Overview: Main Results & Impact

Rebecca van Leeuwen

Coordinator, RVO

Online webinar 1st July 2020

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 764805

Agenda

- Aim/ Activities
- Partners – The Heroes
- Work Methodology
- Main Results & Impact
- Conclusions

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EU HEROES project

EU routes for High pEnetration of solaR PV into lOcal nEtworkS

Aims

- Enable increased deployment of community PV through new models enabling grid-integration

Activities

- Understand needs of communities and network operators
- Develop new business models
- Pilot those business models

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EU HEROES: Partners

Partners

- Partnership formed through Renewable Energy Working Group of the European Energy Network (EnR)

- RVO – Netherlands
- CRES – Greece
- CREARA – Spain
- DENA – Germany
- PROTECH – Lithuania
- KAPE – Poland
- EST - UK

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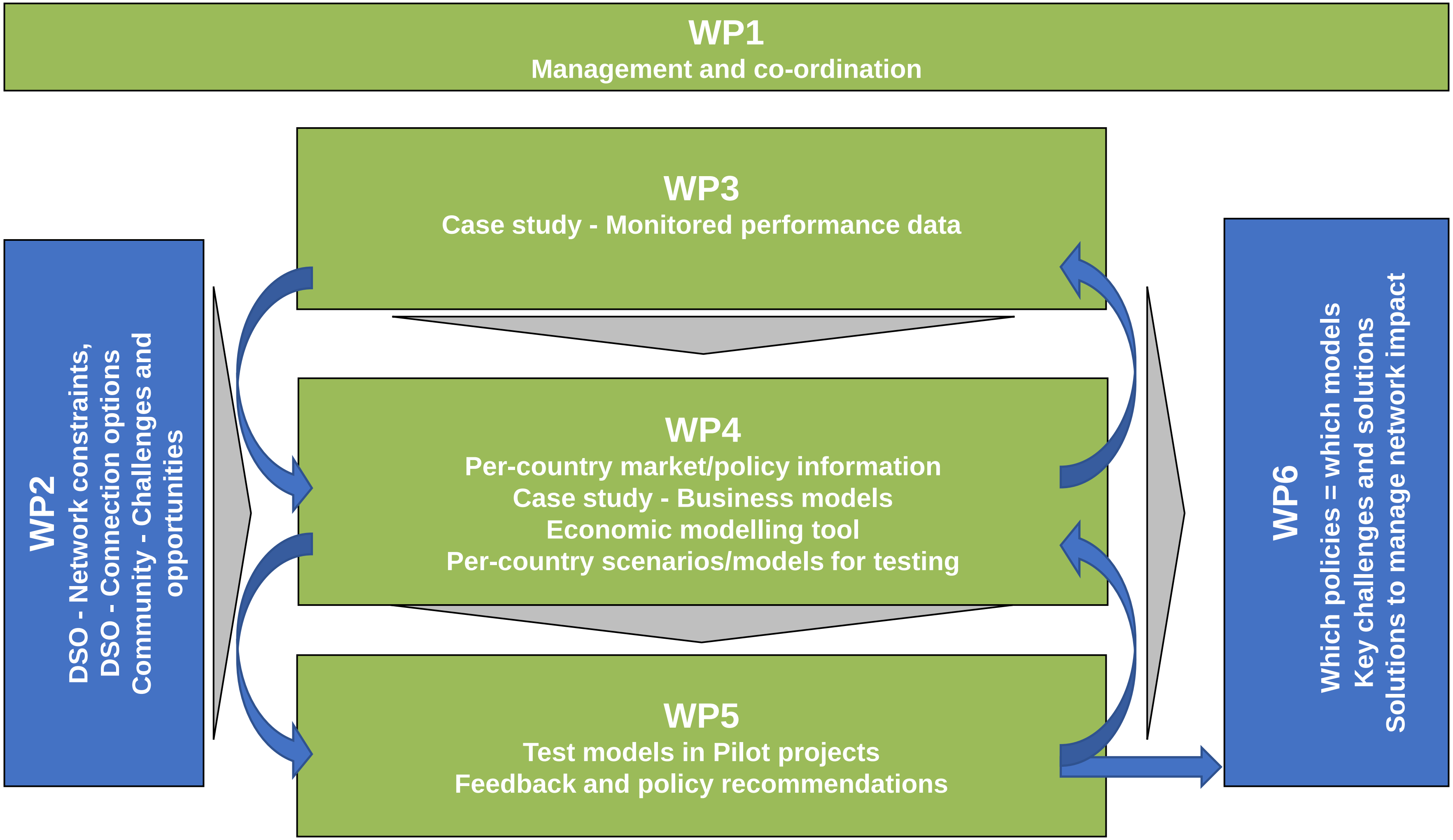
Work Methodology



System Design Monitoring and Evaluation

ACHIEVEMENTS

- **Collected** physical and electrical data from different operating PV Case Studies (PV C.S) **and provided** the most relevant performance indicators 95%
- **Outlined** the grid impact on the selected PV Case Studies 45%
- **Identified** smart grid services in order to reduce the peaks in energy transactions between PV Case Studies and the Distribution Grid and maximised the local consumption of the produced energy 5%

11 PV Case Studies from 7 EU countries ranged from 6,6kWp to 1,6MWp

- *1 Multifunctional arts-education and entertainment complex*
- *1 Hybrid PV community connected to weak electrical grid (PVs production is fall under curtailed operation)*
- *2 Residential complex PV communities*
- *2 Primary schools*
- *1 Community enterprise centre*
- *1Feed-in tariff PV System (considered as virtual energy community)*
- *1 Industrial smart-grid installation*
- *1 Passive house*
- *1 nZeb house*

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Business Model development & training

ACHIEVEMENTS

Description

AIM: to adapt proposed model business cases to community and municipal solar projects taking into account pilot legislative and infrastructural environment.

- Proposed, desiged and contributed to implementation of at least 7 demonstration pilots;
- Monitored performance, refined BM cases and evaluated the effectiveness of the pilot approaches

Objectives

	Objective	Achievement
1	**Provided clear BM description for each case study project, including a country-level context analysis**	**A detailed country report was developed by each country, covering technical, financial & regulatory aspects**
2	**Integrated technical data into an economical analysis that includes:** • Societal costs (owner/ consumer) • Cost for grid operator	**A financial model has been developed to evaluate different BMs for the case study projects. The tool also includes impact of batteries or demand side management.**
3	**Identify and evaluate potential improvements for pilot projects**	**Identifed potential improvements to the financial tool, and identified optimal Business Model for community solar projects in each country.**
4	**Provide conclusions on good practices**	**Recommendations made to overcome the barriers that currently hinder deployment of community pv**

