500
400
300
200
100
0
2000
2005
2010
2015
2020
2025
Year

Challenges ahead

CyprusMail Established 1945

Powered by: ecommbx

Cyprus | Opinion | World | Business & Finance | Sport | Life & Style | CM Videos | SEARCH

PVs rapidly losing their lustre

pv magazine

Subscriptions

News | Features | Events | Awards | Partner news | pv magazine test | Magazine | About | Advertise

Cyprus curtails 29% of renewable energy in 2024

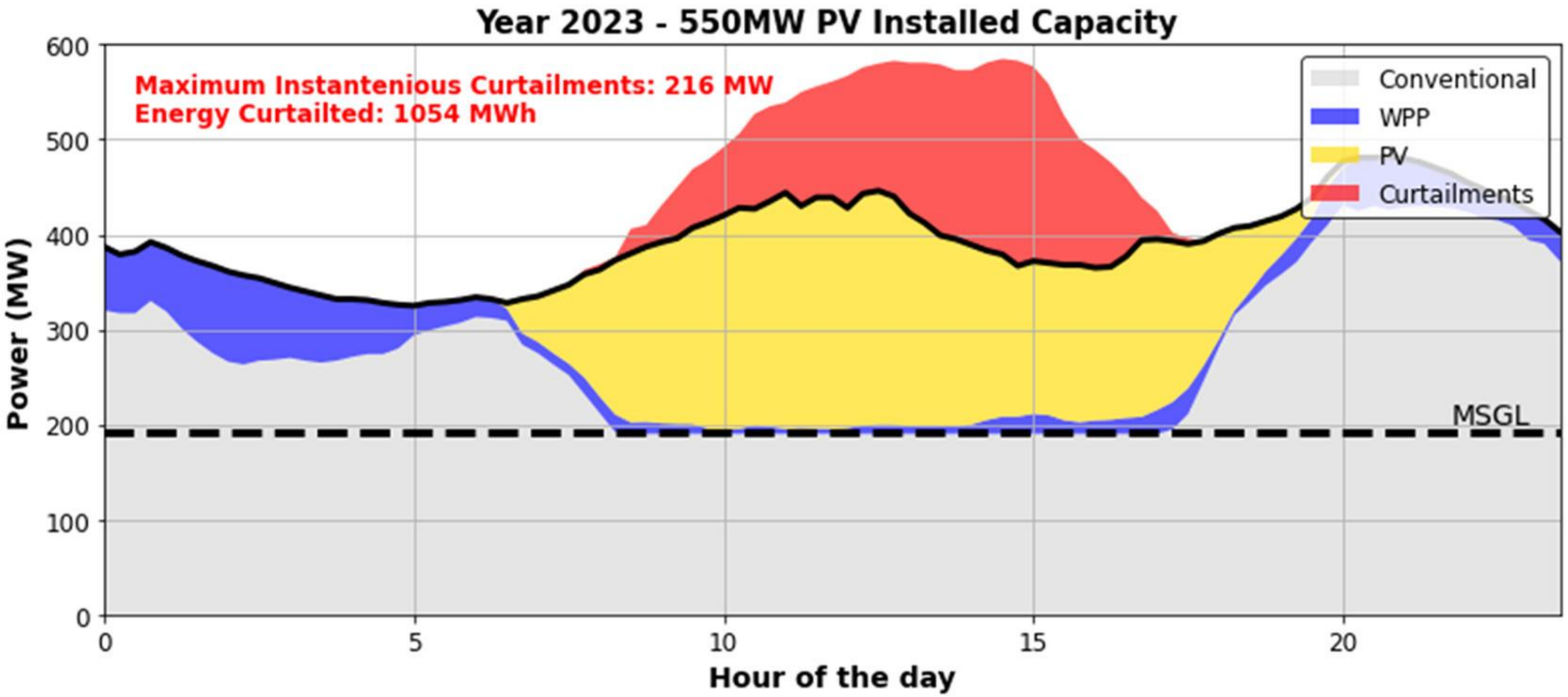
Cyprus curtailed 29% of its renewable energy in 2024, a record high that signals risks to the island's energy transition.

FEBRUARY 14, 2025 ILIAS TSAGAS

Cyprus' record curtailment did not come as a surprise. A year ago, the local transmission grid operator predicted the country would need to curtail 28% of its domestic renewable energy generation in 2024 due to low seasonal demand and the need to keep the network stable.

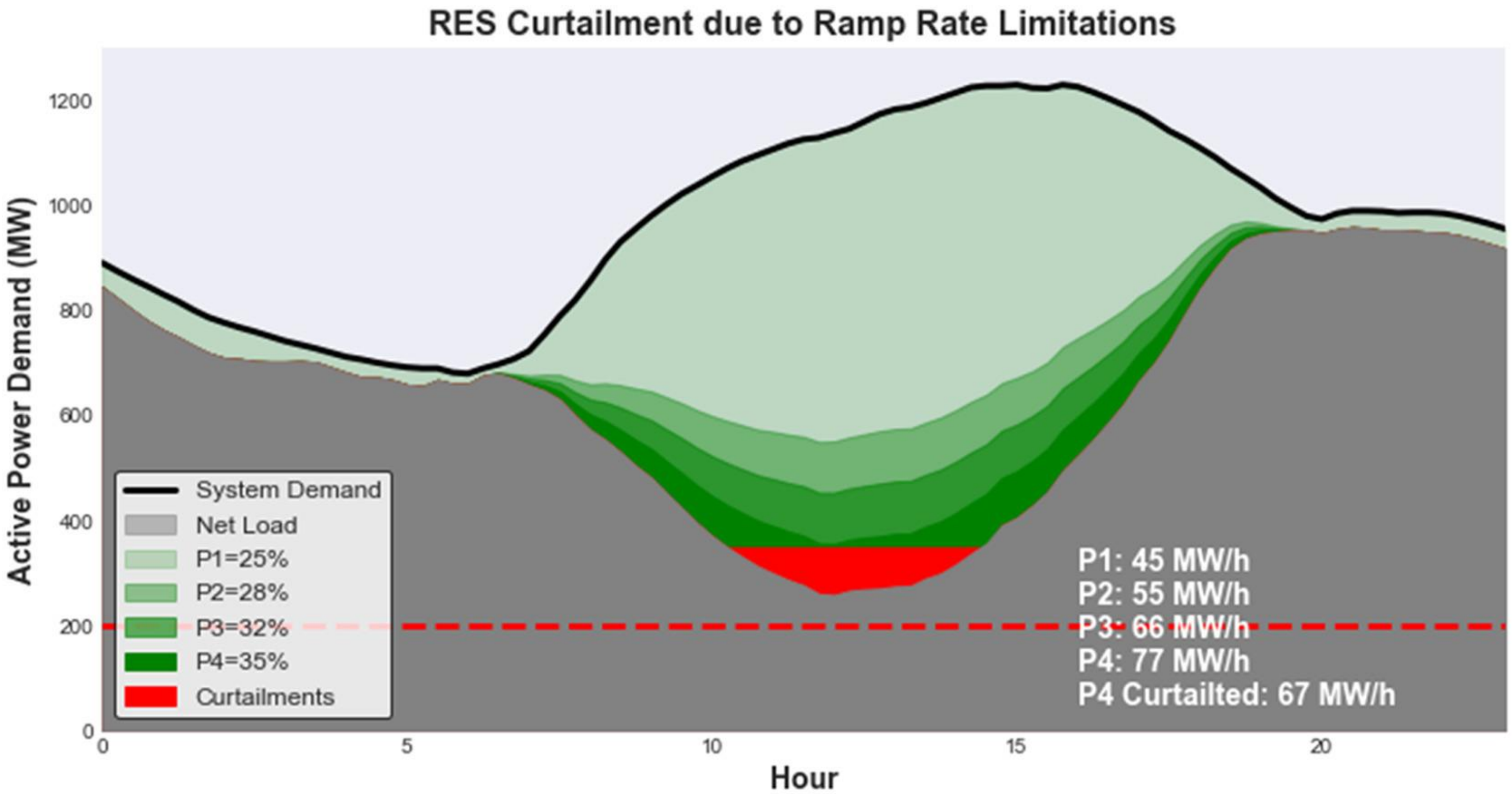
In 2022, Cyprus curtailed 3.3% of renewable energy. That figure rose to 13.4% in 2023 before reaching a record 29% last year, equal to the annual electricity consumption of about 28,000 households, said Procopiou.

Curtailing PV



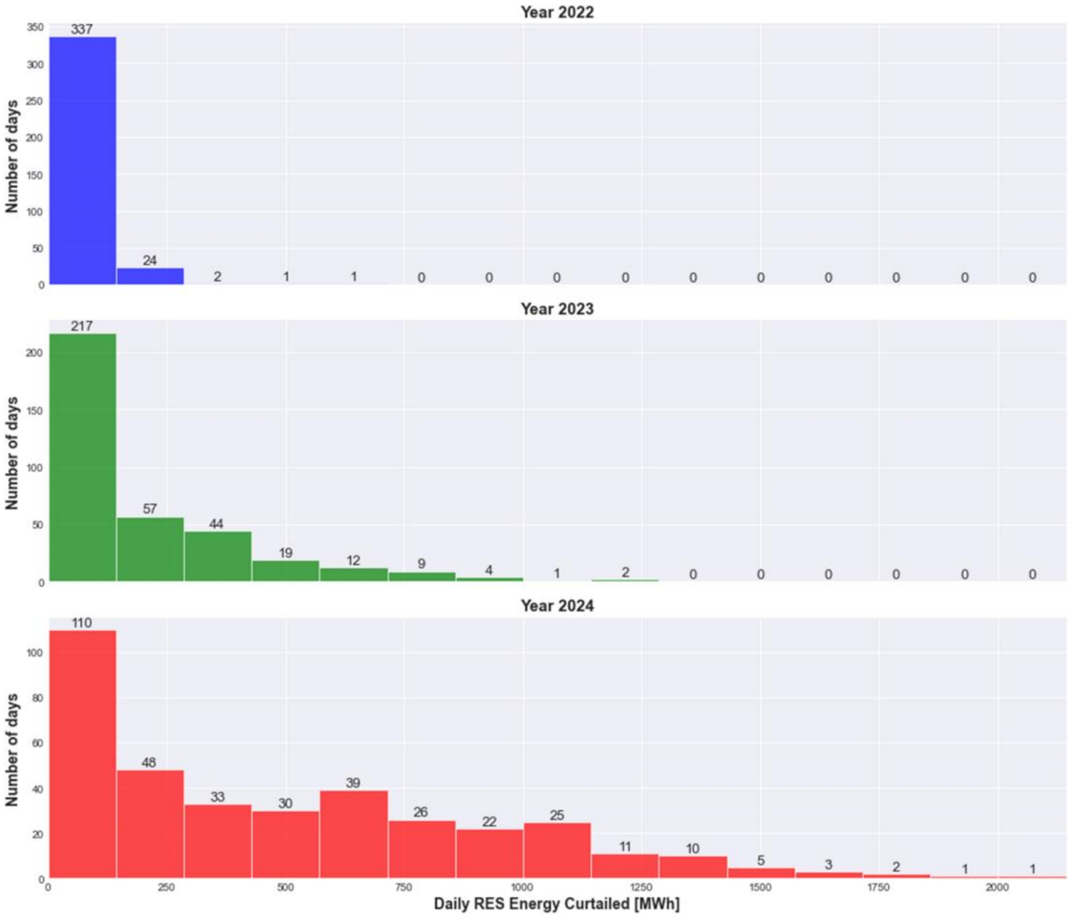
Generation profile for the lowest load demand day of 2023 (16/4/203) in Cyprus.
WPP – wind power plants; MSGL minimum stable generation level
https://doi.org/10.1016/j.seja.2025.100097

