



Urban PV modelling demo



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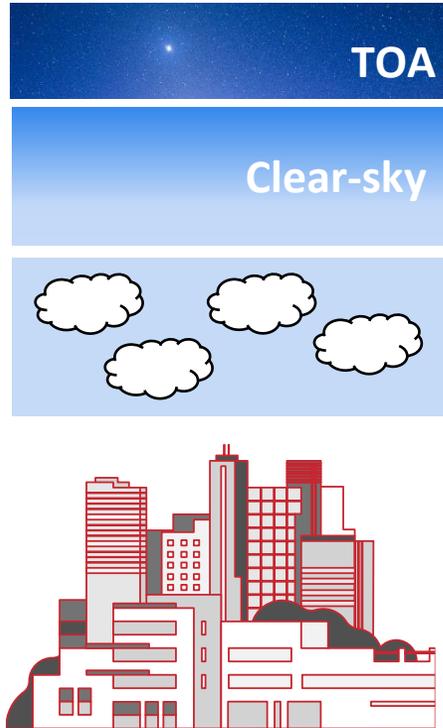
A brief recap



Programme

-  Intro
-  1st brainstorming moment
-  Live demo
-  2nd brainstorming moment

Urban PV and ECoE's strategy



SDs 1-3

SD 4



Bolster ECoE's own activities



Increase potential for collaborations

Urban PV and ECoE's strategy

Dust/aerosols: the key link between ECoE atmospheric activities & urban PV applications



Atmospheric attenuation



PV performance

Moving beyond broader scope data bases

- Local calibration thanks to ECoE's own data and modelling skills

Urban PV @ Cyprus

Currently, the sole CY cadaster available only accounts for terrain orography

PHOTOVOLTAIC POWER POTENTIAL CYPRUS





For today...