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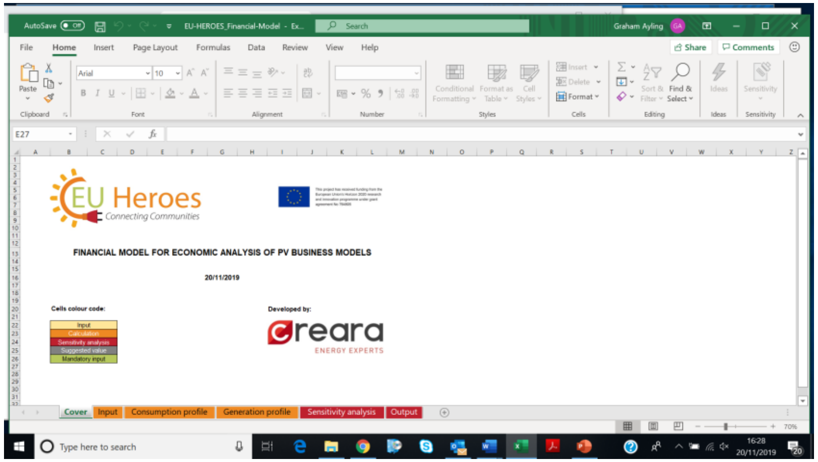
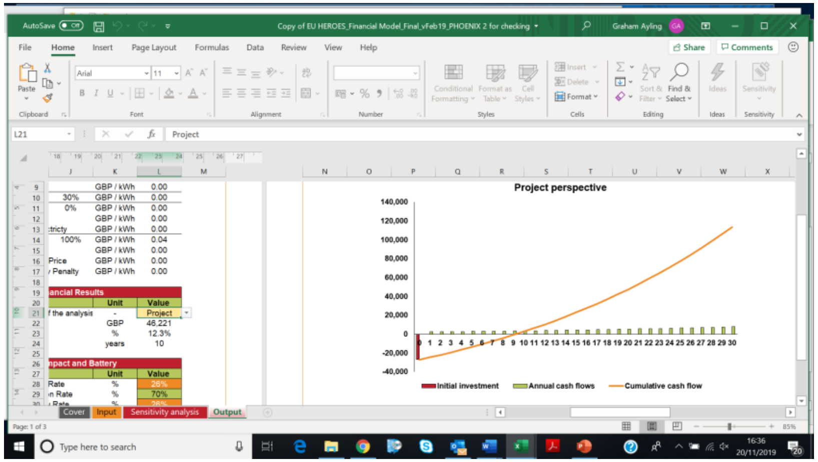
Results: Community solar tool

Tool features

- Aimed at energy communities
- Business modelling
- Can cover community scale
- And include battery storage
- Sensitivity analysis
- Excel-based with user guide
- www.euheroes.com/tool





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PILOTING OF BUSINESS MODEL CASES

ACHIEVEMENTS

Description

AIM: to adapt the business model cases proposed in WP4 to community and municipal solar projects, taking into account specific pilot legislative and infrastructural environments.

Objectives

	Task	Achievement
1	**Task 5.1 - To propose design for specific community and municipal pilot projects utilizing business model cases in terms of interference with the grid, infrastructural solution and profitability**	**List of pilots has been drawn up**
2	**Task 5.2 - To monitor and evaluate the effectiveness of the pilot approaches**	**Efficiency of proposed business case for each of 7 pilots will be tested by obtaining and accumulating relevant energy generation and consumption data on micro grid level and feeding it into model business case for particular pilot.**
3	**Task 5.3 - to provide training for communities pilot projects managers and technicians**	**Under this task specialised training workshops tailored to particular pilot technical solution and business models will be performed for each pilot operational staff. Participants from other community projects will be invited to training workshops widening access to project outputs with hands-on real case experience.**

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Results & Impact

- **Strategic Impact –** Closely following Article 22 of the RES Directive – provide recommendations for effective implementation
- **Market Impact and Socio-economic impact –** smooth transition from subsidised deployment to market conditions. Acceleration & empowerment of citizen engagement with renewable energy and decarbonisation of the EU economy;
- **Energy and Environmental Impact –** contributed to increase in share of renewable energy in EU energy mix and reduced CO2 emissions
- **Shortened the (expensive) learning curve** for making this energy transition in society possible – valuable exchange of info'

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Conclusions

- Could it be that:
  - there are ***"No More Heroes?"***
  - "***We don't need another Hero?" or do we?***

- Or could it be that:
  - With the right legislation in place;
  - With a level/ equal playing field
  - With increased public acceptance

- ***We could (all) be Heroes***'

and contribute to a cleaner, greener & brighter future

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For further info'

http//www.euheroes.eu

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Stakeholder activities and management

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WP2: Stakeholder Engagement

OBJECTIVES AND CURRENT PROGRESS

Description

- Bring together key actors from the energy community and electricity network sectors and engage them in delivering the project objectives
  - Key stakeholder groups
  - Stakeholder engagement plan
  - Feedback loops

Tools

1. **Thematic Workshops**: *local stakeholder exchanges*
2. **Seminars**: *dissemination of results and training purposes*
3. **Bilateral working meetings**: *for in depth discussions and insights*
4. **Telephone conferences:** *ongoing exchange*

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Thematic Workshops and their outcome

Athens, Greece (Grid integration and solar community projects)

- Caps on maximum of renewable energy inst. and grid installation
- High interest loan on financing
- No incentives for micro grids
- Economics of storage

- ➢ Set up funds or grants for easier and cheaper finance conditions
- ➢ Provide incentives reducing grid costs (ancillary services, storage)

Madrid, Spain (Royal Decree and impact on self-consumption)

- Royal Decree sets the base for development of self-consumption
  - However: system is complex and collective self-consumption needs to be specified
- General mismatch of information in society

- ➢ Information campaigns regarding financial opport. of PV and self-consumption

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Swansea, UK (Solar community projects)

- Lack of professionalized structures
- Access to land and buildings, financially viable projects and organising permits
- Legislation preventing increased deployment of community solar and self-consumption

- ➢ Communal buildings opening up their roofs for community solar projects
- ➢ Create framework that enables sites to directly connect to onsite users

Vilnius, Lithuania (Prosumers in multifamily houses and energy communities)

- The concept of cooperatives or energy communities is widespread (no political influence)
- Lack of financing mechanisms

- ➢ Use multifamiliy houses to strengthen the concept of energy communities
- ➢ Set up financing mechanisms

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A brief overview of WP-3
"System Design Monitoring and Evaluation"

WP Leader: CRES

1st July 2020

ΚΑΠΕ CRES | CENTRE FOR RENEWABLE ENERGY SOURCES AND SAVING

Tasos Kyritsis, John Nikoletatos,
Vangelis Mathas, Kiki Papadopoulou

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PV Case Studies (PV-C.Ss)

