EU Heroes

Connecting Communities

Training Material

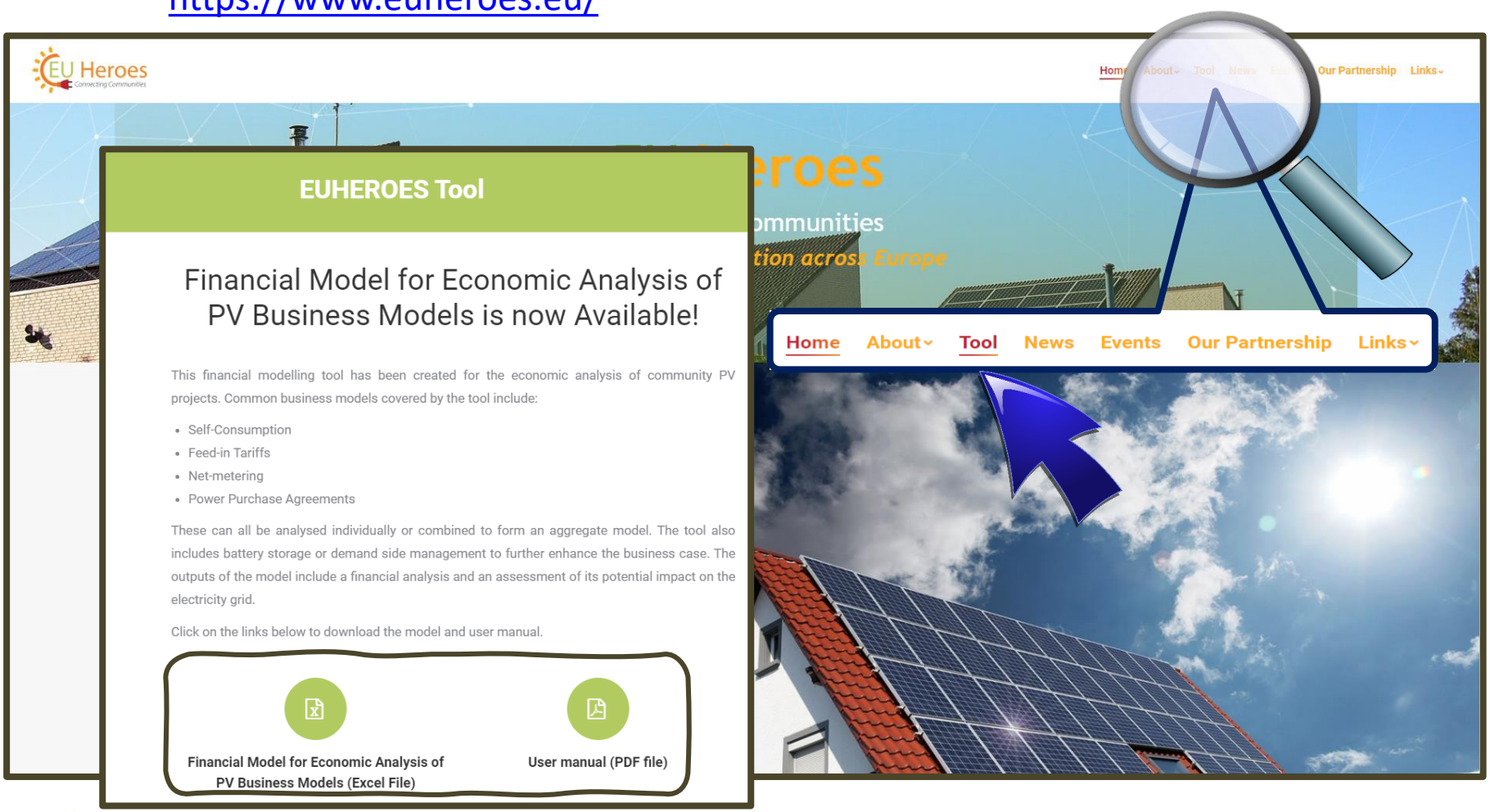
Financial Model for Economic Analysis of PV Business Models

July 2020

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

EU HEROES TOOL " A Financial Model for Economic Analysis of PV Business Models"

https://www.euheroes.eu/



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INTRODUCTION

Financial model for economic analysis of PV case study projects

The main objective of the model is to allow for the analysis of solar PV community projects

