

# opentunity

OPENING the electricity ecosystem  
to multiple actors in order to have a real  
decarbonization opportunity



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## Project OPENTUNITY: Planning methodology for the distribution grid

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ICCS



GRID SERVICES  
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**GSM**  
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8<sup>th</sup> GRID SERVICES & MARKETS Conference

June 29<sup>th</sup> – 30<sup>th</sup>, 2026

- High electricity prices and a high dependence on carbon-based energy sources raise the alarm on energy poverty and climate change.
- The EU-funded **OPENTUNITY project** aims to change this by creating a **flexible and adaptable energy ecosystem** that reduces interoperability barriers and focuses on standards that help reduce emissions and costs.
- The OPENTUNITY project **aims to support energy actors**, such as grid operators, prosumers and market players by using **innovative methodologies** backed by **advanced and interoperable software modules** to provide them with **new features and services**.
- This includes **technologies** and **solutions**
  - ✓ to **increase flexibility** in prosumer environments and
  - ✓ to help grid operators **better manage grid operations**.

**Start:**  
January  
2023

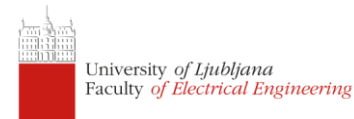
**End:**  
December  
2026

- **48** months
- **4** pilot locations
- **12** innovations
- **21** partners

etra I+D



Que  
technologies



anell

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UNE  
Normalización  
Española

NODES™

KOLEKTOR

reduxi

Elektro  
Primorska

avantcar  
Your Mobility Provider

Elektro Ljubljana

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AEM

HIVE POWER

University of Applied Sciences and Arts  
of Southern Switzerland  
SUPSI



## OPENGRID

*Supporting technologies for DSOs and TSOs to better manage grid issues.*

- Focus is placed on supporting technologies for DSOs and TSOs to better manage grid-related challenges.
- **ICCS** has developed a **Grid Management Software** for:
  - ✓ **Network Planning tool**
  - ✓ Short-term asset management (transformers)
  - ✓ Long-term asset management (smart meters)
  - ✓ Real-Time Thermal Rating Tool
  - ✓ State Estimation and Topology Identification

You are logged in as: *jkarak*

Log out

### Grid Management

- System Planning
- Asset Management - Transformers
  - Alarms & Oil Temp Forecas
  - Historical Data
  - Data Integration
- Asset Management - Smart Meters
  - EoL Curves & Critical Mete
- Thermal Rating
  - Dynamic Forecast
  - Historical Data
  - Data Integration
- State Estimation