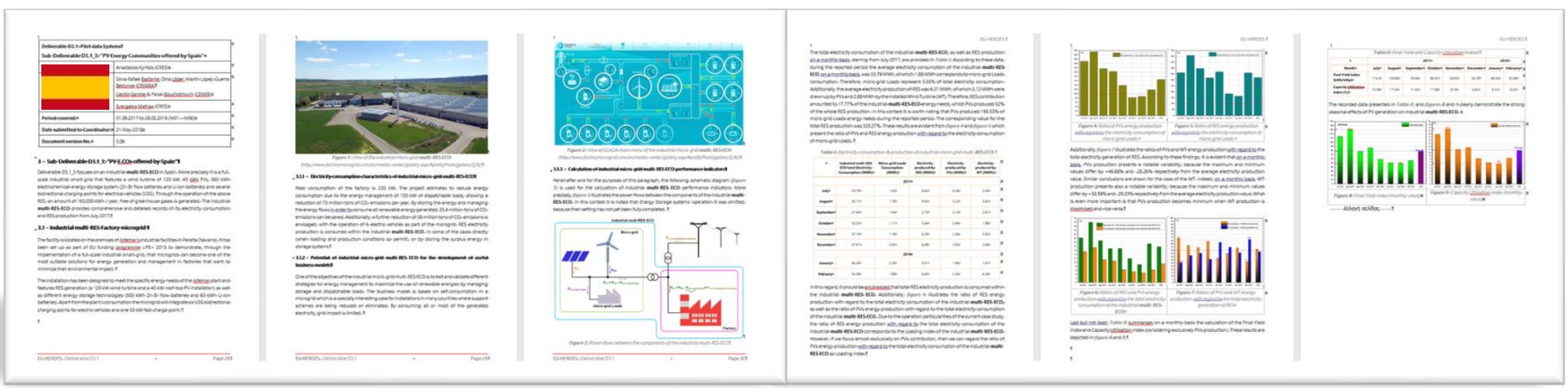
- 11 PV projects from 6.6kWp to 1.6MWp were analysed, focusing either on operational PV Energy Communities or on PV systems which might be essential ingredient of current or future PV Energy Communities.

*11 **PV Case Studies** (**PV-C.Ss**) from 7 EU countries (from 6.6kWp to 1.6MWp)*

***1** Multifunctional arts-education and entertainment complex*
***1** Hybrid PV community (PVs production is fall under curtailed operation)*
***2** Residential complex PV communities, **2** Primary schools,*
***1** Community enterprise centre,*
***1** Feed-in tariff PV System (considered as virtual energy community)*
***1** Industrial smart-grid installation, **1** Passive house , **1** nZeb house*

Country Reports

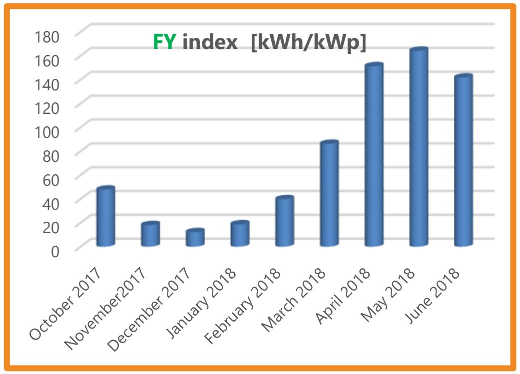
- 7 country reports (for the 11 PV-C.Ss, at least one in every partner's country) was written, giving a detailed technical description of each case study together with characteristic monthly performance data.

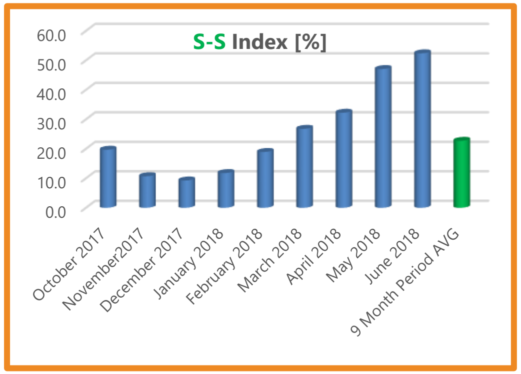


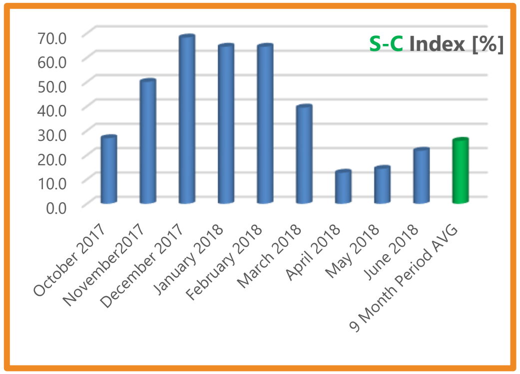
Performance Indicators

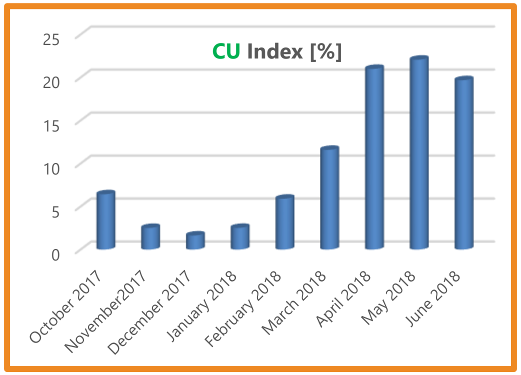
The most relevant performance indicators were calculated for each PV case study :

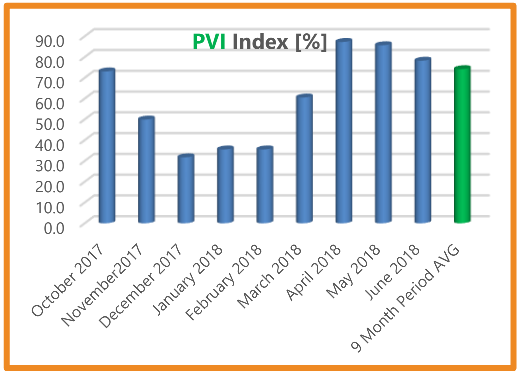
- Final Yield Index,
- Self-Sufficiency Index,
- Self-Consumption Index,
- Capacity Utilisation Index,
- PVs Injection Index,
- PVs Exploitation Index