- Provides flexibility in the individual or aggregated simulation of the most common business models when realizing PV community projects
- Allows the user to mix and match different consumption profiles to obtain the combination that reduces grid injections
- Includes batteries and further schemes to optimize the project (Demand Side Management)
- The outcomes correspond to a financial analysis of the PV project and an assessment on its impact on the electricity grid

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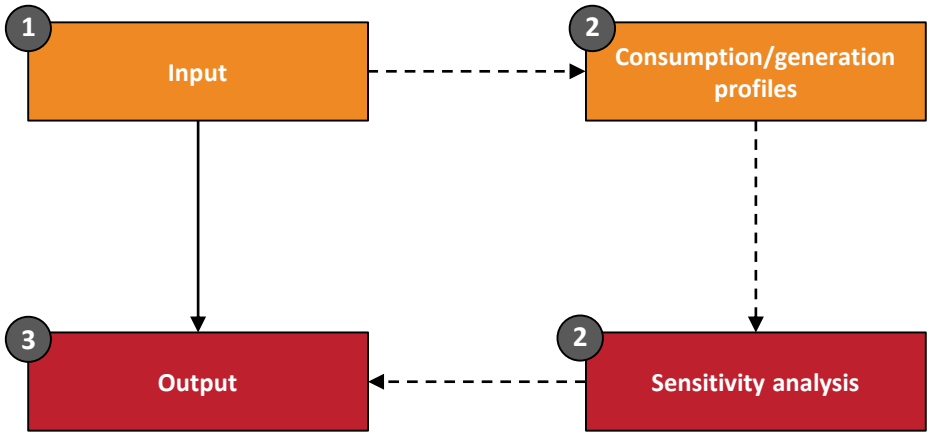
TOOL WORKFLOW

Financial model for economic analysis of PV case study projects

The model is composed of five main tabs:

- Input
  - System description
  - System cost
  - Funding scheme
  - Business model scheme
- Consumption profiles
  - User electricity consumption profile
- Generation profiles
  - Generation profile according to geographic area
- Sensitivity Analysis
- Output
  - Summary of the inputs inserted in the model
  - Profitability of the project and battery and grid impact results

Tool workflow



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COLOUR CODES

Tool is set in accordance to a color code differentiating between tabs and cells

The model follows the color code below:

- Tabs
  - **Input tabs**
  - **Output tabs**
- Cells
  - **User input**
  - **Suggested value**
  - **Mandatory input**
  - **Calculation**
  - **Sensitivity analysis**

Color code of the model

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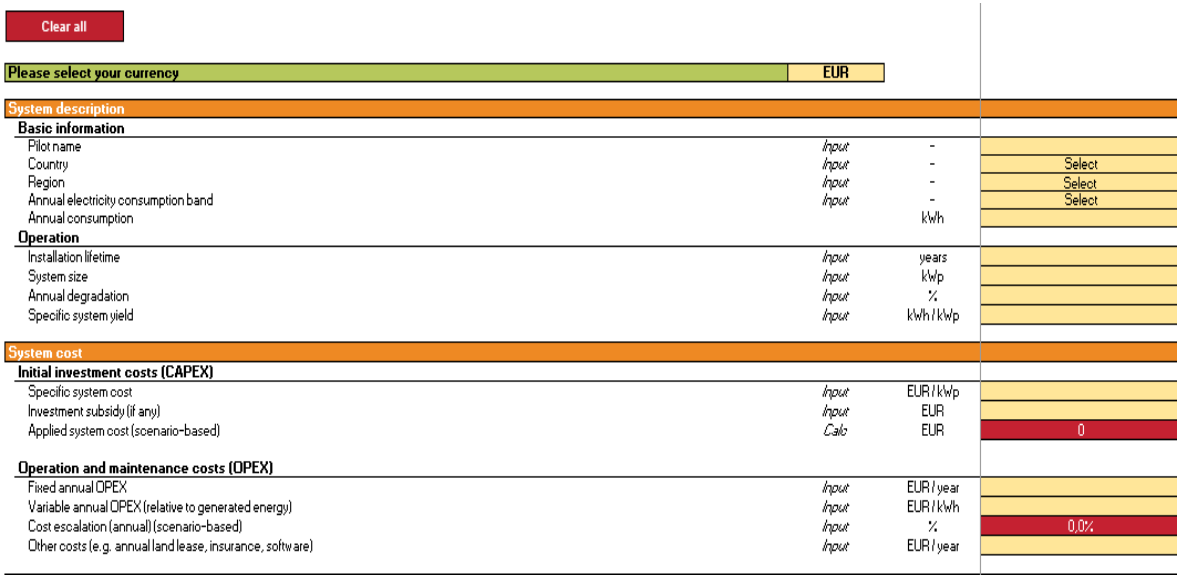
INPUT