Curtailing PV

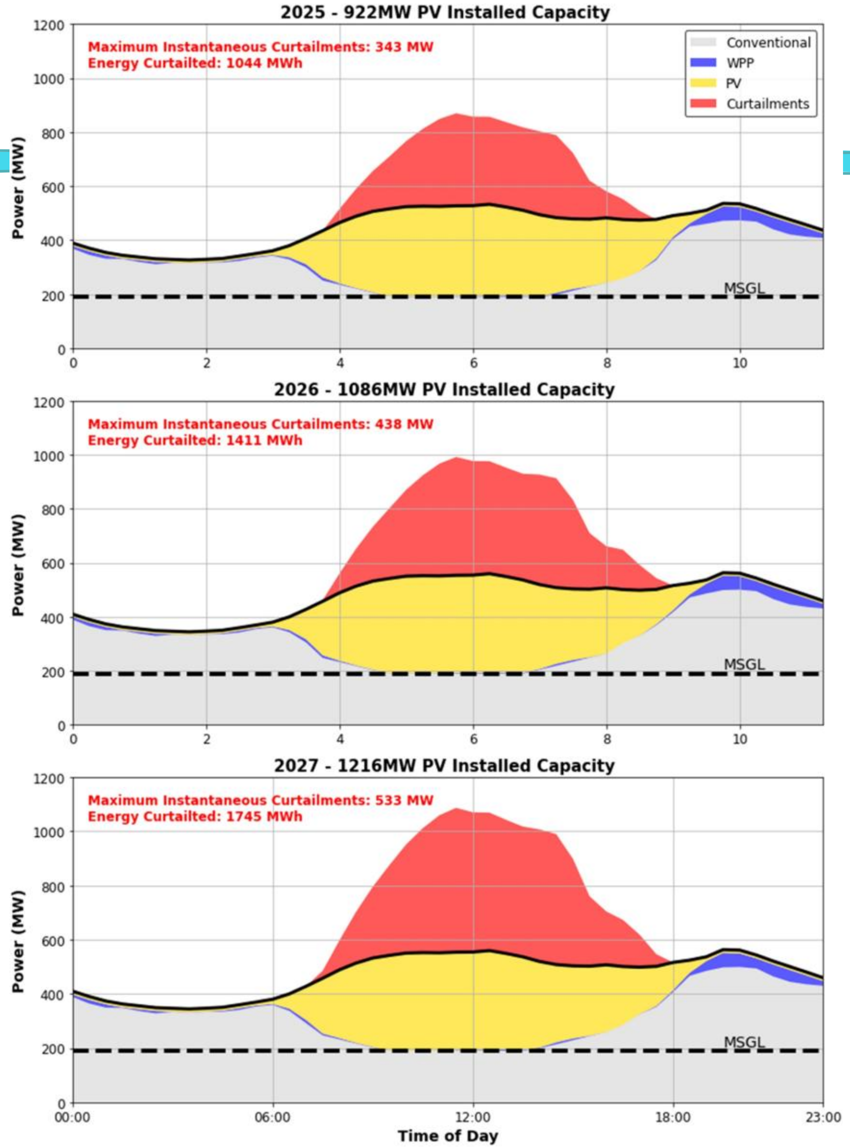


RES curtailments due to ramp rate limitations.

Curtailing PV



Histogram of the daily RES curtailment [in MWh] for 2022, 2023 and 2024.



Forecasted daily generation profiles for typical days in 2025, 2026 and 2027.

Interconnections

GREEK REPORTER

GREEK NEWS | POLITICS | DIASPORA | BUSINESS | SCIENCE | ENVIRONMENT | LIFE

GreekReporter.com › Greek News › Cyprus › Cyprus and Israel Move Toward Finalizing Electric Grid Link

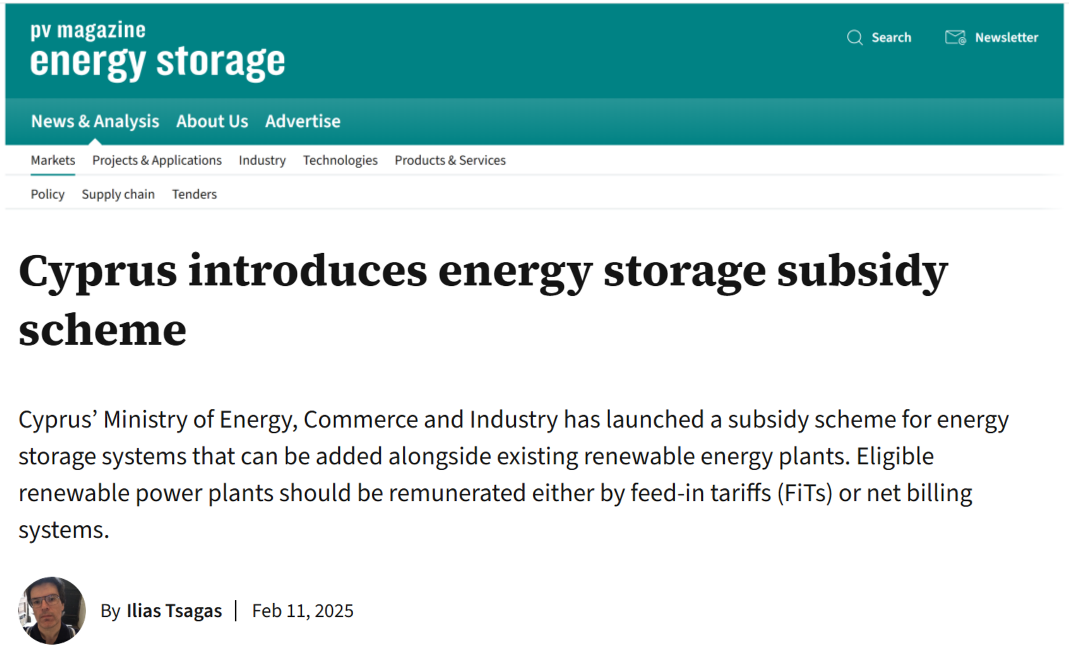
Cyprus and Israel Move Toward Finalizing Electric Grid Link

By **Tasos Kokkinidis** May 6, 2025

Cyprus and Israel have agreed to move forward with finalizing the electric power grid interconnection agreement in 2025, marking a significant step in the development of the Great Sea Interconnector (GSI), a major infrastructure project that will also link to Greece.

The trilateral initiative is poised to enhance energy security and integration across the Eastern Mediterranean. Credit: Video screenshot/YouTube/Musisi Henry

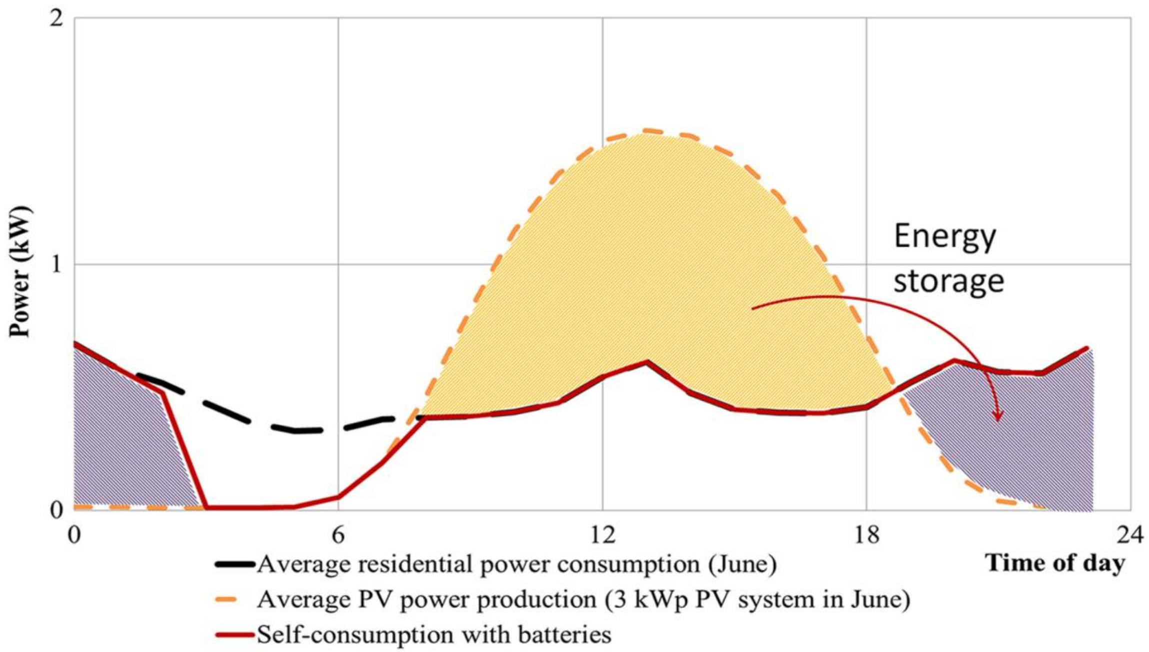
More storage


pv magazine
energy storage
Search Newsletter
News & Analysis About Us Advertise
Markets Projects & Applications Industry Technologies Products & Services
Policy Supply chain Tenders

Cyprus introduces energy storage subsidy scheme

Cyprus' Ministry of Energy, Commerce and Industry has launched a subsidy scheme for energy storage systems that can be added alongside existing renewable energy plants. Eligible renewable power plants should be remunerated either by feed-in tariffs (FiTs) or net billing systems.

By **Ilias Tsagas** | Feb 11, 2025

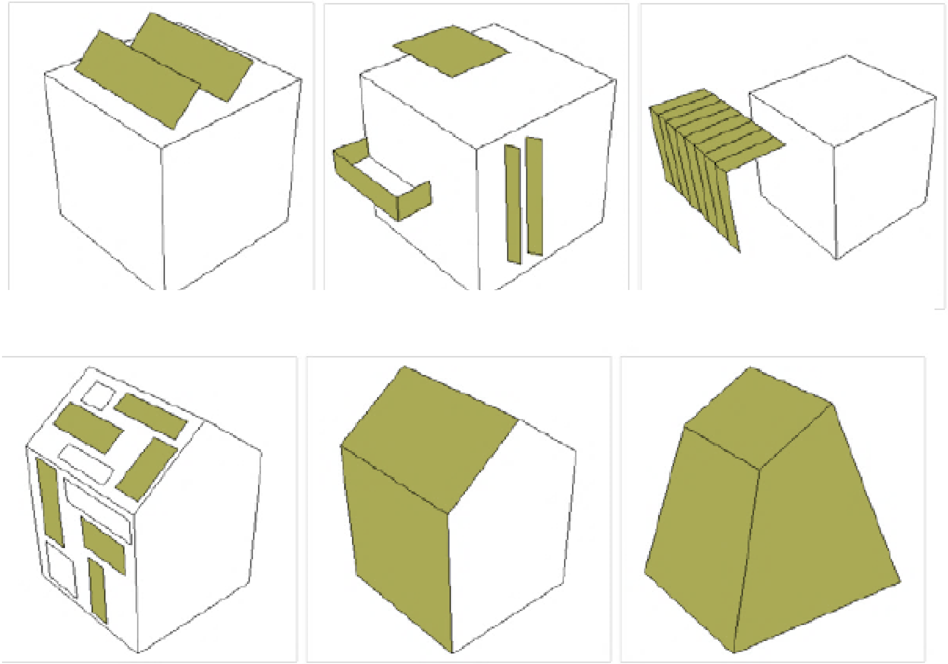


BIPV – PV integrated into buildings

- PV generation closer to demand
- No conflict with land use
- Less than “optimal” inclination/orientation may actually increase the value of PV generation
- May be coupled with local storage or demand flexibility (e.g. EV charging)
- Extra cost may be offset by other building functions