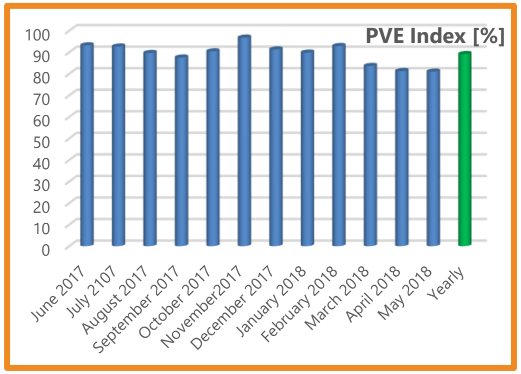








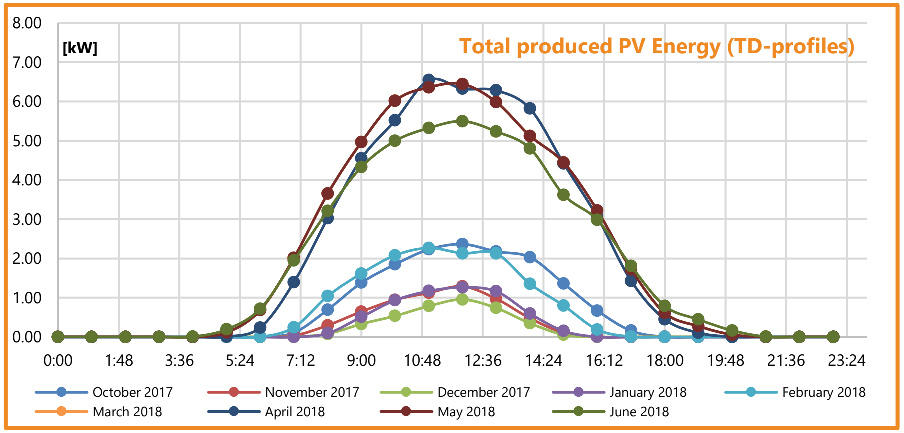


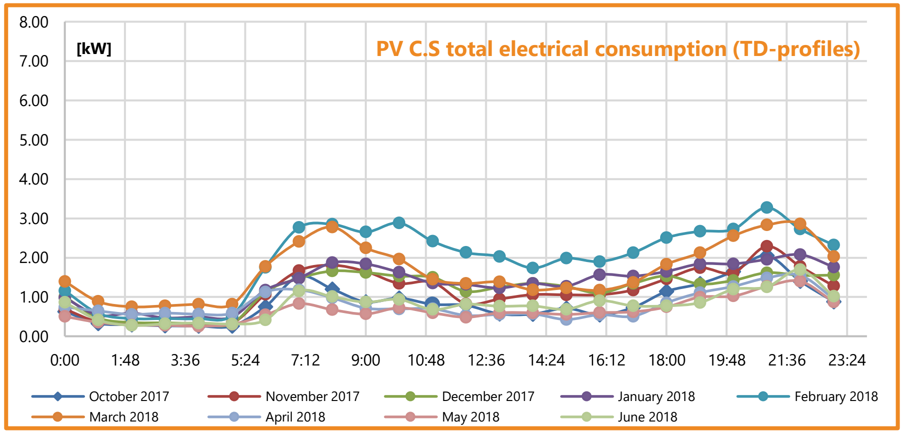


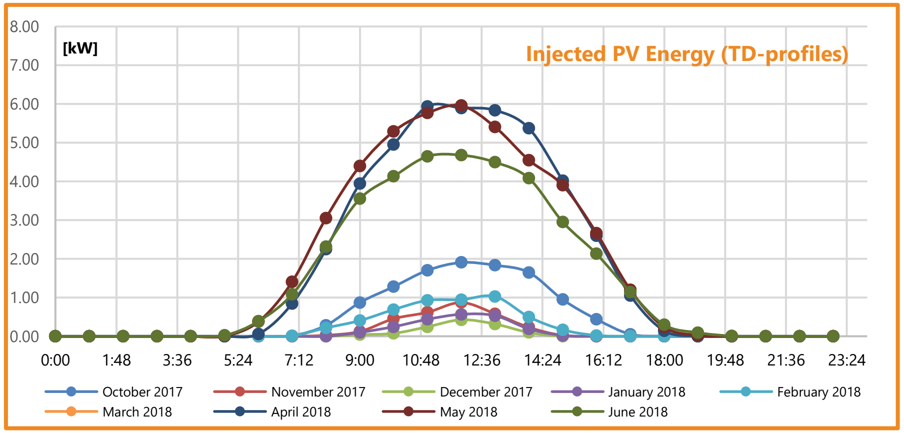
Examples of calculated Monthly Performance Indexes

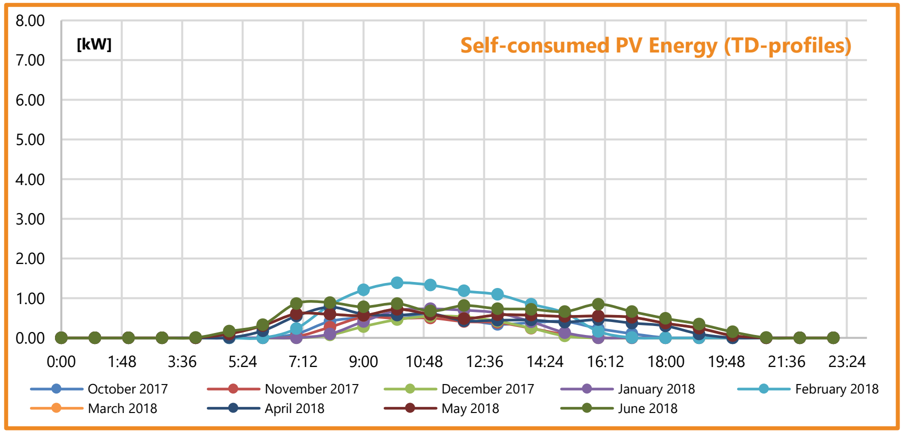
Typical Daily Profiles (TD-Profiles)

- The energy transactions between the output of the under-study PV-C.Ss and the **L**ocal **D**istribution **N**etwork **(L.D.N.)** were studied.
- Energy transactions were modeled in term of Typical Daily profiles. **T**ypical **D**aily **profiles** (**TD-Profiles**) illustrate the average (AVG) hourly values of the energy transactions, for the total days of a month.



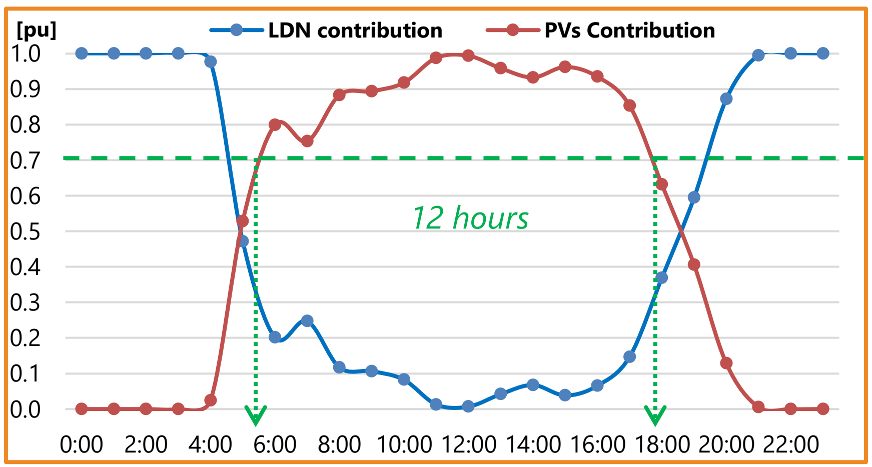




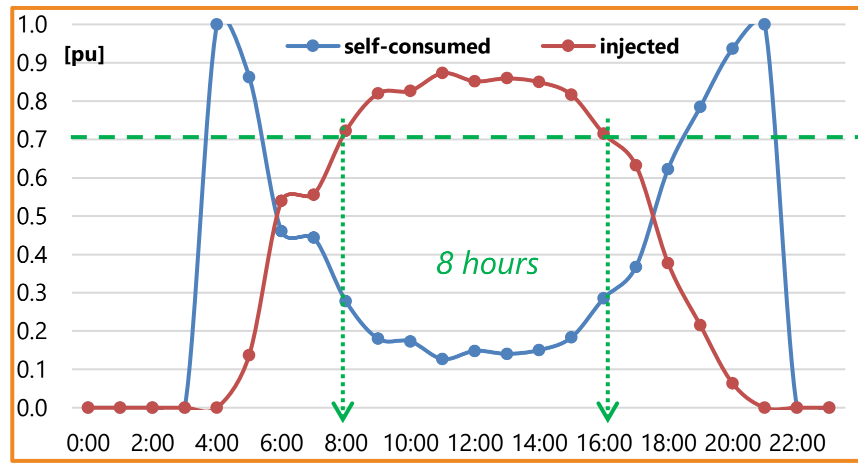


TD-Profiles & p.u system

- All power quantities were reported in the frame of a well-defined "**P**er-**u**nit (**p.u**) system". The main idea of a pu system is to eliminate large differences in absolute values into base correlations.
  - PVs nominal power consisting the base value of the system.
  - Rest power quantities specified as multiples of the selected base value.