Financial model for economic analysis of PV case study projects

The input sheet is divided in 4 subsections.
System Description

- Basic information (Location and electricity consumption)
- Operation
  - Installation lifetime: period of time throughout which the PV plant is expected to be operational
  - System size
  - Annual degradation: expected yearly wear down of the plant
  - Specific system yield: PV plant production or output



Clear all			
Please select your currency		EUR	
System description			
Basic information			
Pilot name	*Input*	-	
Country	*Input*	-	Select
Region	*Input*	-	Select
Annual electricity consumption band	*Input*	-	Select
Annual consumption		kWh	
Operation			
Installation lifetime	*Input*	years	
System size	*Input*	kWp	
Annual degradation	*Input*	%	
Specific system yield	*Input*	kWh/kWp	
System cost			
Initial investment costs (CAPEX)			
Specific system cost	*Input*	EUR/kWp	
Investment subsidy (if any)	*Input*	EUR	
Applied system cost (scenario-based)	*Calc*	EUR	0
Operation and maintenance costs (OPEX)			
Fixed annual OPEX	*Input*	EUR/year	
Variable annual OPEX (relative to generated energy)	*Input*	EUR/kWh	
Cost escalation (annual) (scenario-based)	*Input*	%	0,0%
Other costs (e.g. annual land lease, insurance, software)	*Input*	EUR/year	

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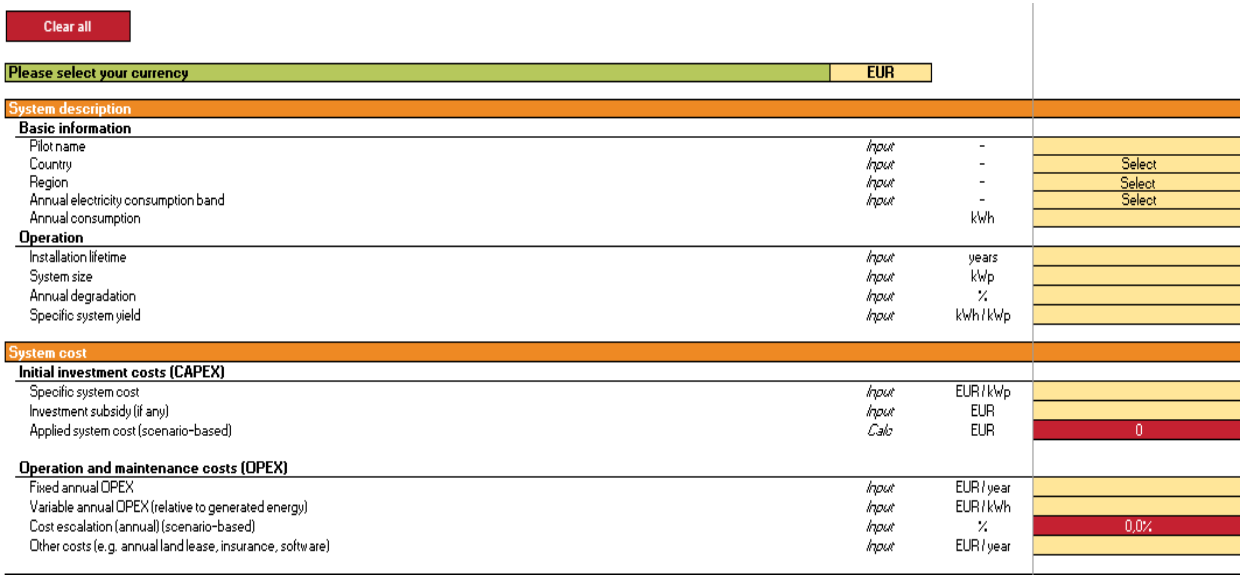
INPUT

Financial model for economic analysis of PV case study projects

The input sheet is divided in 4 subsections

System cost

- Compiles information relating the investment and operating costs of the PV projects
  - Initial investments costs (CAPEX)
  - Operation and maintenance costs (OPEX)