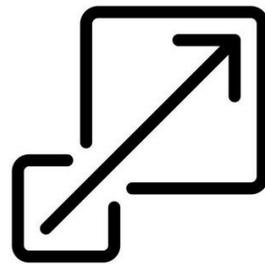
Our solution: the SAaF-aaS

Solar Assessment and Forecasting as a Service

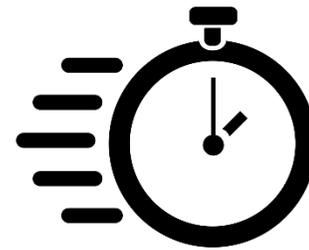
- Our own patented algorithm



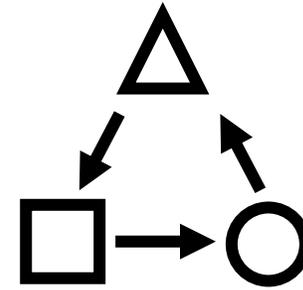
Cloud-based



Scalable



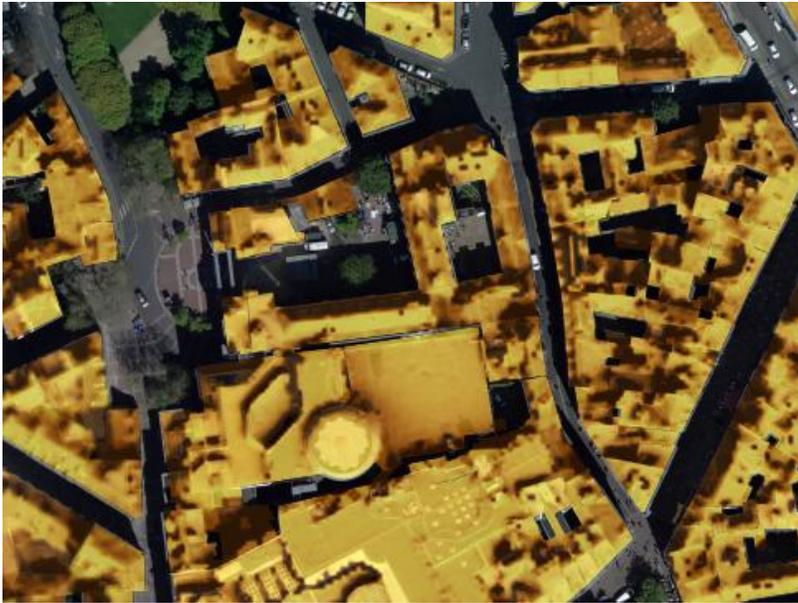
ON-demand
the-fly



Interoperable

- Access to ECoE within ATARRI for teaching and exploratory activities

Many applications



Classic solar cadaster



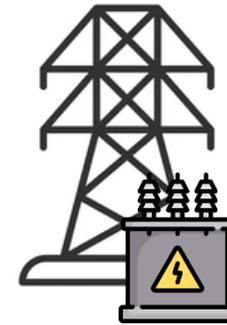
Urbanism



Self-consumption



Solar forecasting



Grid integration

Choisissez votre surface de pose
 0 m² 440 m² 2518 m²

Résultat économique sur 20 ans

REVENUS	INVESTISSEMENT	GAINS
145 000 €	124 500 €	20 500 €

Résultat énergétique sur 20 ans

PRODUCTION	PUISSANCE	CO ₂ ECONOMISÉ
1 380 750 kWh	66 kWc	122.9 tonnes

Soit l'équivalent de 184 ANNAÏS PLAYERS

SOLAÏS SolarPolis™, un cadastre solaire pour tous



Qeeri @ Doha

Main parameters

Orientation: South (23°) | Horizontal | East-West (10°) | Roof tilted

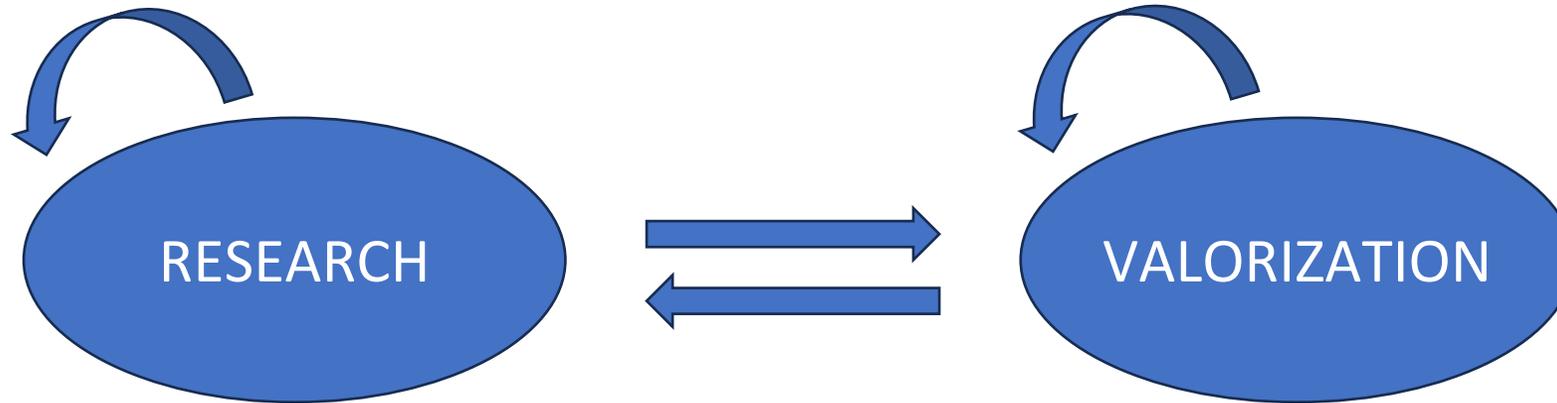
Area: 1,987 / 2,121 m² (94%)
 Min yearly irradiation: 1906 kWh/m²

Results

Installation	Production
Modules: 660 Installed power: 207 kWp Mean irradiation / year: 2,242 kWh/m ²	401,061 kWh per year
Finance	CO ₂ footprint
Costs: 0R 2,070,800 Revenues / year: 0R 48,127 ROI: 43 years	Installation footprint: 207 tons CO ₂ -eq Net offsets / year: 190 tons CO ₂ -eq ROI: 1.1 years

Identified dynamics

Research and valorization activities



Each side fosters itself + **synergies**



First reflection moment

Before actually getting to know SAaF-aaS...