BIPV – PV integrated into buildings

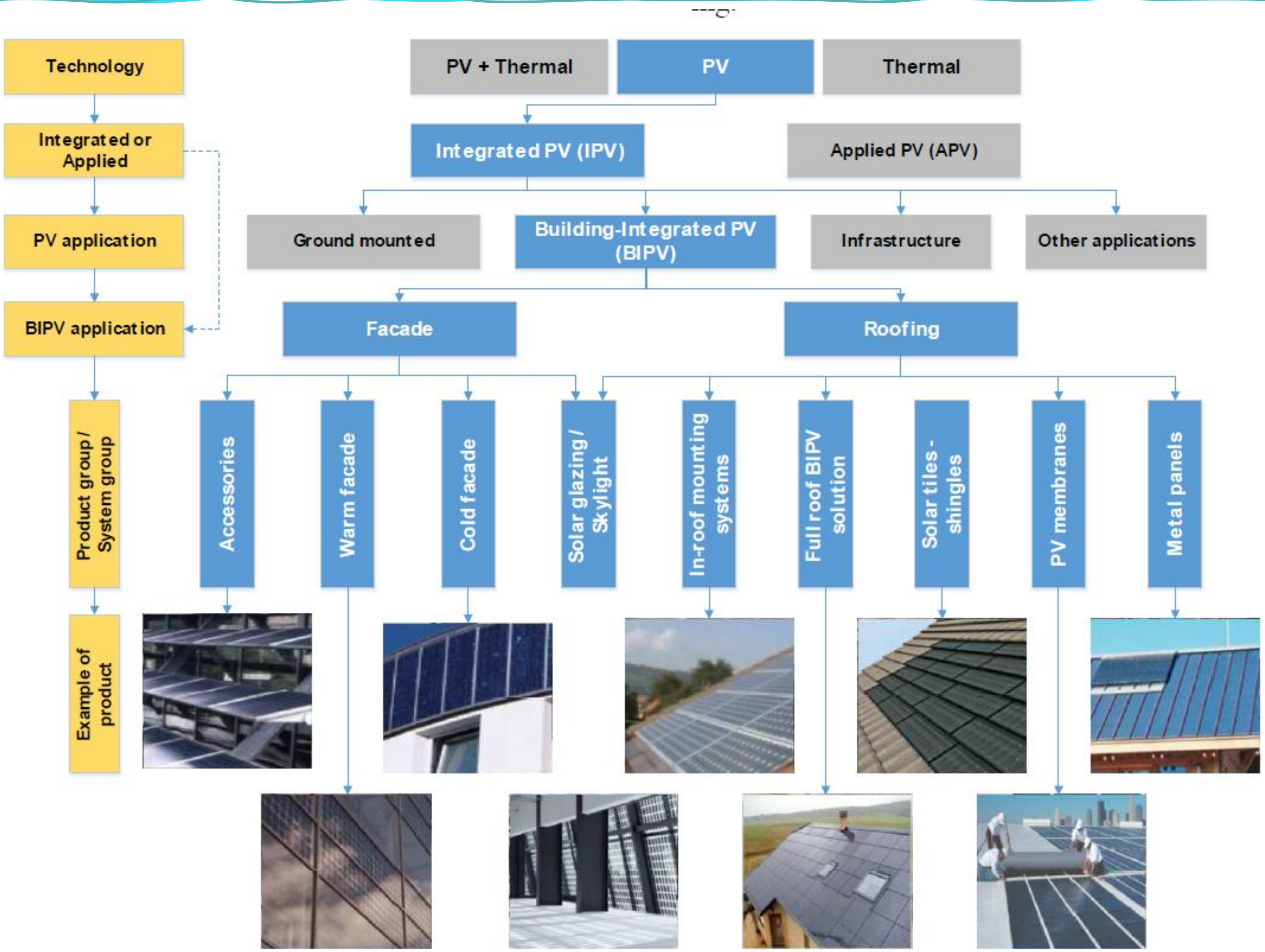
Incorporating it into the building design



- Added technical element
- Added elements with a double function
- Free-standing structure
- Part of the surface composition
- Complete façade/roof surface
- Form optimized for solar energy harvest

BIPV – PV integrated into buildings

Classification



BIPV – PV integrated into buildings

A different approach from “standard” PV systems

Performance

- As much **energy** as possible
- At the **lowest cost** of investment

Integration

- As **functional** as possible
- At the **highest added value**

BIPV – PV integrated into buildings

A different approach from “standard” PV systems

Performance

No or positive temperature dependence

High efficiency & stability

Efficiencies independent of light intensity & type

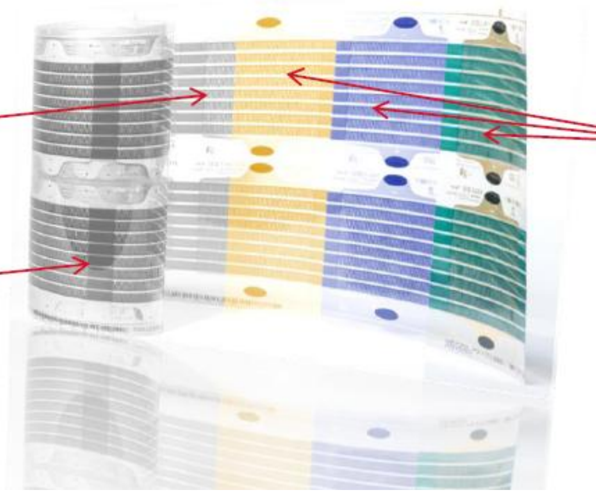
Low costs & capex light production

Efficient off-axis light collection

Semi-transparency and grey-scales

Ability for different colors

Flexible and light-weight



Thin - minimal material usage

Integration

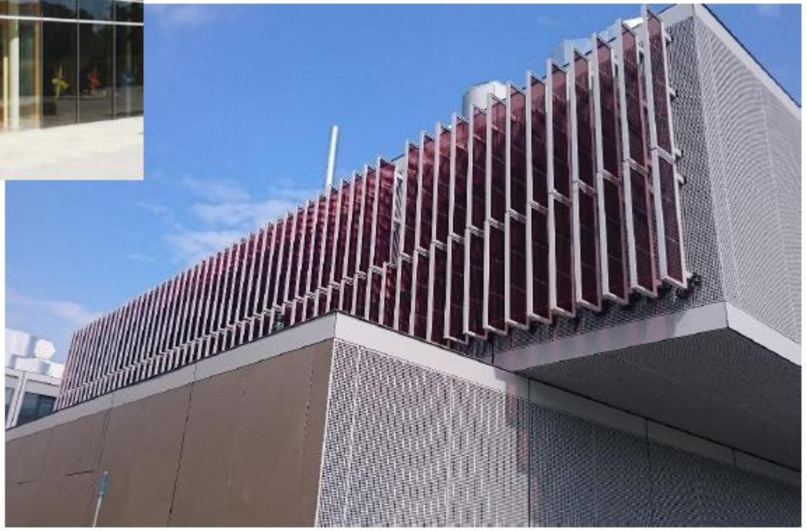
BIPV – PV integrated into buildings

A different approach from “standard” PV systems

With courtesy from Colt international GmbH

Passive system
- Sun shading
- Design

Active system
- Sun shading
- Design
- Electricity generation

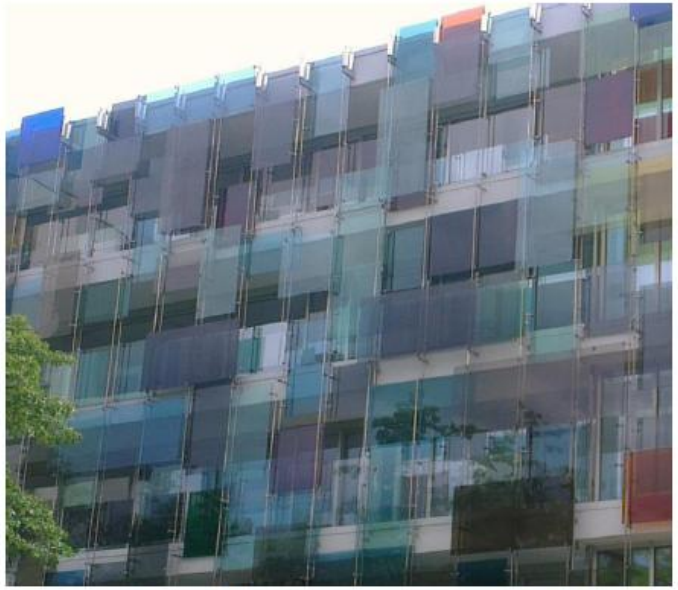


Merck – modular innovation center - Darmstadt

BIPV – PV integrated into buildings

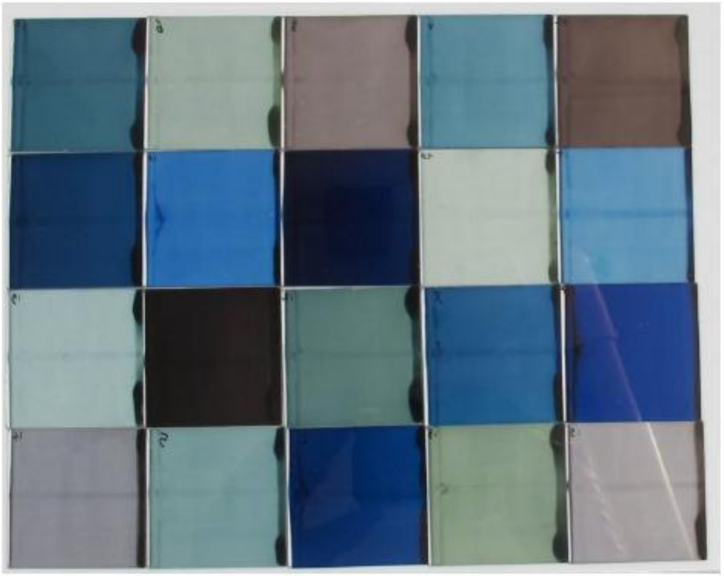
A different approach from “standard” PV systems

Colored windows in architecture (no PV function):



Diener & Diener / Norvatis Campus / Basel, Suisse

Merck’s portfolio of darker colors (example OPV):

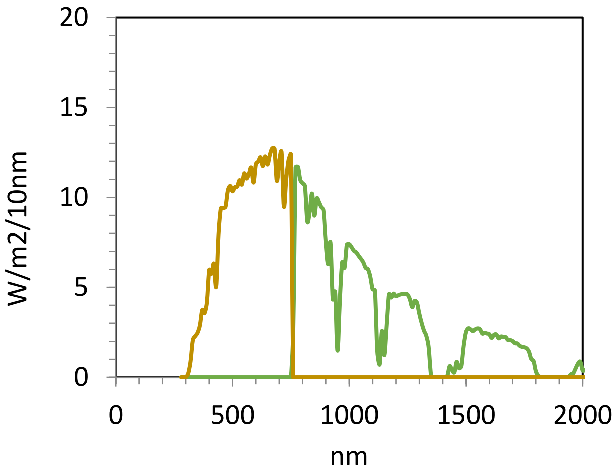


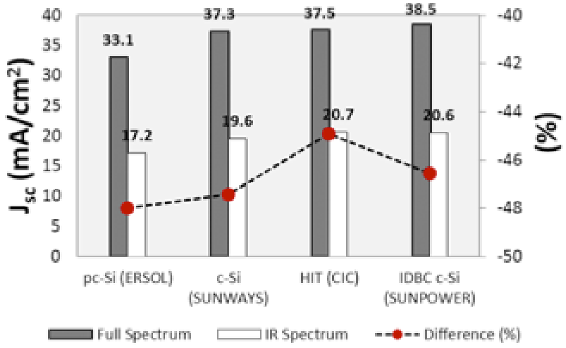
Examples of colors feasible with Merck’s OPV solutions