Clear all			
Please select your currency		EUR	
System description			
Basic information			
Pilot name	*Input*	-	
Country	*Input*	-	Select
Region	*Input*	-	Select
Annual electricity consumption band	*Input*	-	Select
Annual consumption		kWh	
Operation			
Installation lifetime	*Input*	years	
System size	*Input*	kWp	
Annual degradation	*Input*	%	
Specific system yield	*Input*	kWh / kWp	
System cost			
Initial investment costs (CAPEX)			
Specific system cost	*Input*	EUR / kWp	
Investment subsidy (if any)	*Input*	EUR	
Applied system cost (scenario-based)	*Calc*	EUR	0
Operation and maintenance costs (OPEX)			
Fixed annual OPEX	*Input*	EUR / year	
Variable annual OPEX (relative to generated energy)	*Input*	EUR / kWh	
Cost escalation (annual) (scenario-based)	*Input*	%	0,0%
Other costs (e.g. annual land lease, insurance, software)	*Input*	EUR / year	

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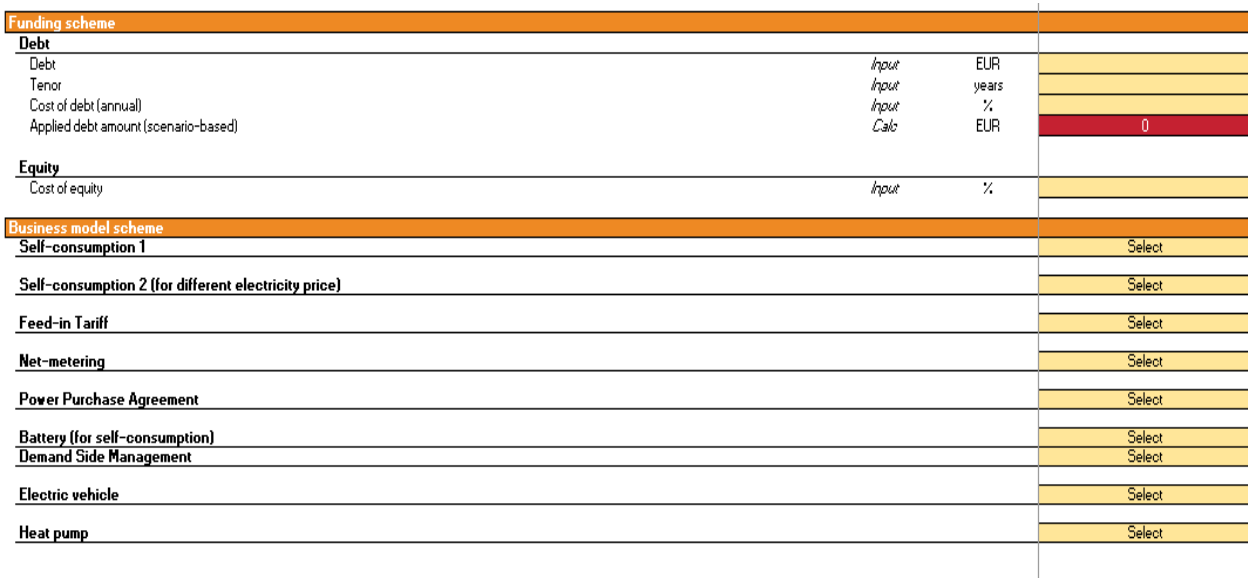
INPUT

Financial model for economic analysis of PV case study projects

The input sheet is divided in 4 subsections

Funding scheme

- Most relevant information with regards to the funding of the project
  - Debt
  - Tenor (duration of the debt)
  - Annual cost of debt
  - Applied debt amount
  - Equity
  - Cost of equity (return paid to investors for the risk undertaken)