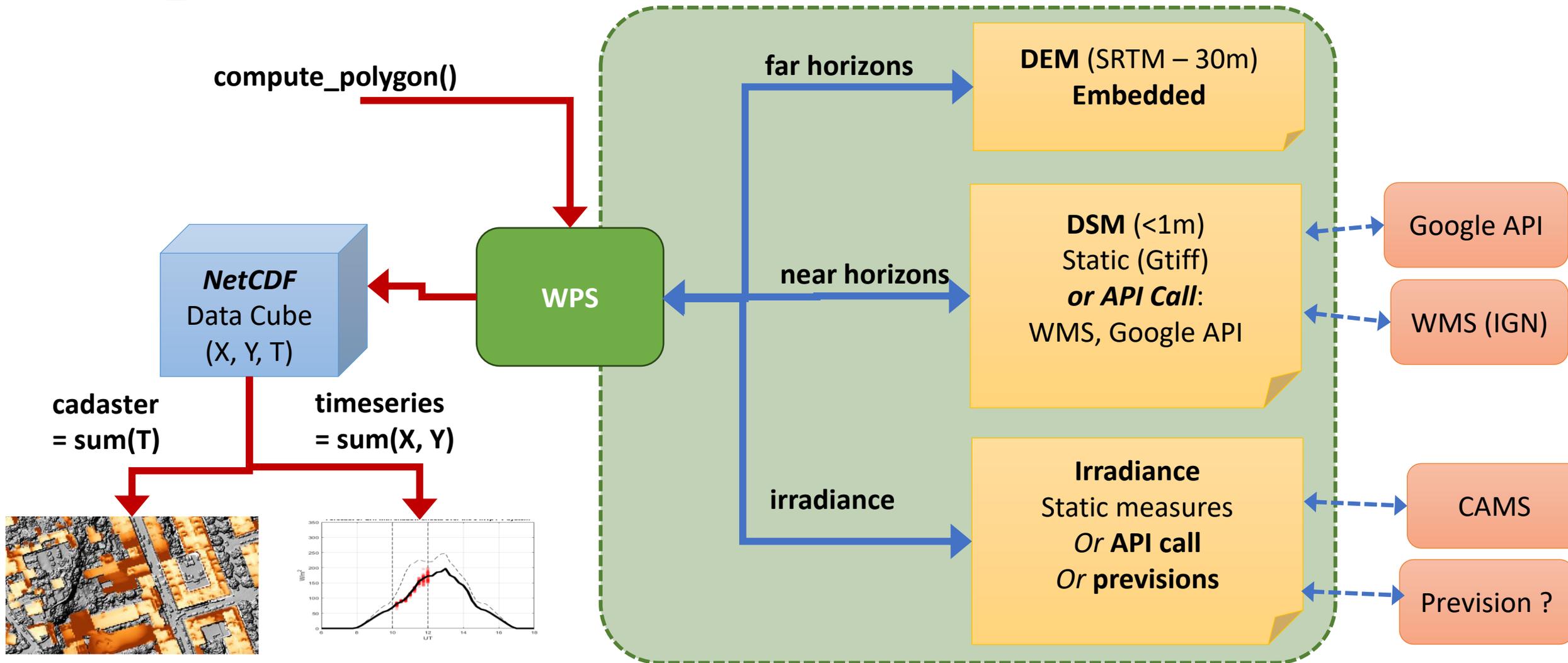
Important to reflect on:

- what is ECoE view into all this on a medium-term horizon?
- what are the infrastructure and HR needs? **resources**
- what are the key stakeholders in Cyprus?



LIVE DEMO

SAF-aaS - Technical Design



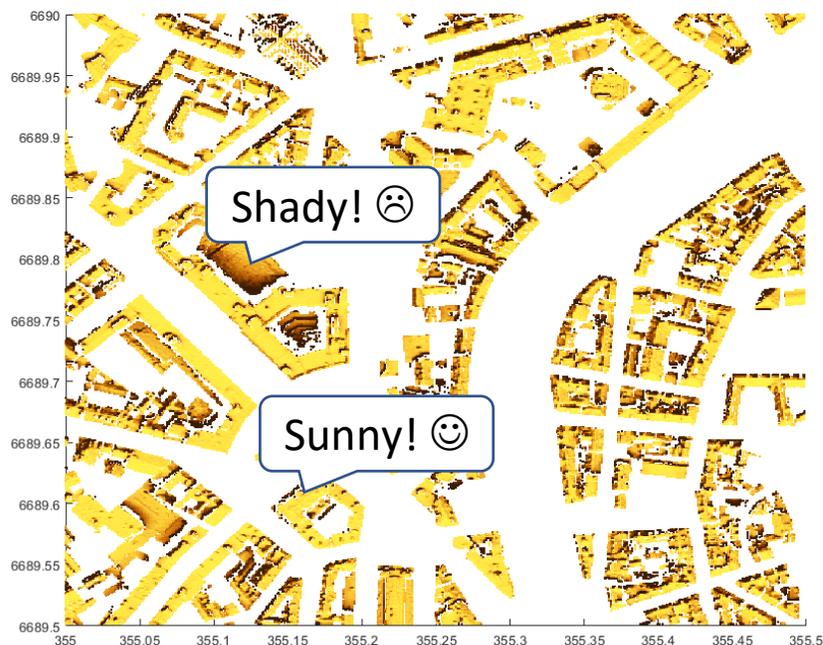
Cyprus data - Mini Cadaster

- **DSM** : [No coverage of Google API](#) 😞
 - ➔ Used sample data of your static DSM (0.5m resolution)
 - **Building footprints** : Bad coverage & accuracy of OSM buildings
 - ➔ Used [open source Google + Microsoft](#) footprint
- ➔ Importance to have DSM and Footprint aligned :
Spatially & temporally