## Welcome to Grid Management!



# opentunity

## Grid Management Software

### Log in

Username

Password

Log in

Please log in to continue



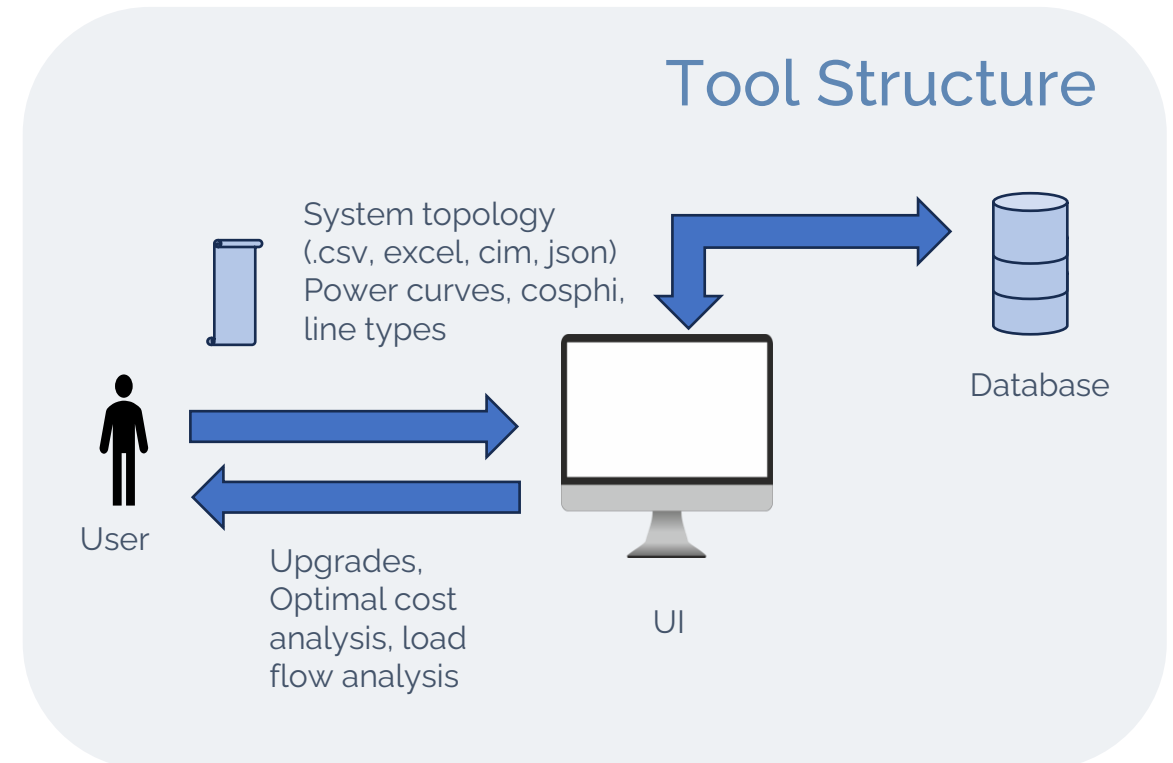
- One of the **core modules** of ICCS' Grid Management Software is the **Network Planning tool**
- The Planning tool considers the following **needs from system operators**:
  - ✓ **Lack of flexibility integration** leads to unnecessary grid upgrades and costs.
  - ✓ Traditional network planning relies on **long processing times**, limiting multi-scenario analysis.
  - ✓ DSOs need **user-friendly, fast, and interactive** planning solutions.
- In this respect, the following **challenges** have been considered:
  - ✓ Designing an optimization engine capable of **handling multi-year formulations**.
  - ✓ Addressing the **complexity of large-scale planning problems**, while ensuring the optimization remains solvable within **acceptable time limits**.
  - ✓ Developing a **fast**, yet accurate, **load-flow algorithm** to replace conventional methods — essential for achieving real-time scenario testing.
  - ✓ Limited availability of references in literature on the effect of local energy markets and **flexibility services on distribution planning**.



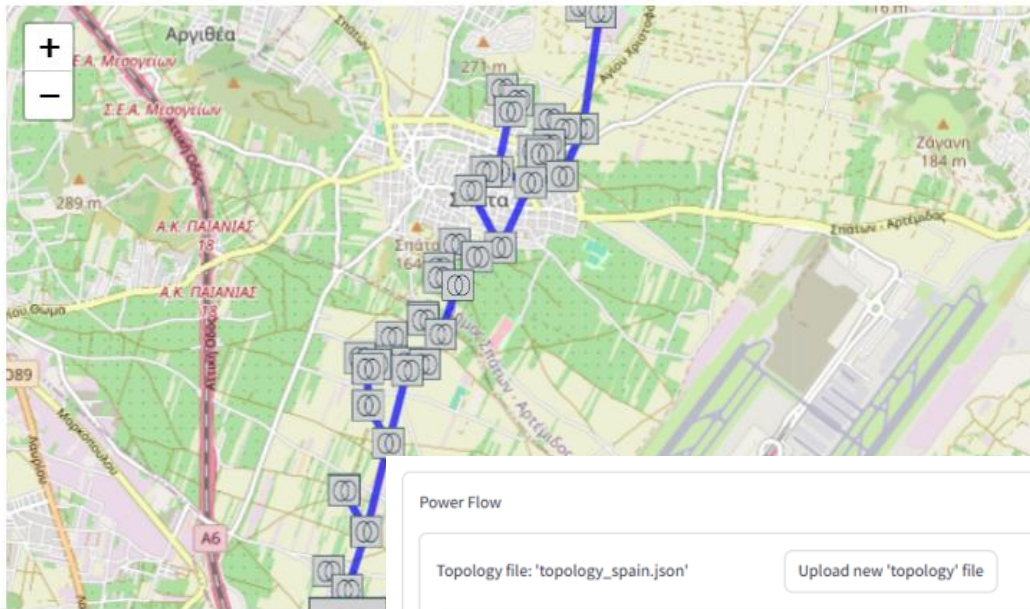
- Considering the previously mentioned needs for grid operators, ICCS developed the **Network Planning Tool** within the OPENTUNITY project:
  - ✓ An **interactive, very fast** (minute-scale) **solution** for DSOs to address the increasing demand and RES growth in a **timely, cost-efficient and reliable way**.
- The tool comprises **three core parts**:
  - 1. Fast Power flow calculations:**
    - ✓ The Fixed-Point Iteration (FPI) load-flow algorithm allows parallel processing
    - ✓ Over 100 times faster than conventional Newton Raphson methods.
  - 2. Advanced clustering methods**
    - ✓ The algorithm is based on K-Means clustering for scenario aggregation
    - ✓ The 365 daily profiles are grouped in three distinctive clusters.
  - 3. Advanced optimization techniques**
    - ✓ Advanced mathematical optimization techniques, MILP (Mixed-Integer Linear Programming) & MISOCP (Mixed-Integer Second-Order Cone Programming), that also integrate flexibility, and support:
      - i. Cost minimization
      - ii. Investment deferral
      - iii. RES maximization.