Typical hourly allocation of the total electricity consumption of one PV-C.S for March 2018



Typical PVs hourly production broken down by component for March 2018

There are time intervals where the PV-C.S energy needs were served by PVs at percentages more than 70%.

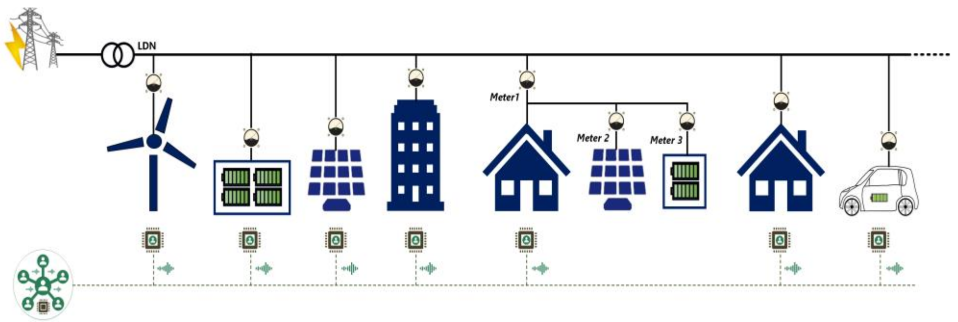
There are time intervals where the injected PV energy corresponds at least to 70 % of the produced power.

Outcomes from T-D Profiles analysis

- In case of residential PV applications that produce part or all of their electrical needs by installing small scale decentralized PV systems.
  - The maximum hourly value of the produced PV power is at most equal to 70% of the nominal PV capacity.
  - The maximum value of under study building's power consumption is usually less than 60% of the nominal PV capacity.
  - The maximum values of PVs production and buildings consumption take place at different times.
  - The power consumption varies between 5 and 35 % of the nominal PV capacity at the time intervals where the maximum PV production is exploited.
  - The mean self-consumption ratio of residential PV applications ranges between 30 and 35%.
  - There are time intervals where the energy needs of all PV-C.Ss were covered by PVs in high rates (almost around 100%). This happens particularly during spring and summer.

Smart grid services

Smart grid services had been sought in order to reduce the peaks in energy transactions between PV C.Ss and the L.D.N. and to maximise the local consumption of the produced energy.



The main scope of smart grids services is to enable consumers and producers to participate to grid management and to improve the operation of the entire energy production, transmission and distribution chain, in reliable and economic terms.

Demand Response (D-R) and Distributed Energy Storage Systems (D.E.S^2) were deemed as the most appropriate smart-grid services for the under-study PV projects.

- **D-R motivates consumers to modify their electrical consumption profile**
- **D.E.S^2 stabilise the production of intermittent RES**

Demand Response (D-R)

- D-R is a valuable tool that could have a potential impact on demand profile either by reducing or shifting consumers' electricity usage during peak periods or by motivating consumers to modify their electrical consumption profile according to RES availability.

Consumers are remunerated either:

- for their D-R availability (following contracted time-based rates and critical peak rebates) or
- for the procurement of the service (following variable peak pricing or real-time pricing and time-of-use pricing).
- D-R, sometimes, includes the direct control of air conditioner /heat pump units/ water heaters (from aggregators) during periods of peak demand or peak RES production.

the EU Heroes consortium did not have a detailed picture of electricity consumption components and thus the impacts from the application of a DR scheme was not quantified.

Distributed Energy Storage Systems (D.E.S^2)

- The addition Of D.E.S^2 into interconnected PV systems can contribute to mitigate concerns arising from the intermittent nature of photovoltaic systems.

  - Bloomberg's Energy Finance (BNEF) ninth Battery Price Survey states that the prices of lithium-ion batteries fell 85% from 2010 to 2018, reaching the price of 176$/ kWh (wholesale price).
  - According to the same Survey, the cost of E.S^2 is expected to fall roughly 52% through 2030 (reaching the price of 85$/ kWh).

Under the EU Heroes program, D.E.S^2 were regarded to be either

- behind the meter (in the case of single households), or
- behind the Common Coupling Point (in the case of building complex or energy communities of very limited geographical area)

Outcomes From the addition of D.E.S^2

- D.E.S^2 were deemed not only to increase the self-consumption of locally generated clean electricity, but also to provide ancillary services to distribution networks.

  - D.E.S^2 absorb PV energy either from local produced PV energy or from neighbouring PV installations (without storage facilities) at midday hours with high irradiation and low electric load and inject it back to the grid at hours with electrical energy demand (mitigation of grid congestion and appeasement of transformers and lines thermal overload).

  - In this way, peaks in energy transactions between PV-C.Ss and grid can be reduced, and the profitability of PVs' owners can be increased.

  - The proposed price charging of the abovementioned ancillary services (almost at half of the competitive energy tariff) offsets the cost of adding D.E.S^2 and prevents any increase in time required to recoup the investment (compared to PV systems without energy storage).

Economic Viability of D.E.S^2

PV-C.S. (Poland): nZeb house, 9.75kWp PVs, annual electrical consumption 9.4 MWh & annual produced PV Energy 10.4MWh	CAPEX	Pay back Period
Current Situation	9750€	105 months[*1]
Addition of 10kWh D.E.S^2	11000€	97 months[*2]
Addition of 15kWh D.E.S^2	11625€	103 months[*3]

PVs Self-Consumed Energy **1: 25.15%, **2:** 50.70%, **3:** 53.89%*

Assumptions:

Capital Expenditure (CAPEX)

1000€/kWp (procurement & installation of PVs)

100€/kWh (procurement & installation ofD.E.S^2)

Electricity Tariffs without V.A.T.

Competitive Charges (Power procurement): 11c€

Regulated Charges (Transmission & Distribution grid charges, etc):~30% of the competitive charges

Ancillary Services Tarif without V.A.T.