#1: Static solar cadasters

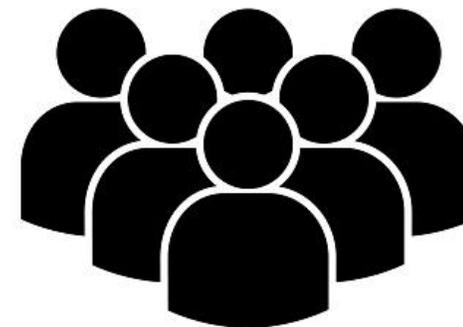
A classic output, great for feed-in tariff



Part of a neighborhood in Nantes, France.
Resolution: 1 meter, long-term annual mean.



Policymakers



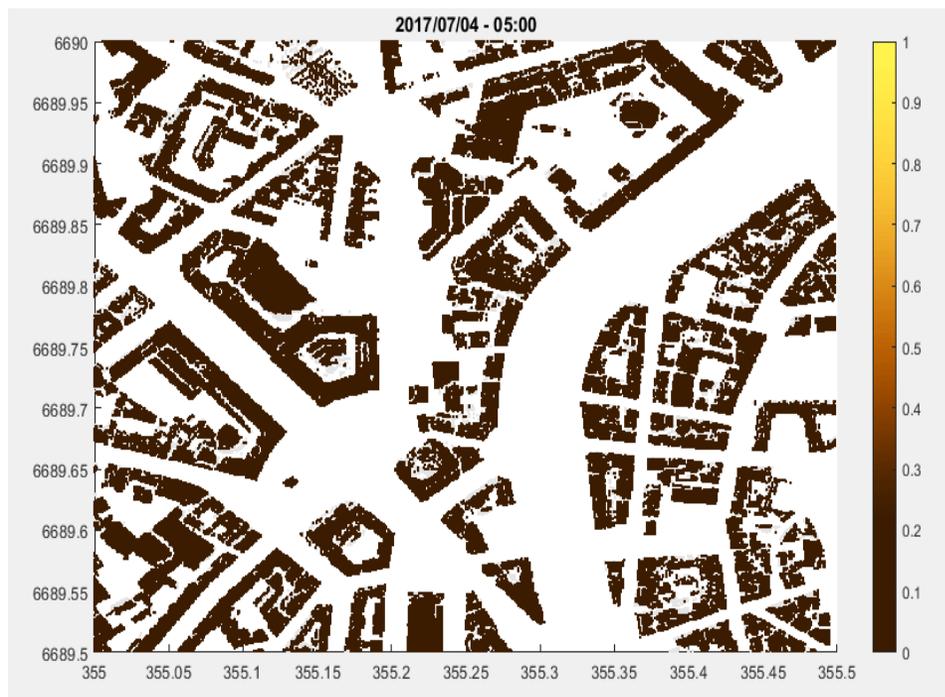
Civil society



PV industry

#2: Urban self-consumption sizing

Self-consumption: the need to temporally matching PV-demand



Requires similar product but with much higher temporal resolution (15-60 min)

⚠ : Beware of Timezones

#3: Urban planning (the right to light)

In 2019, a 18-floor building project in Lisbon was rejected by locals

- Would block natural light for buildings behind, but also “kill” PV



Assessed only with few snapshot/visual simulations (qualitative!)

Quantitative studies would be more comprehensive and support compensations when such projects are implemented



Second reflection moment

Now that we have a first impression of SAaF-aaS...

Same questions:

- what is ECoE view into all this on a medium-term horizon?
- what are the infrastructure and HR needs?
- what are the key stakeholders in Cyprus?