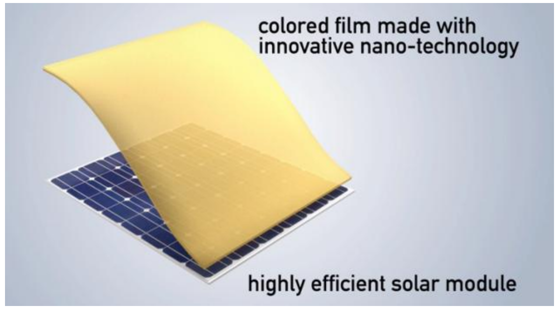
BIPV – PV integrated into buildings

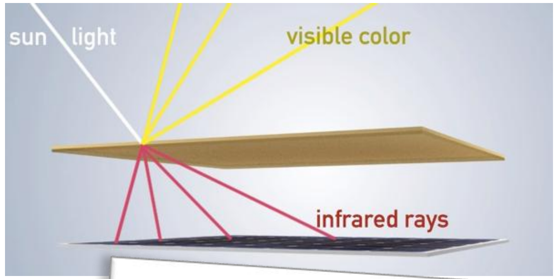
SOLAXESS
white solar technology

A different approach from “standard” PV systems









BIPV – PV integrated into buildings

(Bifacial) PV in balconies – an example of a different "optimum"

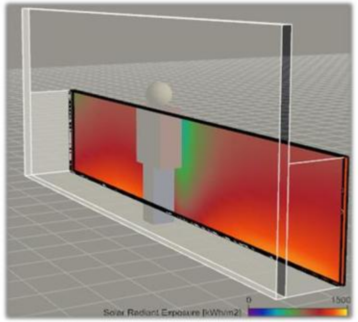
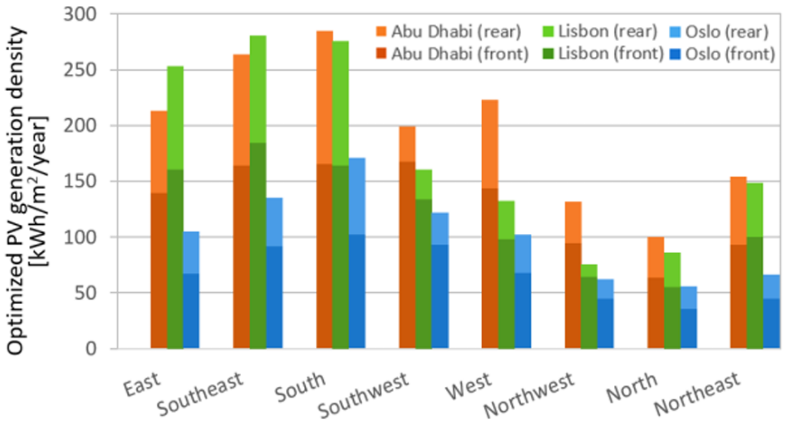


Figure 7: Detail of the simulation with partial-shadow cast by a person standing in a south facing balcony, in Lisbon.



The alternatives

This article is more than 5 months old

In Spain, balcony panels benefit more than roof panels from the low winter sun. Photograph: Tornasol Energy

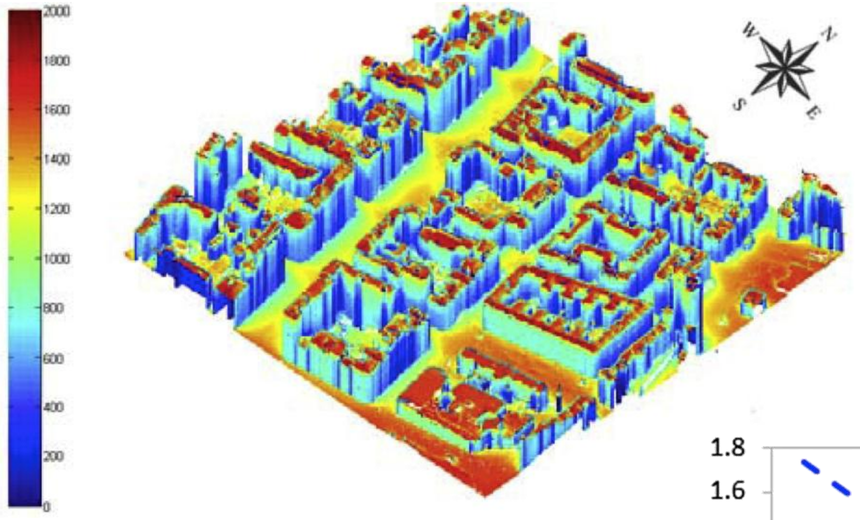
'If 1.5m Germans have them there must be something in it': how balcony solar is taking off

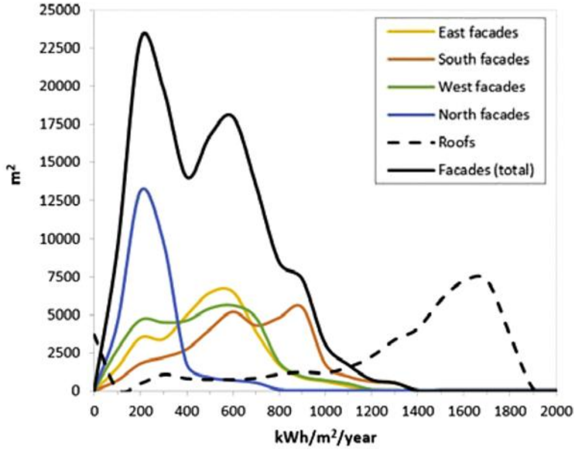
Balcony solar panels can save 30% on a typical household's electricity bill and, with vertical surface area in cities larger than roof space, the appeal is clear

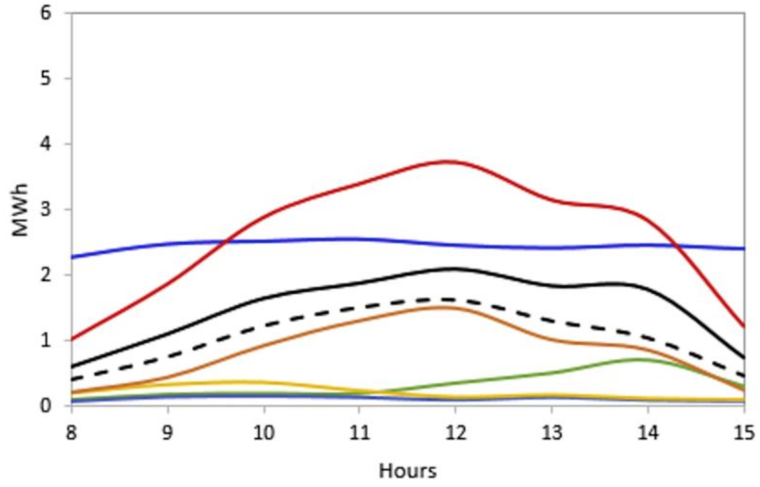
By Stephen Burgen in Barcelona

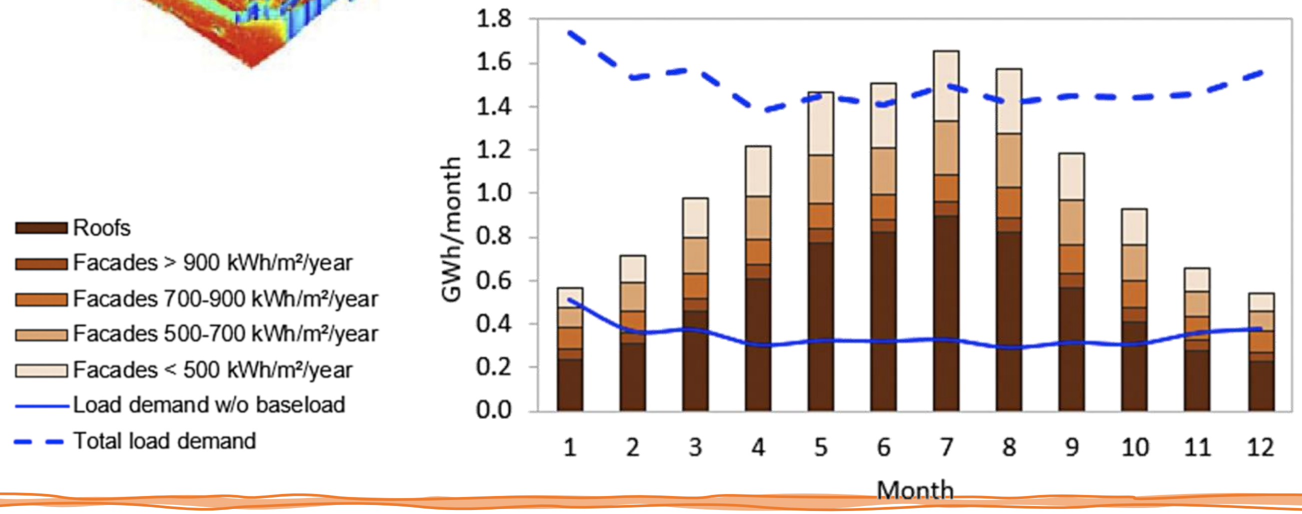
BIPV – PV integrated into buildings

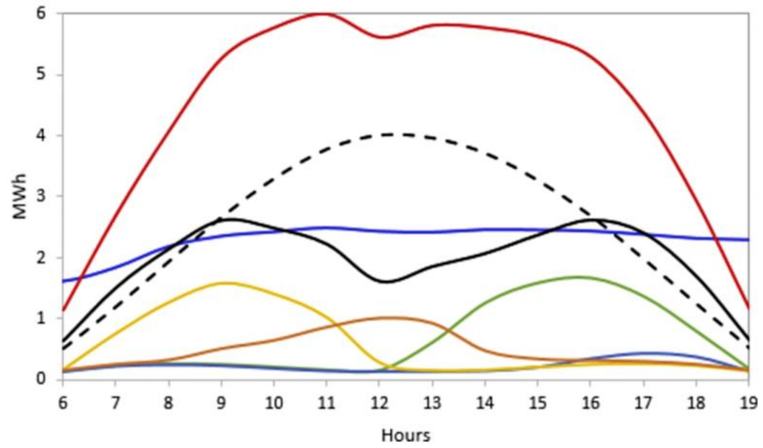
BIPV facades











https://doi.org/10.1016/j.renene.2017.03.085

BIPV – PV integrated into buildings

How much does it cost?