MGC Mitigation of Grid Congestion) Services : 5c€

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Thank you for your attention

Andrea Real – arr@creara.es

Business model adaptation development and training

1st July 2020

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 764805

Business model adaptation development and training

OBJECTIVES

Objectives

	Objective	Result
1	**Provide clear BM description for each case study project, including a country-level context analysis**	**A detailed country report has been developed by each country, covering technical, financial and regulatory aspects in order to deeply describe the national context.**
2	**Integrate technical data into an economical analysis that includes:** • Societal costs (owner/ consumer) • Cost for grid operator	**A financial model has been developed to evaluate different BMs for the case study projects. Additionally to conventional BMs, the tool allows to test more innovative ones, such as the impact of batteries or demand side management.**
3	**Identify and evaluate potential improvements for pilot projects**	**Potential improvements from the BM testing with the financial tool have been identified for each of the case studies, and detecting the optimal BM for community solar projects in each country.**
4	**Provide conclusions on good practices**	*Once the optimal BM in each country has been identified, recommendations will be made in order to overcome the barriers that currently hinder its deployment.*

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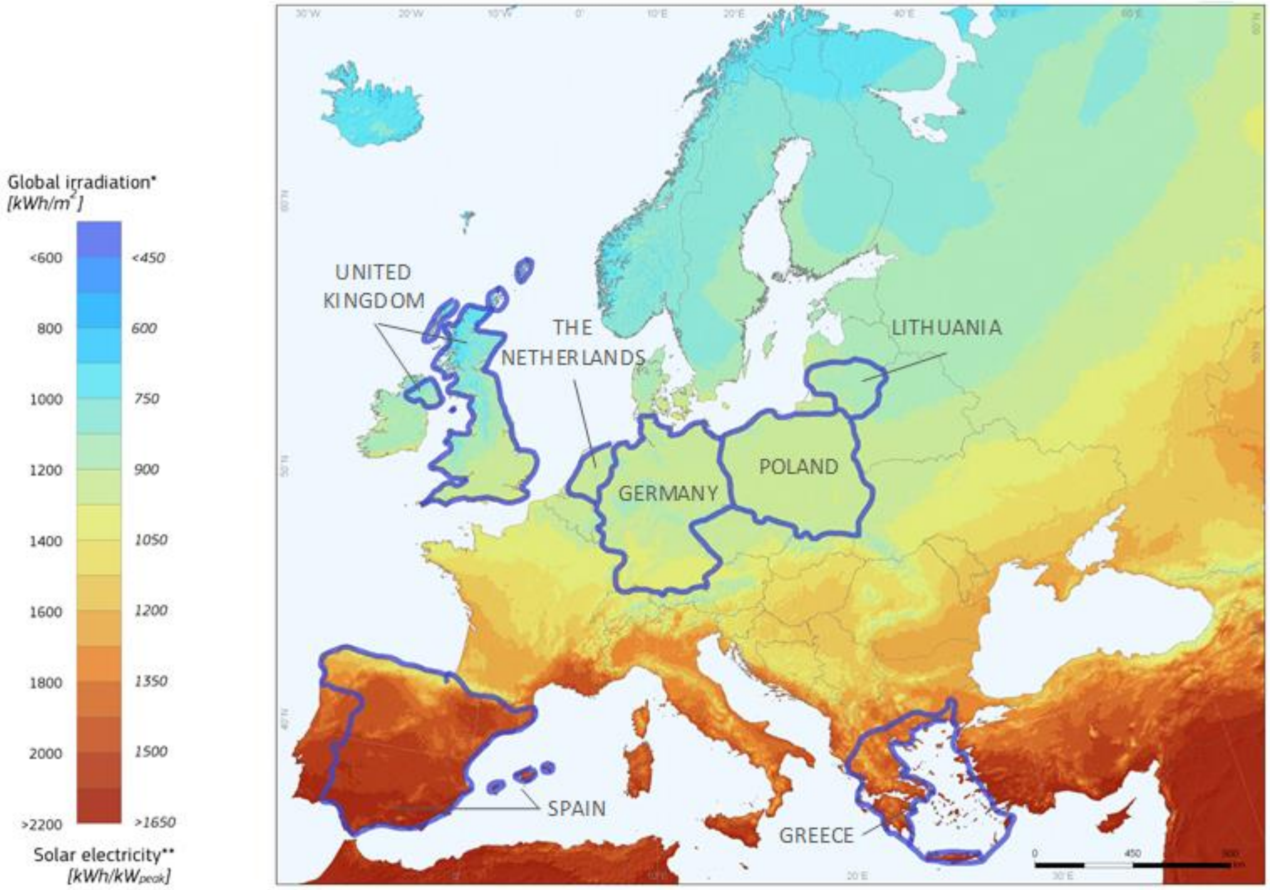
CONTEXT ANALYSIS

The current situation and potential for development of the national PV market was explained and the applicable regulation was presented

Countries studied

- Greece
- United Kingdom
- Spain
- Netherlands
- Poland
- Lithuania
- Germany



Source: CREARA

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Case studies

The business models of the case study projects were analysed, presenting definitions and general structures of generic business cases for PV systems

Business model analysis

Pilot project	Country	Connected to grid	Curtailment	Injection	Benefit from grid	
Stavros Niarchos Foundation Cultural Center	Greece	Yes	No	Yes	No	
Iveron Monastery	Greece	No	Yes	No	N/A	
Phoenix Centre	UK	Yes	No	Yes	Yes	FiT
Ysgol y Bedol	UK	Yes	No	Yes	Yes	FiT
Industrial multi-RES Factory	Spain	Yes	Yes	No	N/A	
College park Zwijsen	Netherlands	Yes	No	Yes	Yes	Net metering
Aardehuizen-Olst	Netherlands	Yes	No	Yes	Yes	Net metering
Passive Residence	Poland	Yes	No	Yes	Yes	Net metering
Rudamina	Lithuania	Yes	No	Yes	Yes	FiT
Bukciai	Lithuania	Yes	No	Yes	Yes	Net metering
Warthausen	Germany	Yes	No	Yes	Yes	FiT

Source: **CREARA**

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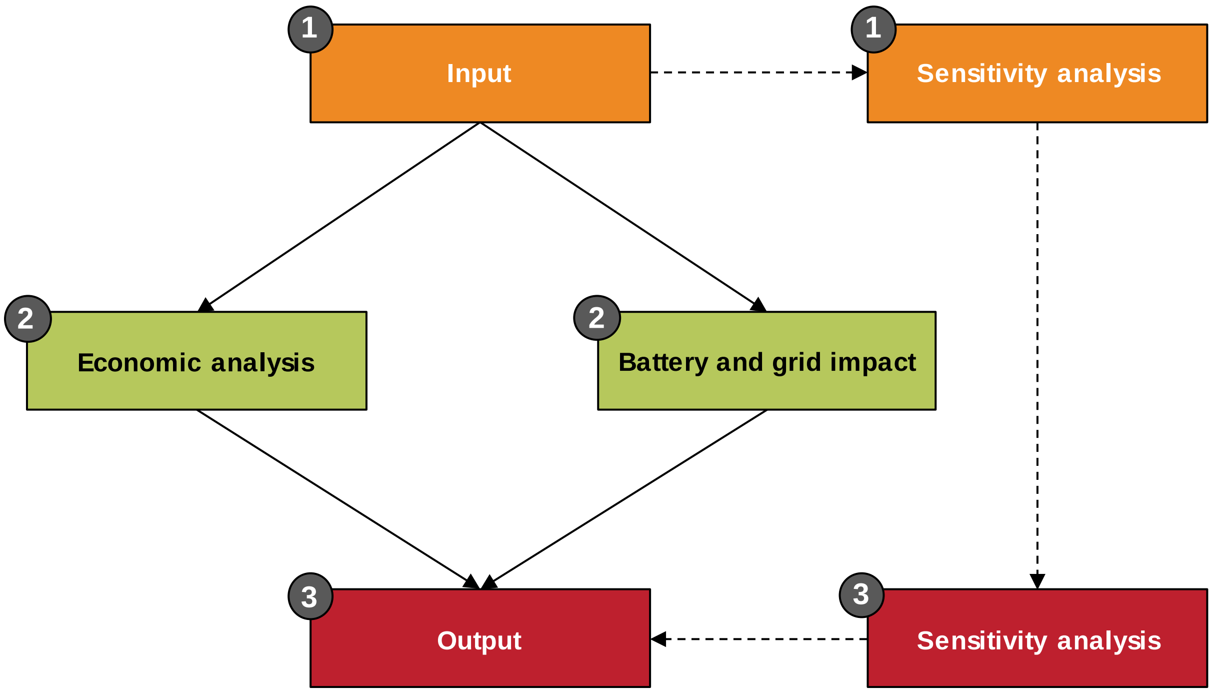
Financial tool for rapid analysis of PV projects