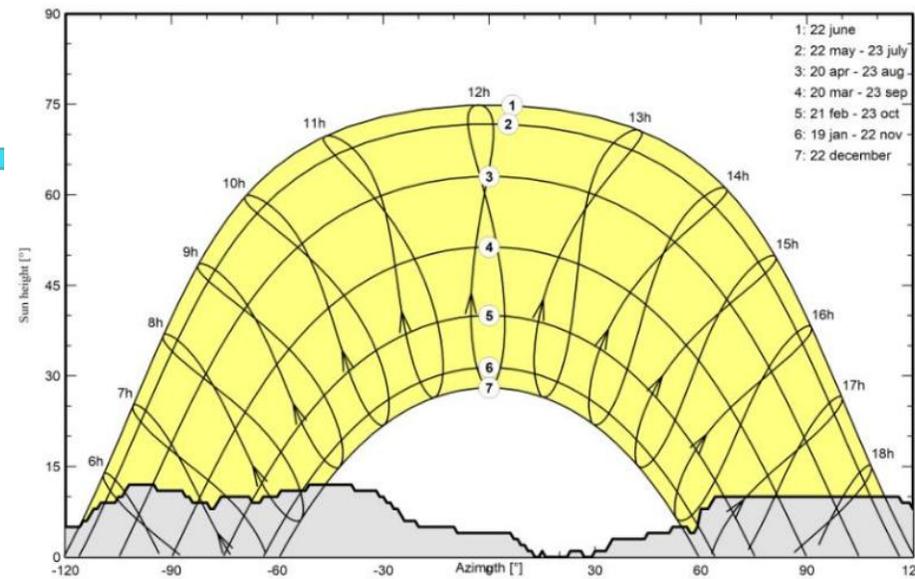
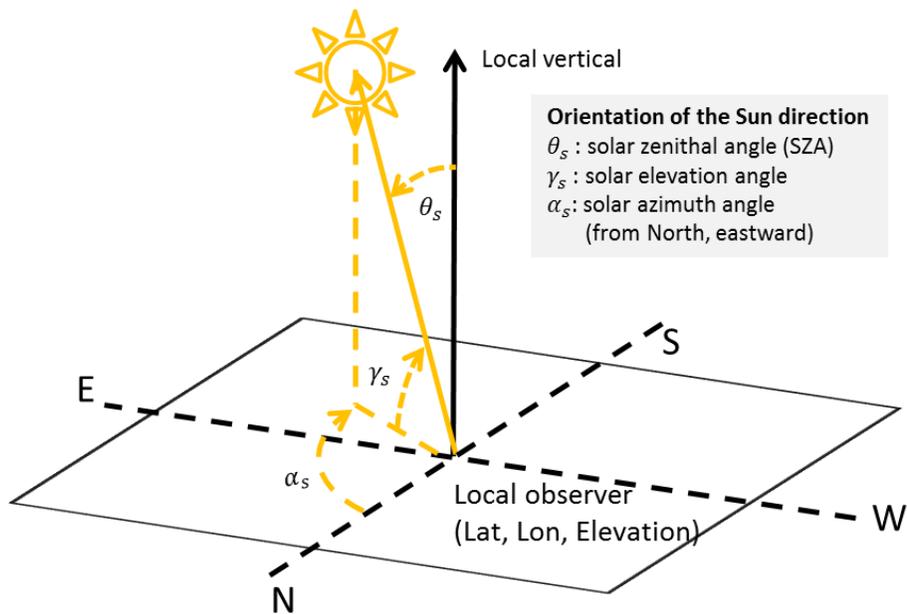
A new layer: the importance of co-design and fast prototyping