- Roof BIPV market more developed than facades
- Average end-user price is about 200 €/m^2, despite large range of prices
- Significantly **costier than standard PV** modules (50€ m^2)
- But it avoids the use of other building materials (at comparable costs) and therefore **PV function may be almost free**

VIPV – solar powered vehicles

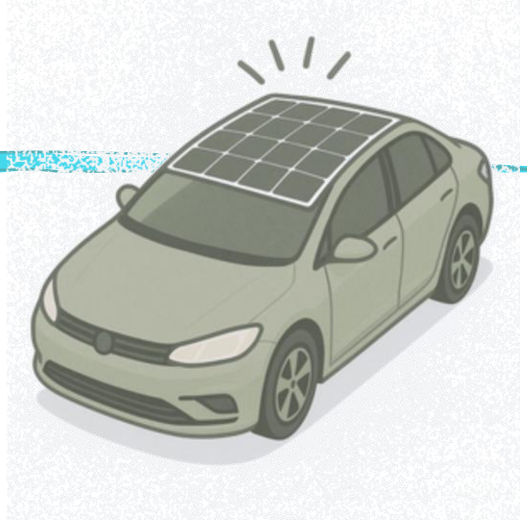
VIPV – solar powered vehicles

- Decreasing CO_2 emissions associated with the transport sector
- Reducing charging frequency/duration
- Decoupling the EV market from infrastructure deployment
- (Maybe, one day) lower operating costs for vehicle users

VIPV – solar powered vehicles

VIPV – solar powered vehicles

VIPV – solar powered vehicles



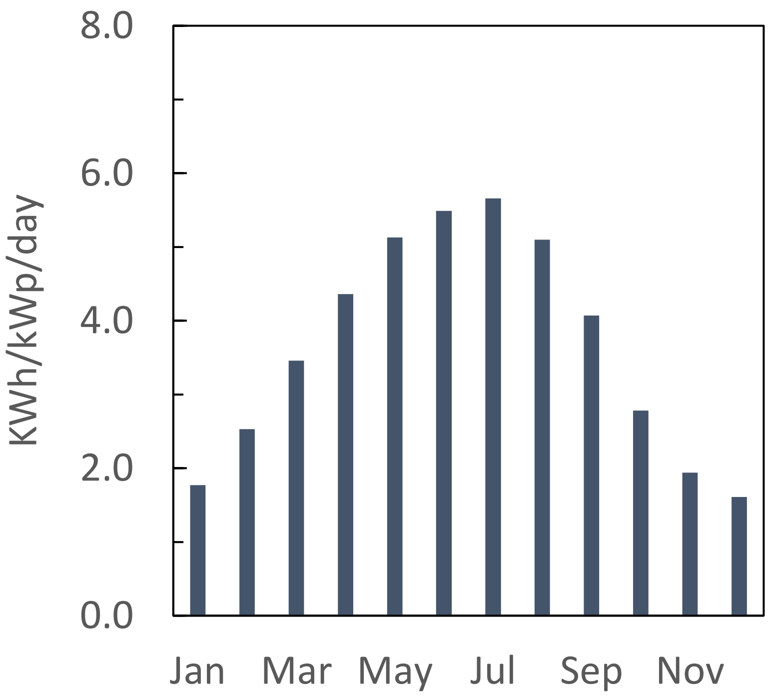
How far can we drive?

Assumptions

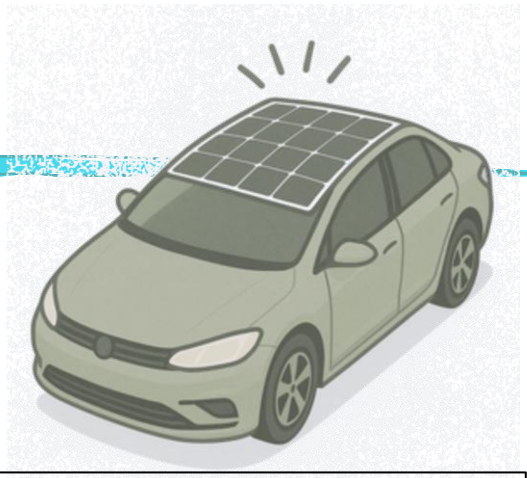
- 1 kWp installed PV
- Lisbon

Daily average irradiation

- 3.66 kWh/kWp/day



VIPV – solar powered vehicles



How far can we drive?

Assumptions

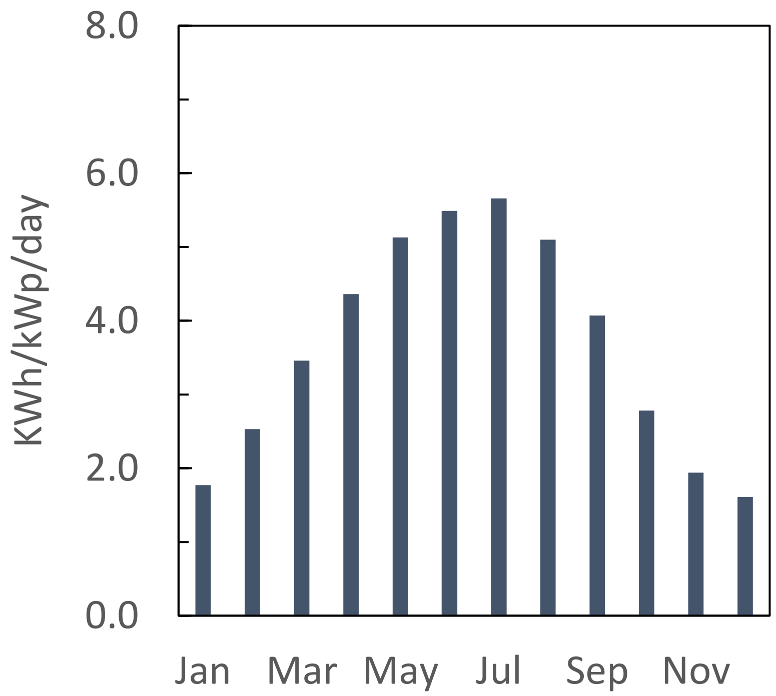
- 12.5 km/kWh

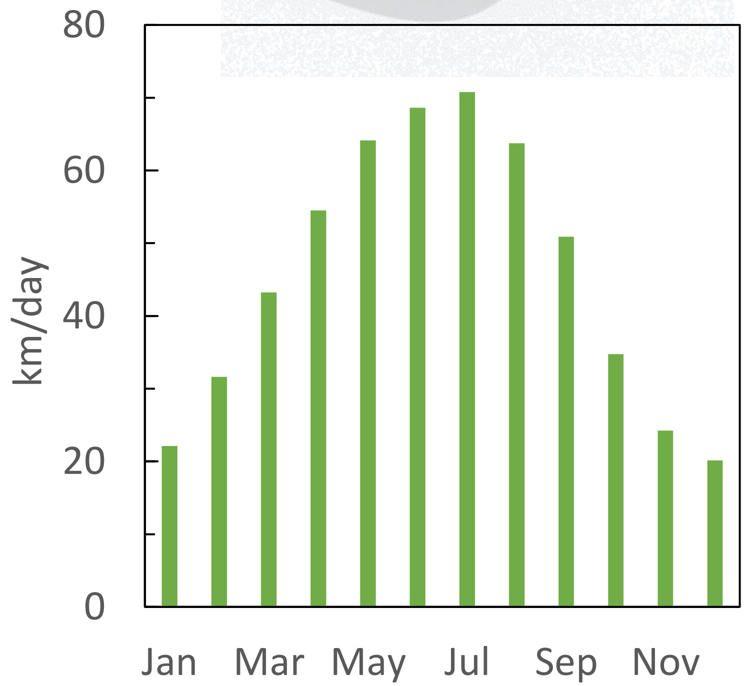
Daily extended driving range

- 45.7 km/kWp/day

For 30 km/day vehicle kilometer travelled (VKT)

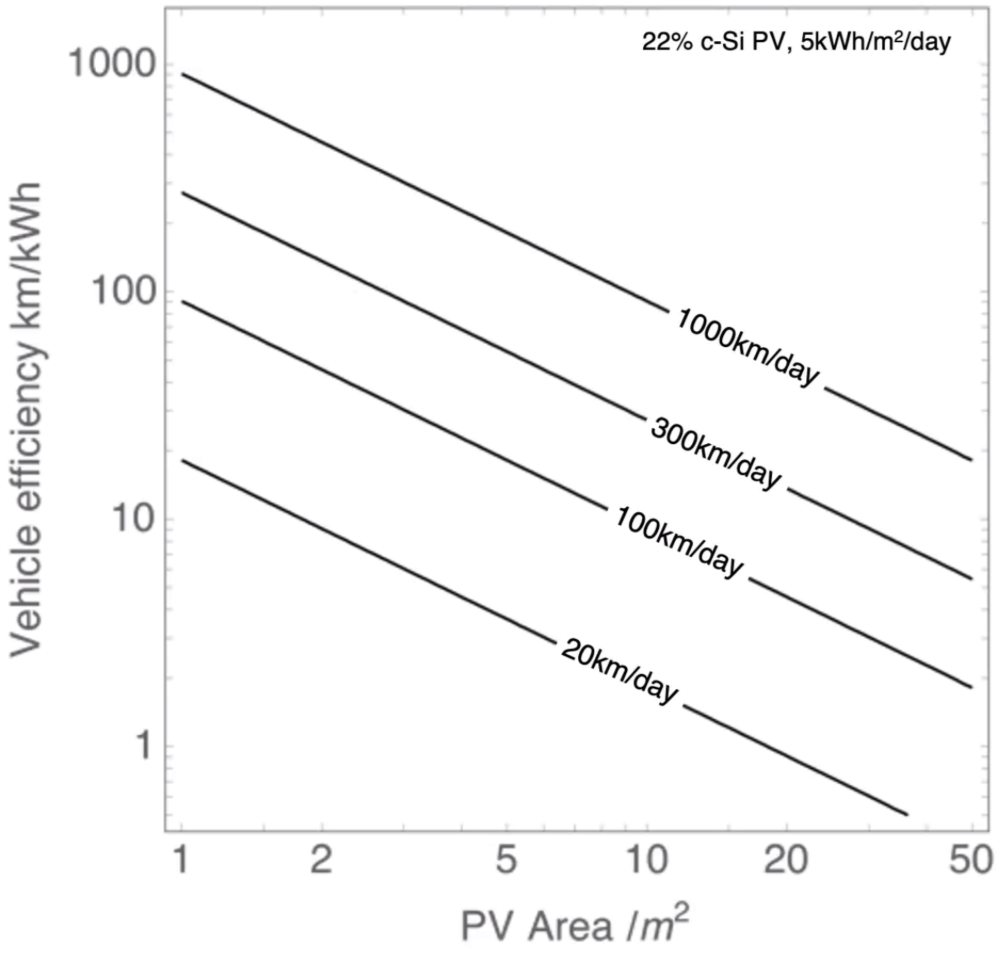
- Autonomy 9 months/year
- Solar provides 93% annual charge