Financial model for economic analysis of PV case study projects

The model is composed of three main tabs:

- Input
  - System description
  - System cost
  - Funding scheme
  - Business model scheme
  - **Generation profiles**
  - **Consumption profiles**
- Sensitivity Analysis
- Output
  - Summary
  - Financial and grid impact results

Tool workflow



Source: **CREARA**

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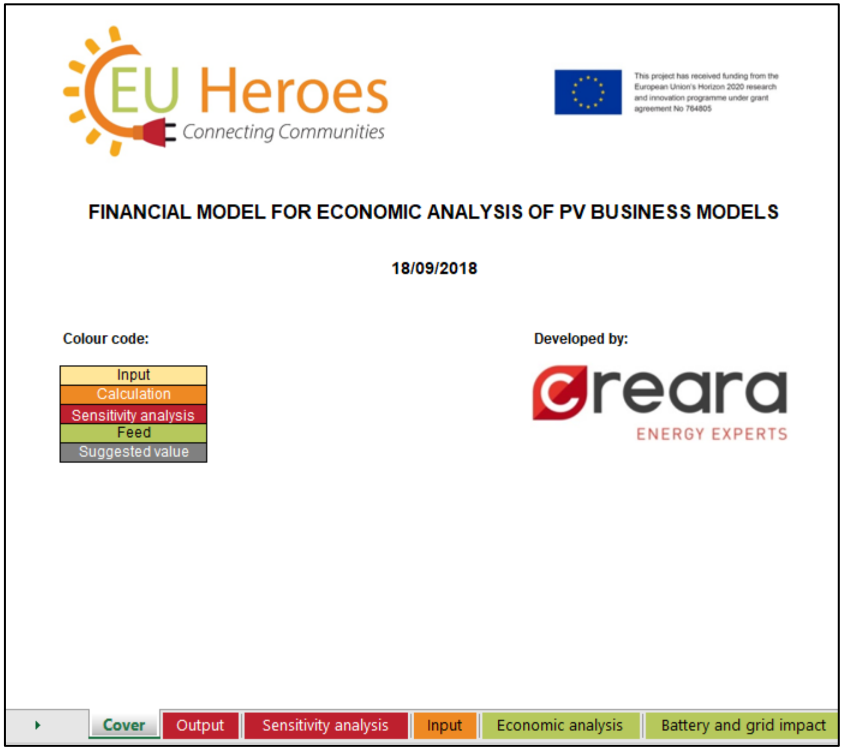
D4.2 (D4.1 on the portal) – Financial model for economic analysis of PV case study projects

The model follows the color code below:

- Tabs
  - Input tabs
  - Calculation tabs
  - Output tabs
  - Sensitivity analysis
  - Internal tabs
- Cells
  - Input
  - Calculation
  - Sensitivity analysis
  - Feed
  - Suggested value

Color code of the model



Source: CREARA

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ACHIEVEMENTS DURING REPORTING PERIOD

D4.3 – Pilot scenario evaluations

Using the tool designed in D4.2, the goal is to combine different BMs and analyze their effects on project profitability

- **Alternative BMs or a combination of several of them**
  - E.g., 50% self-consumption + 50% PPA or 50% FiT + 50% PPA
- **Impact of regulatory changes, if any has occurred since project starting date**
  - E.g., in Spain, there was a charge on self-consumed energy that is no longer applying
- **How the removal of incentives would affect the profitability of the system**
  - E.g., how would affect the system's profitability in the case of it had to operate on a 100% self-consumption scheme
- **How the removal of regulatory restrictions would increase profitability of the system**

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THANK YOU

arr@creara.es
www.creara.es

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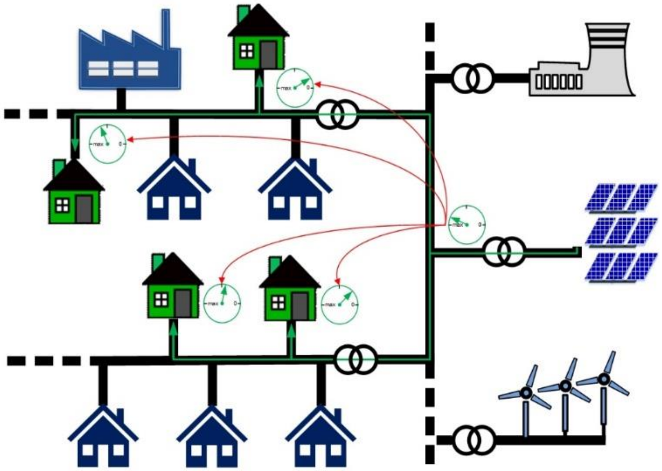
WP5 Piloting of Business Model Cases

M13-M36

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 764805

Aim

- WP5 is dedicated to the demonstration of the tools developed under the project and to show their capability to support community project developers and owners
- **Aim** - to adapt proposed in WP4 model business cases to community and municipal solar projects taking into account particular pilot legislative and infrastructural environment.



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Tasks

Tool piloting and evaluation:

T5.1. To propose design for specific community and municipal pilot projects utilizing model business cases in terms of interference with the grid, infrastructural solution and profitability.

T5.2. To monitor and evaluate the effectiveness of the pilot approaches

Training "how to use tool":

T5.3. To provide training for communities pilot projects managers and technicians

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Implemented activities

Five pilot cases identified and analyzed (Greece, Spain, Poland, Netherlands, Lithuania):

1. **Greece:** “Hyperion” - innovative PV energy community project providing distributed ownership of the community solar PV system.
2. **Spain:** Valencia administrative complex with a total area of 35,000 m^2, of which 10,000 m^2 are built, distributed in 6 public buildings.
3. **Poland**: Municipality-owned Public Kindergarten with PVs
4. **Netherlands**: “Groene Mient” social ecological housing project that consists of 33 (private) sustainable homes.
5. **Lithuania:** “Varniai Green House” project for renewable energy based refurbishment of soviet style multifamily house to the modern zero emission entity.