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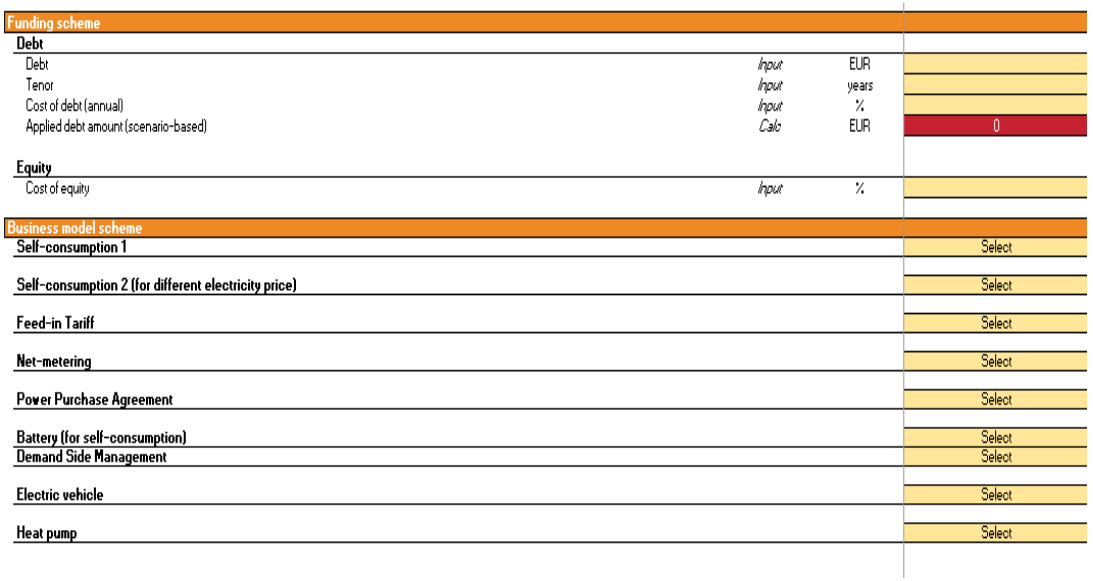
INPUT

Financial model for economic analysis of PV case study projects

The input sheet is divided in 4 subsections

Business model scheme

- Based on percentage rates
  - Self-consumption (either residential or industrial) Energy generated consumed instantly
  - Feed-in Tariff: Energy injected subject to feed-in-tariffs
  - Net-metering
    - Direct consumption
    - Net-metering credits (energy not self-consumed and injected into the grid)
    - Excess electricity (energy credits not compensated throughout the year remunerated at the end of the period)



Funding scheme			
Debt			
Debt	*Input*	EUR	
Tenor	*Input*	years	
Cost of debt (annual)	*Input*	%	
Applied debt amount (scenario-based)	*Calc*	EUR	0
Equity			
Cost of equity	*Input*	%	
Business model scheme			
Self-consumption 1			Select
Self-consumption 2 (for different electricity price)			Select
Feed-in Tariff			Select
Net-metering			Select
Power Purchase Agreement			Select
Battery (for self-consumption)			Select
Demand Side Management			Select
Electric vehicle			Select
Heat pump			Select

Source: **CREARA**

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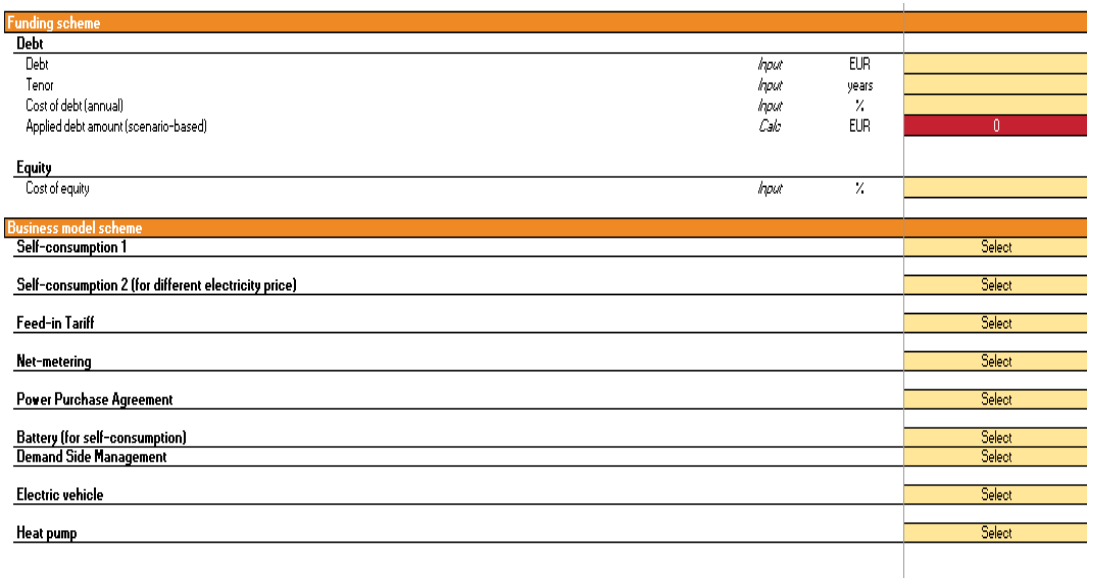
INPUT