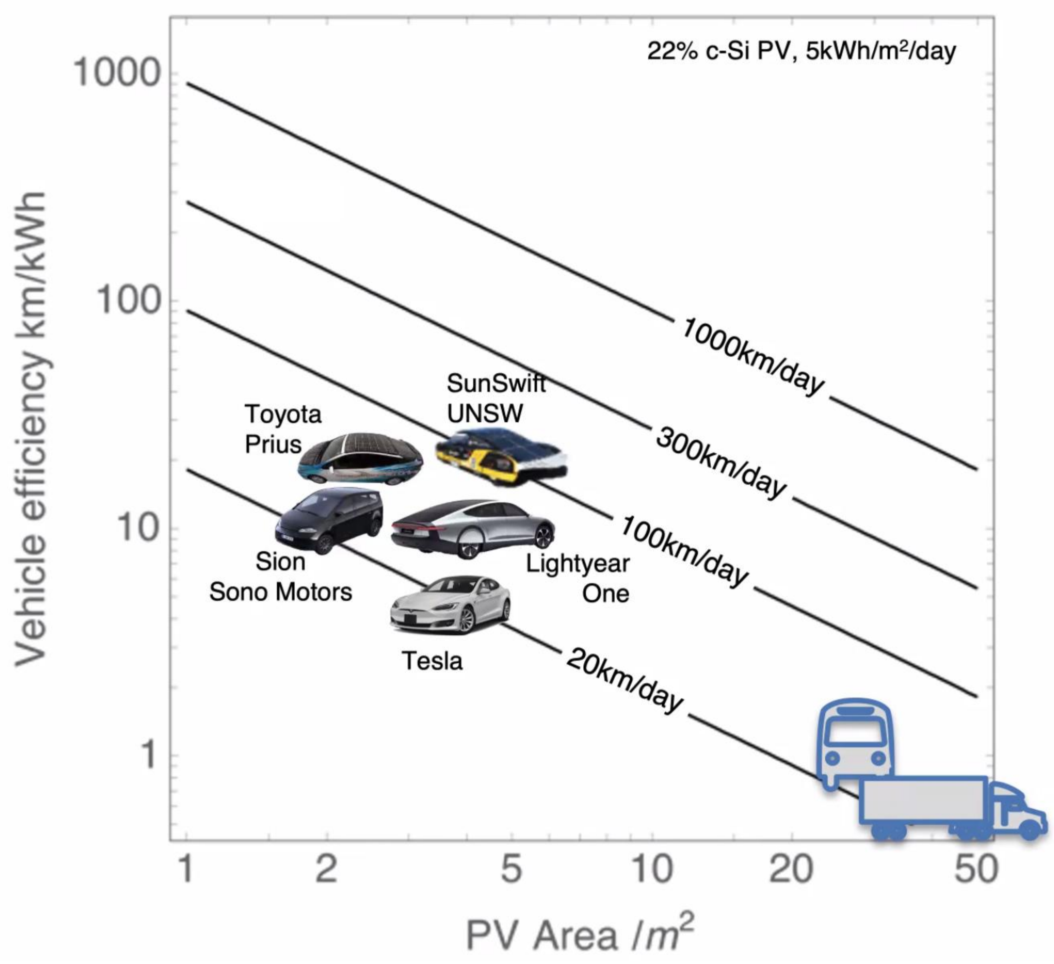
VIPV – solar powered vehicles

How far can we drive?



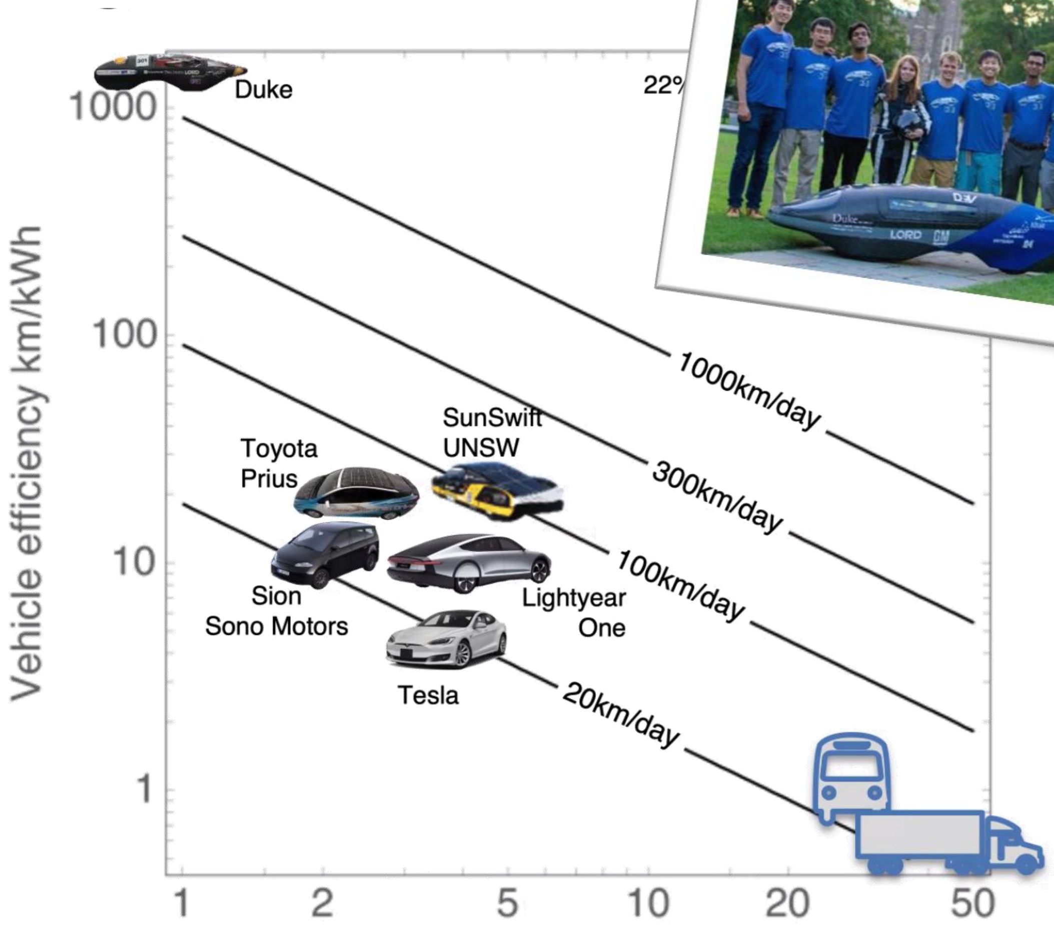
VIPV – solar powered vehicles

How far can we drive?



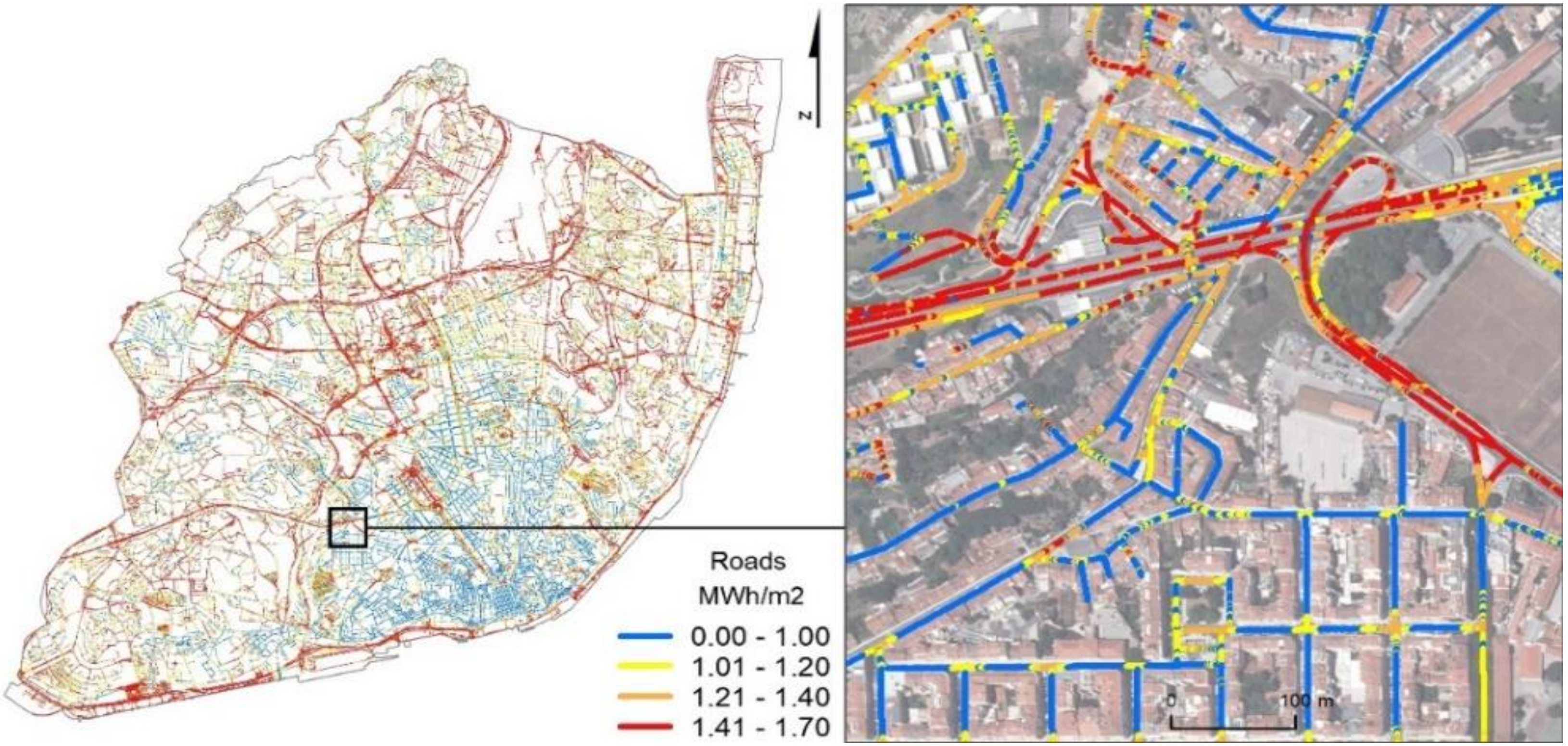
VIPV – solar powered vehicles

How far can we drive?