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Deliverables

- D5.1 Report on pilot model business cases
- D5.2 Training materials for community PV plants operators
- D5.3 7 seminar reports

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Conclusions

- Model is applicable to wide variety of situations
- Simple enough to understand
- Provides insights to existing configuration
- Provides possibilities to analyze impact of infrastructure configuration modification as well as impact on business case outcomes.

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End

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WP6 Dissemination and Policy

Jul 2020

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Dissemination and communication

Dissemination activities

- **Website and social media**
- **Articles and presentations**
- **National-level dissemination webinars**
- **EU dissemination webinars**
  - Today
  - 8th July – Policy recommendations
  - 15th July – Delivering Solar Communities

- **Online publication of results**
- **Online publication of policy paper**

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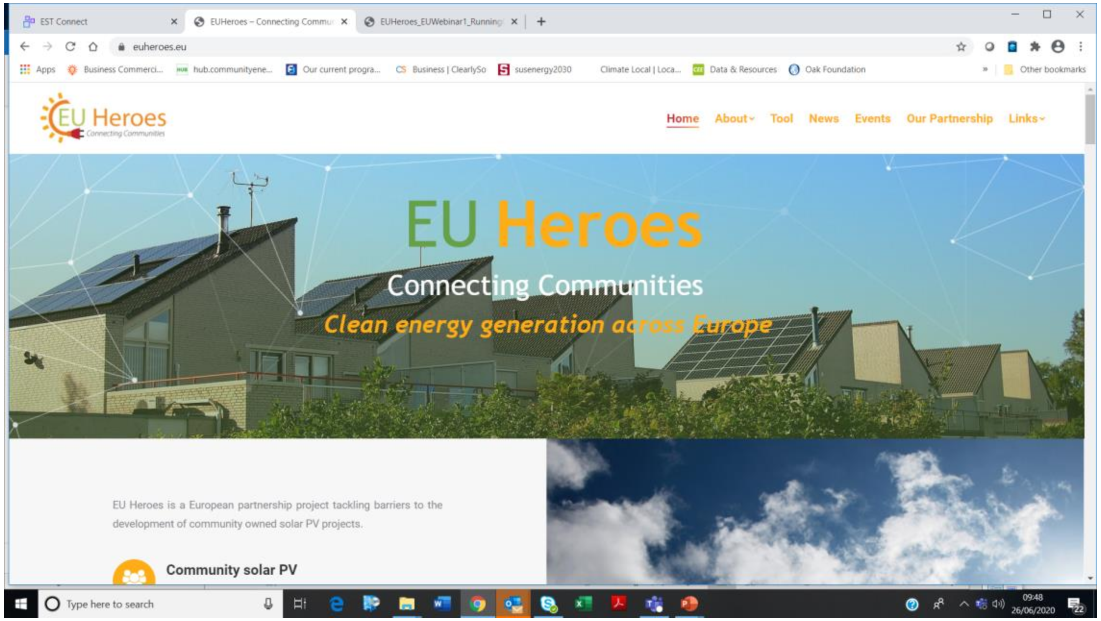
Dissemination and communication

Website

- **euheroes.eu**
  - Case studies
  - News
  - Project outputs
  - Tool



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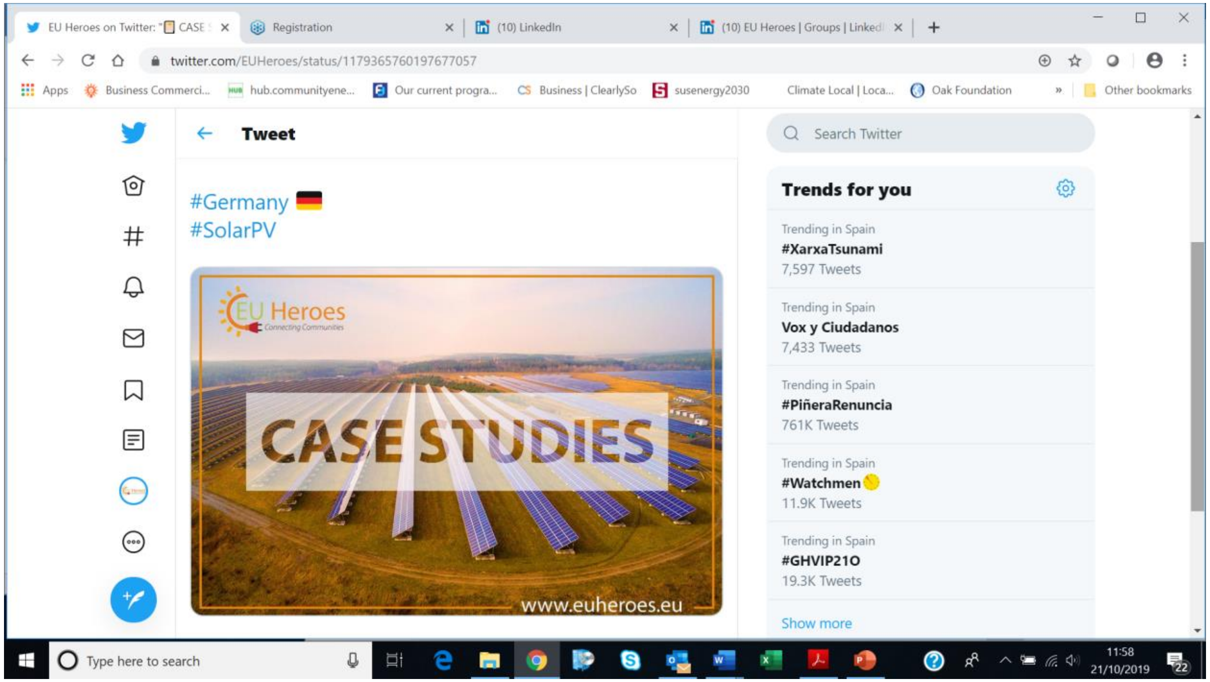
Dissemination and communication

Social Media: Twitter and LinkedIn

- **Twitter: @euheroes**
- **LinkedIn group: EU HEROES**



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Understanding Energy Communities

- **Energy communities are not the same!**
- **National variation**

- **Evolution of the sector:**
  - Stage 1: Pioneering
  - Stage 2: Developing
  - Stage 3: Paradigm shift

*Source:

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Policy recommendations

Building capacity

- **Public (and private) sector PPAs for PV communities**
- **Consistency in support frameworks for community energy**
- **Targeted support for PV/batteries**
- **More experience sharing**

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Policy recommendations

Paradigm shift

- **Recognise the role of PV in net zero**
- **Regulatory framework for smart-flexible**
- **Enable local supply**
- **Long term certainty on smart, flexible future**
- **Role of shared ownership in achieving scale?**

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Policy recommendations

EU policy

Good practice jigsaw

- **Many countries have part of the picture**
- **None have all?**

E.g.

- **Greece**
  - Definitions, exemptions and special dispensation
  - Virtual net metering for communities!
- **Lithuania**
  - LAs identify sites for community PV
  - Remote net metering – not for communities?

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END

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UPCOMING JULY WEBINARS

Wednesday 8 July: Enabling community PV – A Policy Blueprint

Wednesday 15 July: Energising Community PV

Find out more about of the upcoming July webinars HERE:

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