Financial model for economic analysis of PV case study projects

The input sheet is divided in 4 subsections

Business model scheme

- Power Purchase Agreement
  - PPA supply (in accordance to the PPA contract)
  - Excess electricity (energy supplied on top of the contract)
  - PPA undersupply (penalties for not meeting the energy supply agreed in the contract)
- Battery
  - Analysis of the energy saved through the installation of a battery based on generation and consumption hourly curves built on a monthly basis
- Demand Side Management



Funding scheme			
Debt			
Debt	*Input*	EUR	
Tenor	*Input*	years	
Cost of debt (annual)	*Input*	%	
Applied debt amount (scenario-based)	*Calc*	EUR	0
Equity			
Cost of equity	*Input*	%	
Business model scheme			
Self-consumption 1			Select
Self-consumption 2 (for different electricity price)			Select
Feed-in Tariff			Select
Net-metering			Select
Power Purchase Agreement			Select
Battery (for self-consumption)			Select
Demand Side Management			Select
Electric vehicle			Select
Heat pump			Select

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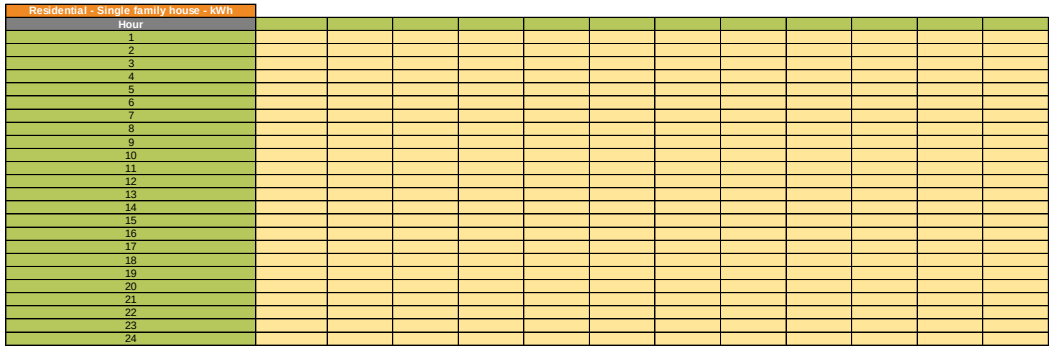
CONSUMPTION PROFILE

Financial model for economic analysis of PV case study projects

Allows users to manually introduce their consumption profiles, differentiating by sector

- Sectors
  - Residential - Single family house
  - Residential - Multifamily house
  - Commercial
  - Public building
  - Industrial
- It is necessary to include the number of buildings included in each of the profiles
- If the users do not have access to the hourly consumption and generation curves
  - The tool generates an estimate self-consumption rate
  - Introduce relative amount of consumption per profile on the



Residential - Single family house - kWh												
Hour												
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												

If you do not know your consumption profile, please fill in the data below

Segment	Relative consumption (%)
Residential - Single family house	
Residential - Multi family house	
Commercial	
TOTAL	INCORRECT

Source: **CREARA**

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GENERATION PROFILE

Financial model for economic analysis of PV case study projects

Users can manually introduce the % of energy consumed by hour and month

- If the user cannot provide said information, a default profile will be used
- EU Heroes tool allows users either to load their real production profiles (average day of each month, build upon average hourly values) or to use generalised preloaded production profiles for the administrative areas of each country.

GENERATION PROFILE (%)												
Hour	January	February	March	April	May	June	July	August	September	October	November	December
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
TOTAL	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR

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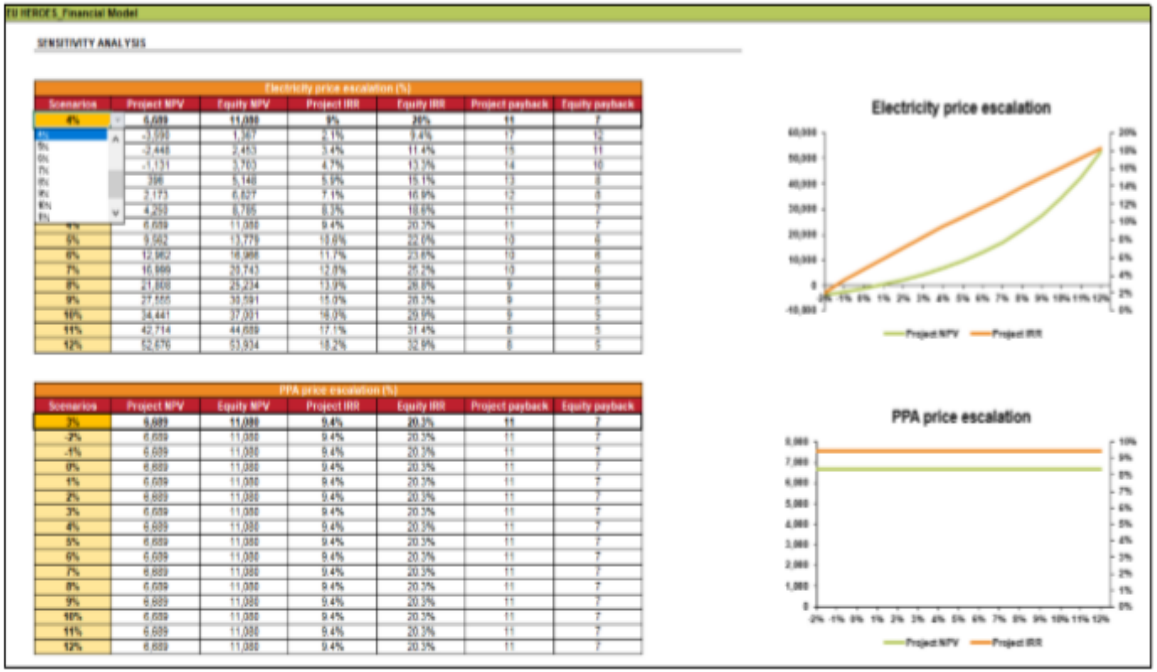
SENSITIVITY ANALYSIS

Financial model for economic analysis of PV case study projects

Allows the user to visualize the impact of some key parameters on the final profitability results of the project

- Users can modify the default value to be used in the base scenario for each of the categories by overriding the values in the cells in **yellow**
  - Electricity price escalation (%)
  - PPA price escalation (%)
  - OPEX costs escalation (%)
  - System price (EUR)
  - Debt amount (EUR)
- Analysis of how variations affect the profitability of the project (scenario analysis)



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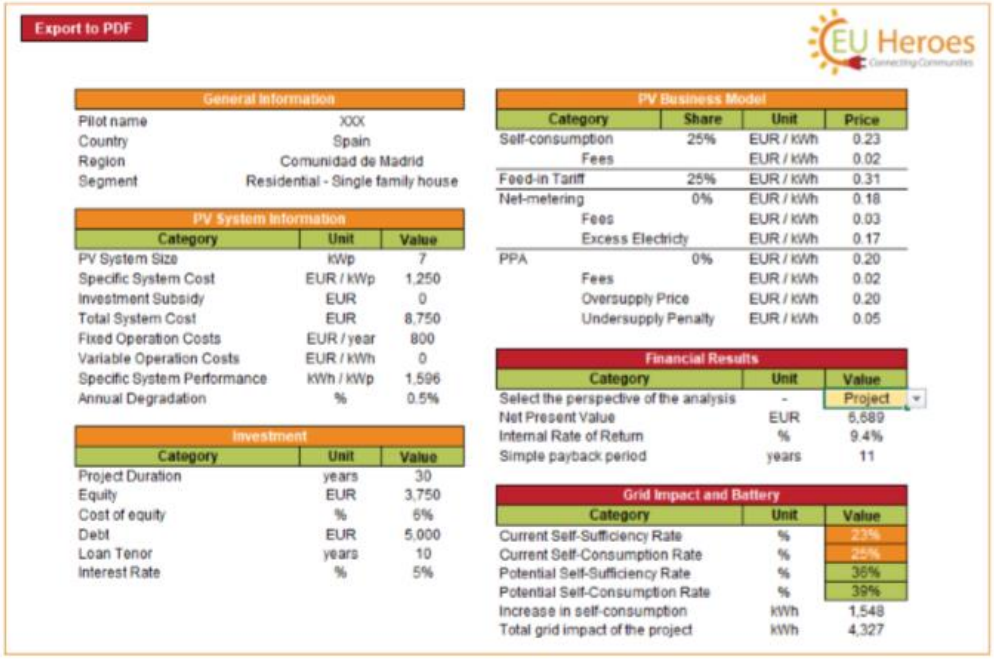
OUTPUT

Financial model for economic analysis of PV case study projects

Allows the user to visualize the impact of some key parameters on the final profitability results of the project