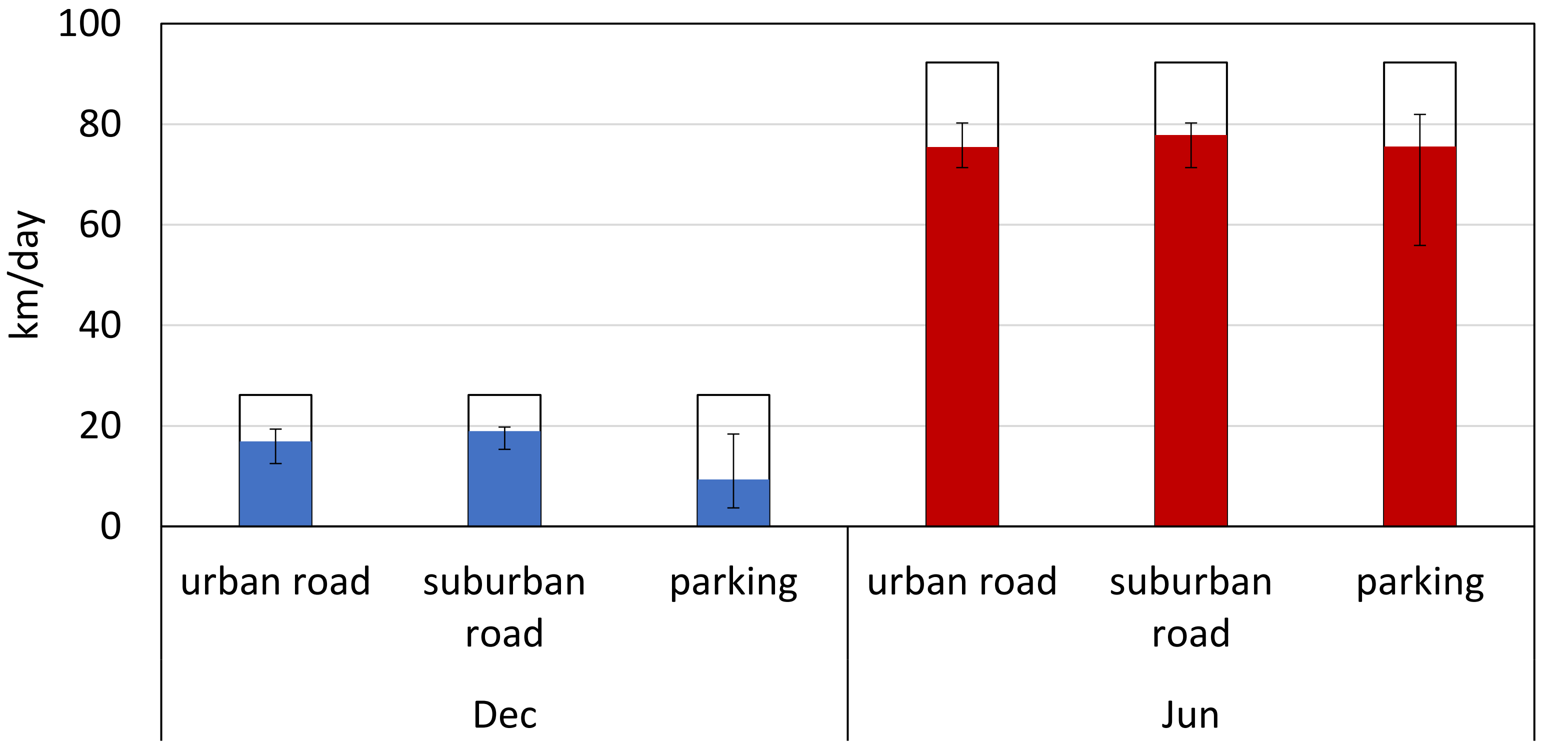
VIPV – solar powered vehicles

Effect of urban shading



VIPV – solar powered vehicles

Effect of urban shading

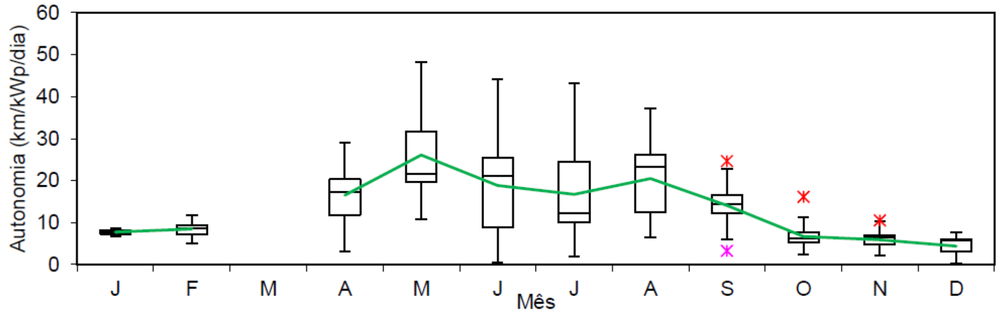


VIPV – solar powered vehicles

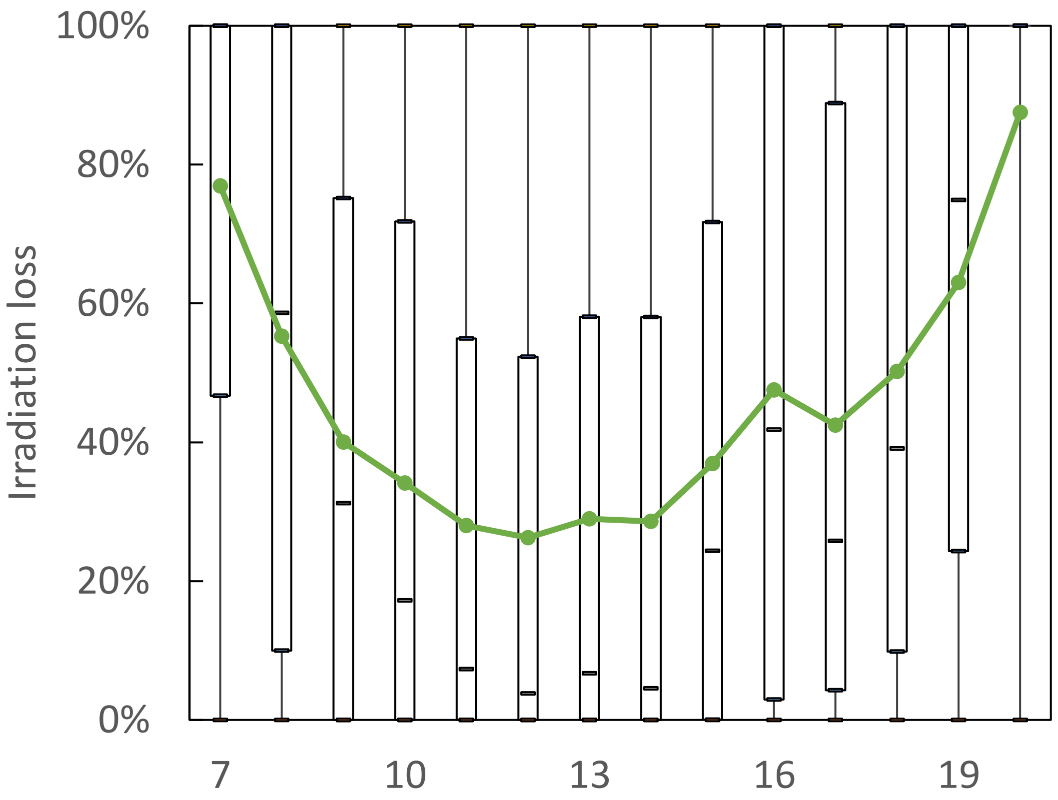
Effect of urban shading

VIPV – solar powered vehicles

Effect of urban shading



Average solar driving range
14 km/kWp/day which corresponds to about **1/3 of daily travelled distance**



VIPV – solar powered vehicles

Benefits

- Increased autonomy and battery life
- Unburdening the grid
- Reduced mobility costs

Challenges

- Curved surfaces
- Aesthetics (colour is important!)
- Robustness
- High efficiency due to small area
- Inhomogeneous irradiation requires MPPT at the cell level

AgriPV – combining PV and farming

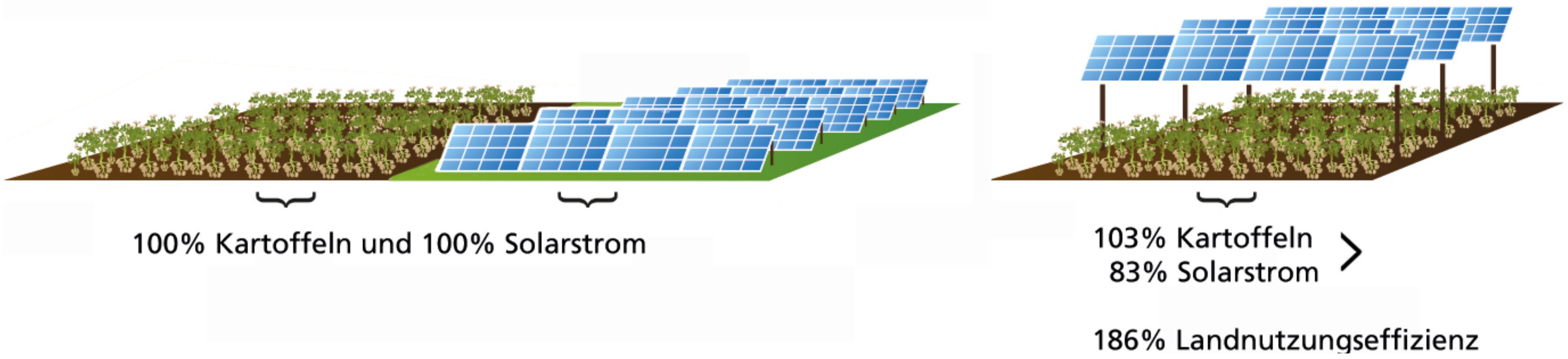
AgriPV – combining PV and farming

- No conflict with other land uses
- Synergetic performance, may increase PV and farming yields
- Lower environmental impacts
- Decrease irrigation needs
- PV generation may be used for water pumping, local produce refrigeration or fed into the grid

AgriPV – combining PV and farming

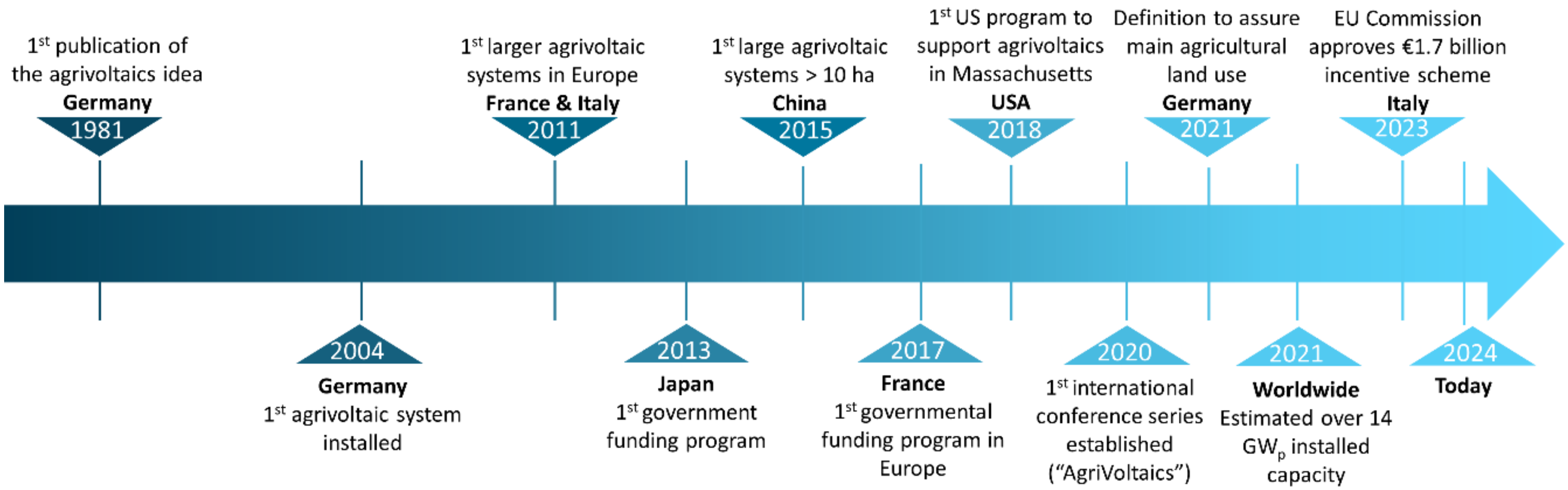
Combining farming and solar generation

- Dual use of land
- Controlled environment for higher crop yield
- Reduced temperature for PV higher yield
- Decreased water usage