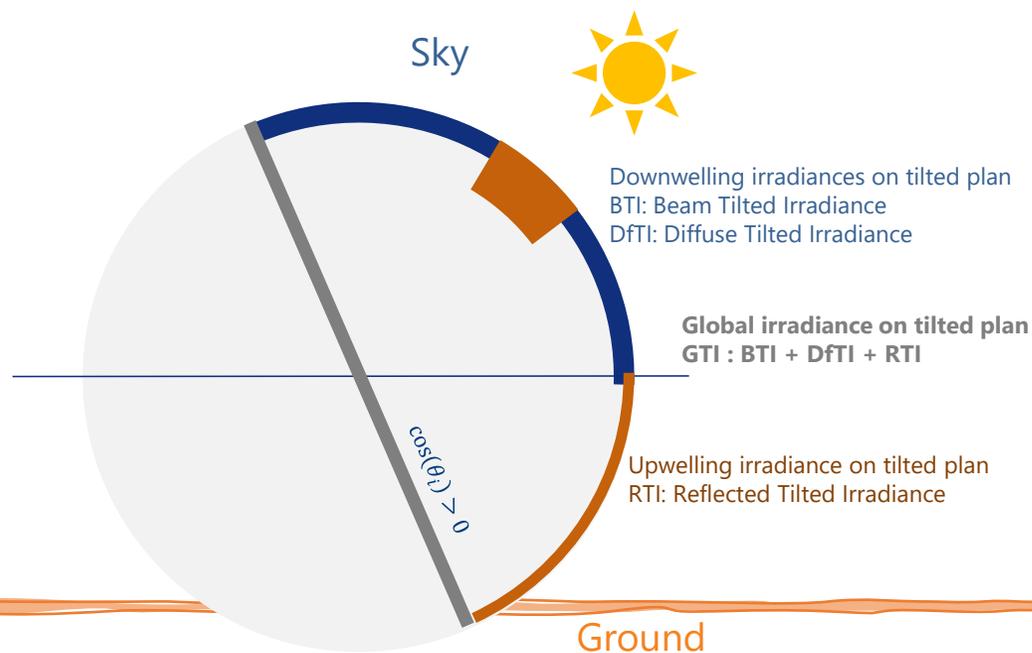
EXTRAS



Solar irradiance 101



GHI : Global Horizontal
DHI : Diffuse Horizontal
BNI : Direct Normal
GHI = DHI + BNI x cos(sza)





WPS - Methods

WPS is Self described : [GetCapabilities](#)

[Python Client](#) 

- [compute_polygon](#)(GeoJSONPolygon, TimePeriod, Offset=0.5, Summarization=15m, DSM_source)
 - **NetCDFdata cube (x, y, time) / metric grid (UTM CRS)**
 - **Tilted irradiance (GTI) : computed tilt** from DSM
- [compute_orientation_points](#)(GeoJSONPoints, dsm_source) :
 - NetCDF(npoint) with absolute **height, azimuth & elevation** angle of each point
- [compute_points](#)(GeosonPoints[+height, azimuth, elevation_angle], TimePeriod, ...)
 - **NetCDF(npoint, time)**
 - **Tilted irradiance (GTI)** - requested tilt

SAF-aaS principles

- **On demand** computation
- Based on F.A.I.R principles :
Findable, Accessible, Interoperable, Reusable
- **Open standards** :
 - **WPS** : XML + HTTP
 - **NetCDF** (+ CF conventions) : QGis, Python, Matlab, R, Panoply, ...
- **Data agnostic** :
 - **DSM** : Static GeoTiff ; API (Google API, WMS , IGN)
 - **Irradiance** : Static measures, API (CAM5, Forecast, ...)

SAF-aaS - Solar Assessment and Forecasting



Cloud-based



ON-demand the-fly



Scalable



Input agnostic



CAMS
McClear

CAMS
RAD



WPS for downscaling at urban scale solar irradiance and PV power output



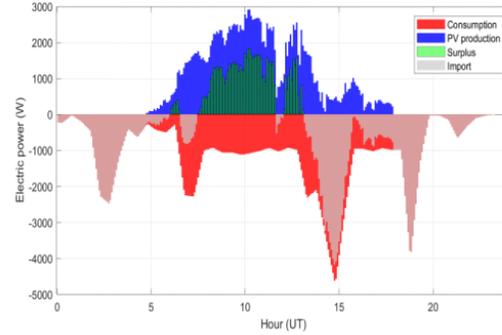
Use case 2

Use case 3

DSM*
DEM*

*DSM : digital surface model (< 1m)
*DEM : digital elevation model (30 m)

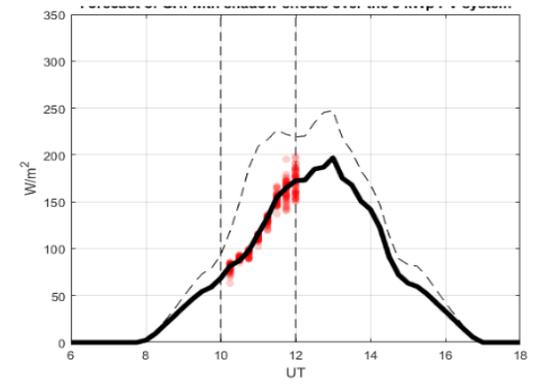
PV self-consumption



Total consumption: 26.5 kWh
Total PV production: 16.7 kWh
Total used PV production: 4.8 kWh

Self-consumption ratio: 28.6%
Self-sufficiency ratio: 18.0%

Energy trading (Forecast)



PV integration in the grid