- Summary of the inputs inserted in the model
  - General information
  - PV System information
  - Investment
  - PV Business Model
- Profitability of the project and potential savings of battery with its grid impact results
  - Financial results
  - Grid impact and Battery



Export to PDF

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General Information	
Pilot name	XXX
Country	Spain
Region	Comunidad de Madrid
Segment	Residential - Single family house

PV System Information		
Category	Unit	Value
PV System Size	kWp	7
Specific System Cost	EUR / kWp	1,250
Investment Subsidy	EUR	0
Total System Cost	EUR	8,750
Fixed Operation Costs	EUR / year	800
Variable Operation Costs	EUR / kWh	0
Specific System Performance	kWh / kWp	1,596
Annual Degradation	%	0.5%

Investment		
Category	Unit	Value
Project Duration	years	30
Equity	EUR	3,750
Cost of equity	%	6%
Debt	EUR	5,000
Loan Tenor	years	10
Interest Rate	%	5%

PV Business Model			
Category	Share	Unit	Price
Self-consumption	25%	EUR / kWh	0.23
Fees		EUR / kWh	0.02
Feed-in Tariff	25%	EUR / kWh	0.31
Net-metering	0%	EUR / kWh	0.18
Fees		EUR / kWh	0.03
Excess Electricity		EUR / kWh	0.17
PPA	0%	EUR / kWh	0.20
Fees		EUR / kWh	0.02
Oversupply Price		EUR / kWh	0.20
Undersupply Penalty		EUR / kWh	0.05

Financial Results		
Category	Unit	Value
Select the perspective of the analysis	-	Project
Net Present Value	EUR	6,689
Internal Rate of Return	%	9.4%
Simple payback period	years	11

Grid Impact and Battery		
Category	Unit	Value
Current Self-Sufficiency Rate	%	23%
Current Self-Consumption Rate	%	25%
Potential Self-Sufficiency Rate	%	36%
Potential Self-Consumption Rate	%	39%
Increase in self-consumption	kWh	1,548
Total grid impact of the project	kWh	4,327

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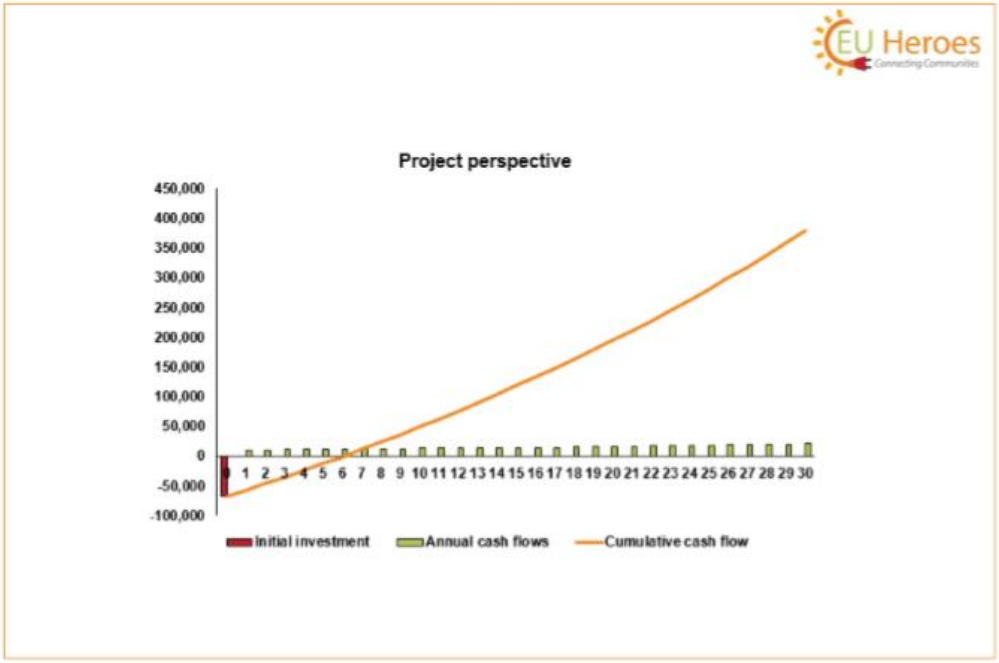
OUTPUT

Financial model for economic analysis of PV case study projects

Allows the user to visualize the impact of some key parameters on the final profitability results of the project

- Cash flows charts are available from the **project** and **equity** perspective including:
  - Initial investment
  - Annual cash flows
  - Cumulative cash flow



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