AgriPV – combining PV and farming

An emerging application



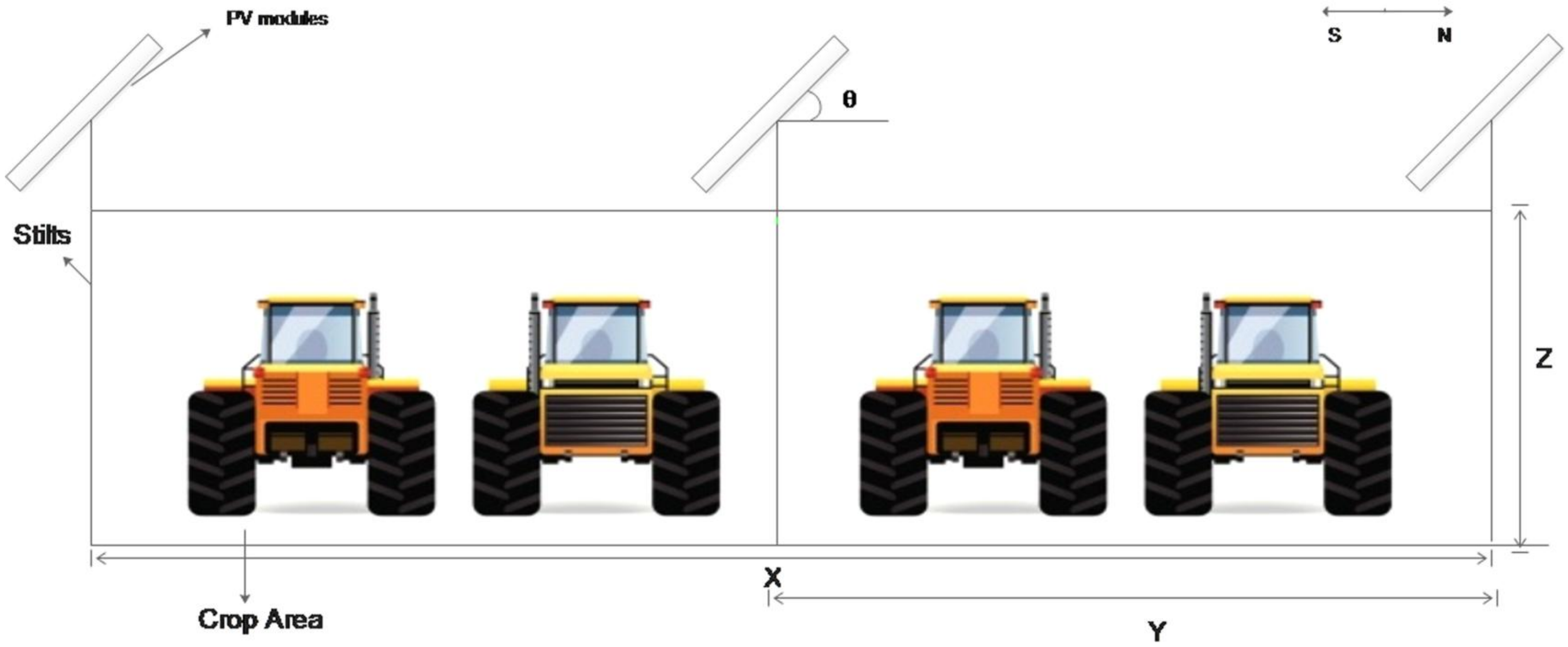
AgriPV – combining PV and farming

Different configurations

- Ground mounted PV modules with the area between the panels being used for farming.
- The spacing between the PV modules has been kept wide enough to allow standard sized farming equipment to pass between the rows.

AgriPV – combining PV and farming

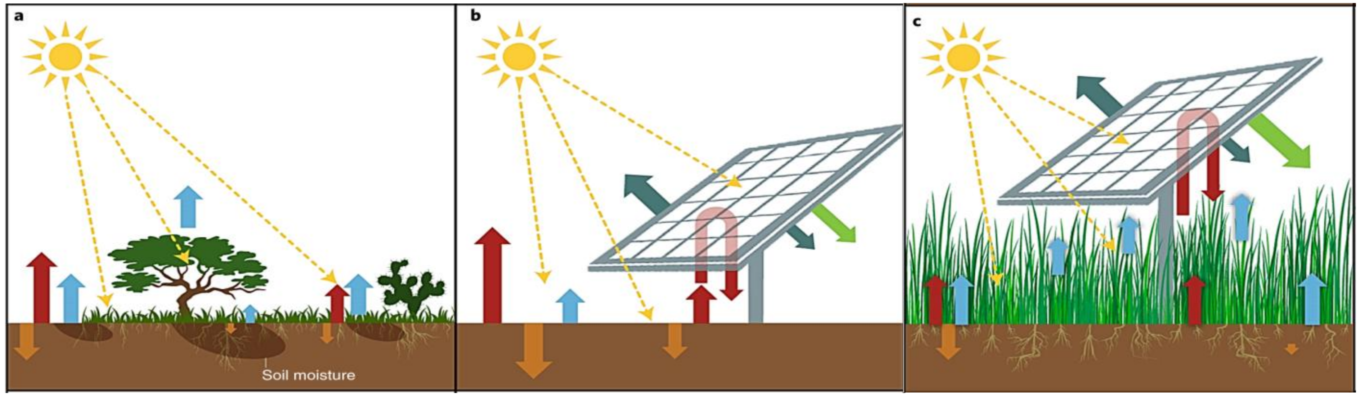
Different configurations



- PV modules mounted on stilts.
- More expensive (racking) but better land use.

AgriPV – combining PV and farming

Impact on soil and crop yield

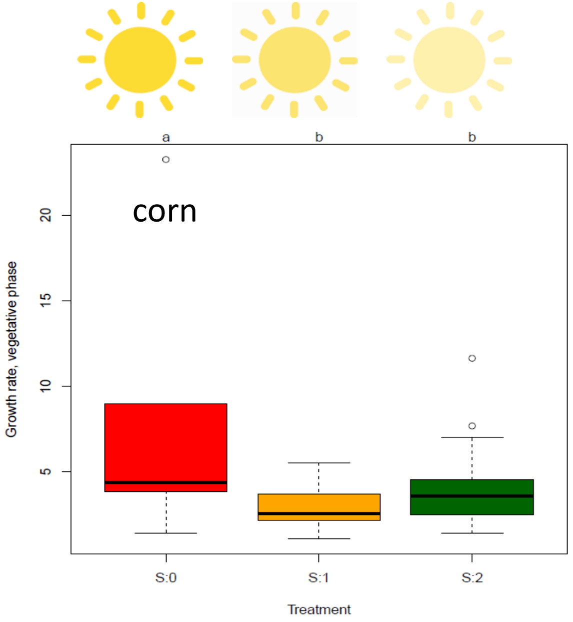


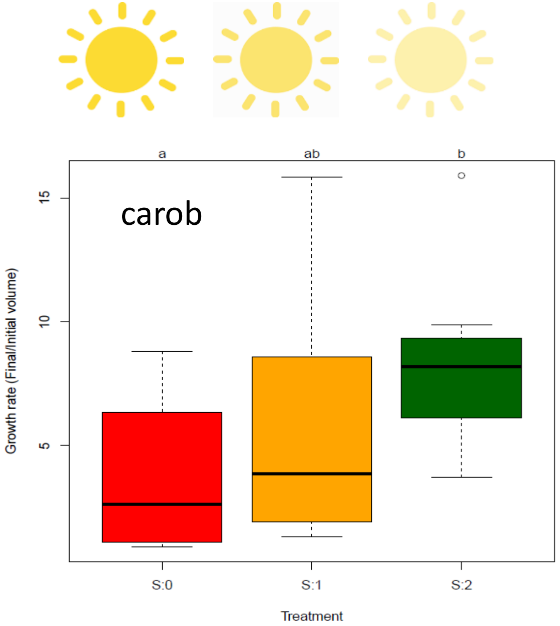
No vegetation reduces latent heat fluxes yielding higher temperature and sensible heat fluxes.

- Reduced evaporation due to shading (lower irrigation needs ~20%)
- Protection against intense solar radiation
- Reduced wind erosion
- Rainwater collection for irrigation

AgriPV – combining PV and farming

Impact on soil and crop yield





Some crops fare better than others under the PV shade

AgriPV – combining PV and farming

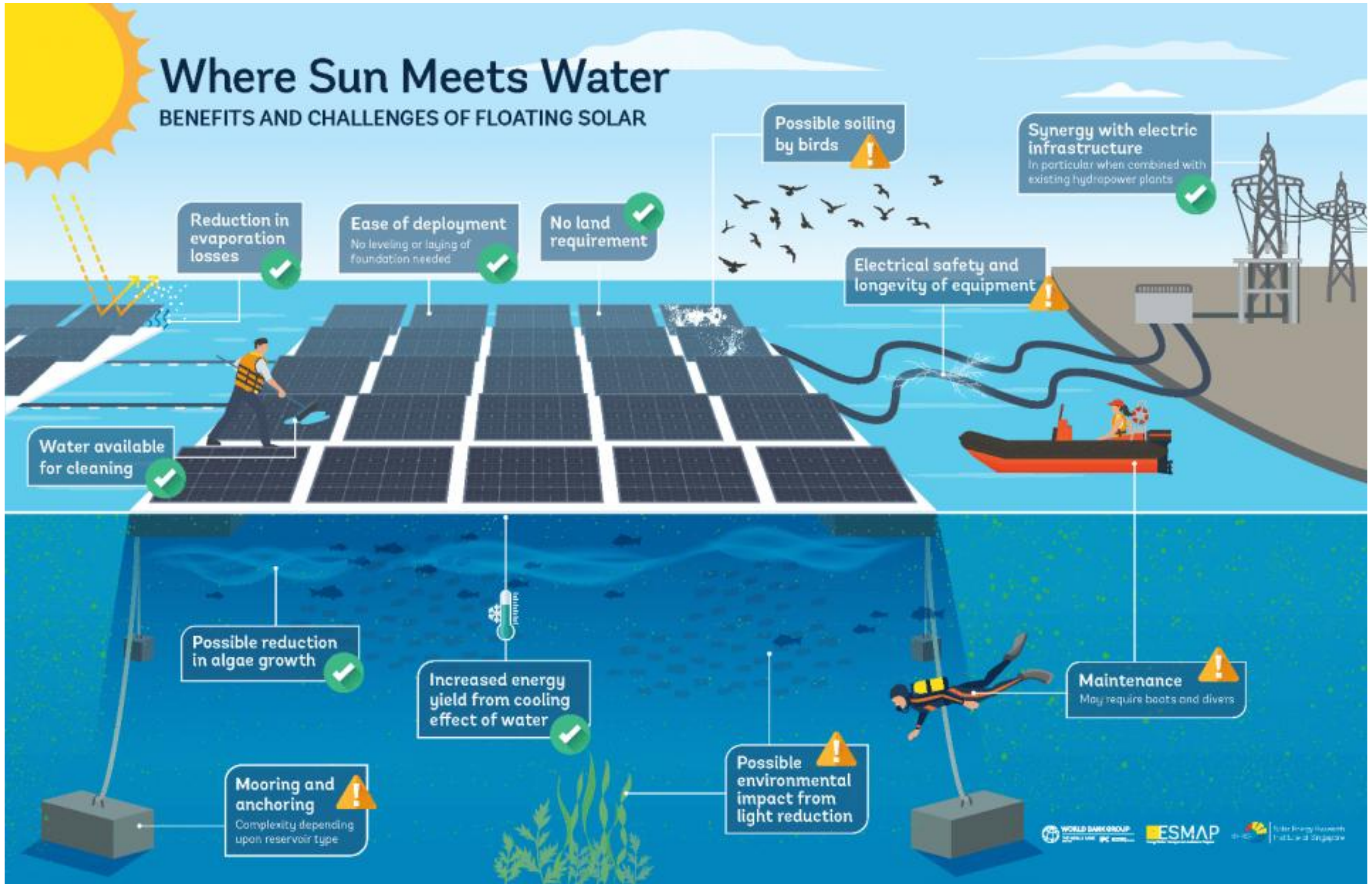
Further examples

Floating PV – PV in waterways

Floating PV – PV in waterways

- **Avoids** competition with **land use**
- Combined with hydropower for better use of **grid connection**
- Higher performance due to lower operating **temperature** and not **shading**
- Attention to **soiling** and higher **costs**

Floating PV – PV in waterways



Final remarks

Today, **PV is cost competitive** almost everywhere.

Unconventional/new PV applications are being explored, raising **opportunities** and **challenges** with high potential.

Less than "optimal" inclination/orientation may lead to **lower yields** but **higher value** solar power.

ATARRI

Funded by the European Union

THANK YOU

This project has received funding from the European Union's Horizon Europe Framework Programme under the grant agreement No 101160258. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union.

ERATOSTHENES CENTRE OF EXCELLENCE | BSC Barcelona Supercomputing Center, Centro Nacional de Supercomputación | GRASP | ARMINES | MINES PARIS | PSL | Ciências ULisboa | FCiências ID | pmod wrc