- A **user-friendly GUI** has also been developed:
  - ✓ Allows DSOs to easily configure scenarios and visualize results, supporting clear and efficient planning decisions.
- Within the OPENTUNITY project, the planning tool is currently being tested in **pilots** in the following countries:
  - ✓ Greece
  - ✓ Slovenia
  - ✓ Spain
- The following **test-cases** will be evaluated within the project:
  - ✓ *Investment Deferral*: Compute how much the investments in the network can be postponed through the utilization of flexibility.
  - ✓ *Grid planning while increasing RES integration*: Compute how much the RES integration can be increased with the effective utilization of flexibility.



The topology map is generated based on the loaded 'topology'. It shows the network structure, including buses, lines, and their connections.



- The user can upload the **topology file** of the examined network (included options: excel, cim, json)
  - ✓ The user can **view the topology map**
- The tool calculates the load-flow results based on:
  - ✓ **Files uploaded by the user** (including information on the system's load, etc.),
  - ✓ **Parameters** selected by the user (e.g. number of Planning Years, PV capacity planned within the examined planning period, etc.)

Power Flow

Topology file: 'topology\_spain.json' Upload new 'topology' file

The following lines are de-energized:

Modify de-energized lines

View ▾

---

Power curves file: 'power\_curves\_spain.csv' Upload new 'power curves' file

View ▾

---

Cosphi file: 'cosphi\_spain.csv' Upload new 'cosphi' file

View ▾

Power Flow Parameters

Planning Years  ?

Load Growth Rate (%)  ?

Select Substations Load Growth Rate ?

Choose options ▾

Select PV Locations ?

Choose options ▾

Calculate



Analysis Graphs Map

Lines Buses

name	Maximum Loading (%)	Year of Max
...	109.6	15
...	73.0	15
...	44.4	
...	36.0	
...	17.4	
...	16.6	
...	16.4	
...	11.2	
...	5.1	
...	4.3	

Analysis Graphs Map

Lines Buses

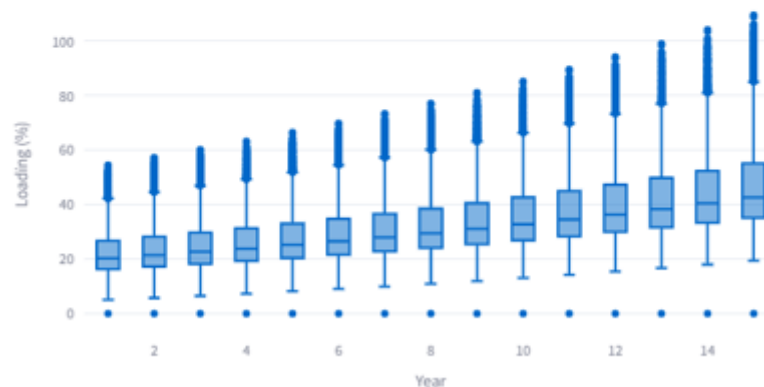
Lines

Loading of [selected line]

Power Flow Results ^

Optimization

- The **power flow results** are presented to the user via the developed **GUI**
- The user can view **detailed information for the lines** or the buses.
- The user can also view the **results in the form of graphs**
  - ✓ For instance, a **box-plot** with the results appear, indicating information on the maximum, minimum, etc. voltage/loading (for selected lines/buses)
- The user can also **view the results in a map**
  - ✓ Different coloring in the lines indicates their loading



Optimization Goal  
Investment Deferral

Economic Parameters

Interest Rate (%)	Flexibility Price (€/MWh)	Energy Price (€/MWh)	Investments Year	Inflation Rate (%)	Involuntary RES Curtailment Price (€/MWh)	Involuntary Load Shedding Price (€/MWh)
5,00	70,00	50,00	10	5,00	5000,00	5000,00

Flexibility Parameters

Maximum Flexibility (% of available power)	RES Power Factor Limit	Maximum Flexibility (% of demand)
5,00	0,80	5,00

Battery Energy Storage System Parameters

Select candidate storage buses  
Choose options

Optimization Results

Power Flow

Calculate

Save System Planning

➤ The following (optimization) **planning options** are provided:

1. Investment deferral
2. Cost reduction
3. Optimal Investment for RES Maximization

➤ The user easily provides the optimization **economic and flexibility parameters via the UI**

Optimization Goal  
Optimal Investment for RES Maximization

Economic Parameters

Interest Rate (%)	Flexibility Price (€/MWh)	Budget Constraint (€)
5,00	70,00	40000,00

Flexibility Parameters

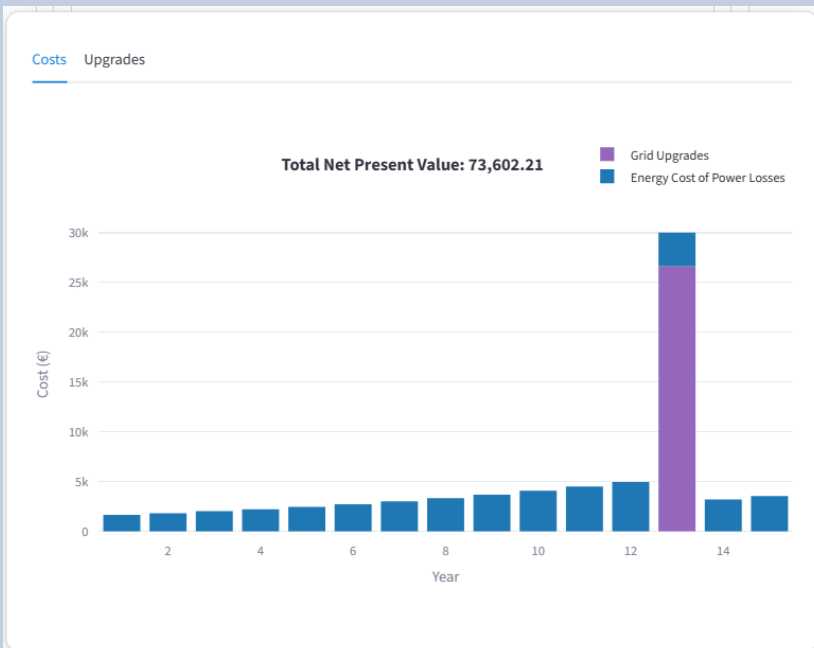
Maximum Flexibility (% of available power)	RES Power Factor Limit
20,00	0,80

➤ **Results** are calculated **very fast (minute-scale)** thanks to:

1. **Advanced clustering methods** (efficient grouping of daily profiles in three distinctive clusters)
2. **Advanced optimization techniques** (MILP & MISOCP)



### Scenario-1: Flex. 5%



Optimization Results ^

Costs Upgrades

Lines BESS

Line Type	Line Name	Cost (€/km)
		26,641.13

**Investment deferral:** Indicative examined scenarios

Scenario-1: flexibility offered by demand and RES is equal to **5%**:

- The **flexibility is not enough** in this case **to avoid grid upgrades**
- **Grid upgrades are required in year-13:**
  - ✓ Their cost is visible in the diagram
  - ✓ Additional details are provided in the GUI (specific line to be upgraded and relevant cost).

Scenario-2: flexibility by demand and RES is **increased to 20%**

- The flexibility is enough in this case to **avoid grid upgrades**
  - ✓ **No grid upgrades are required.**

### Scenario-2 Flexibility 20%



Optimization Results ^

### Scenario-A: Flex. 5%

Upgrades		Hosting Capacity
Name	Hosting Capacity (kW)	
Total	3,477.58	
[Image]	629.99	
[Image]	629.95	
[Image]	399.99	
[Image]	399.98	
[Image]	399.98	
[Image]	399.70	
[Image]		
[Image]		
[Image]		

Upgrades			Hosting Capacity
Line Type	Line Name	Cost (€/km)	
[Image]	[Image]	26,641.13	

- The tool also allows planning with the option for **'Optimal Investment for RES Maximization'**
  - ✓ Results indicate:
    - ✓ The RES Hosting Capacity that can be achieved (Total and per bus)
    - ✓ The required upgrades (in each line) and their relevant cost
- Indicative case **examining two cases of flexibility** in the Spanish network:
  - ✓ *Scenario-A*: 5% RES offered flexibility
  - ✓ *Scenario-B*: 20% RES offered flexibility
- The **hosting capacity can be increased** when **increasing the RES flexibility** that can be offered

Scenario	RES Flexibility	Total RES hosting capacity
Scenario-A	5 %	3478 kW
Scenario-B	20%	+9%: 3780 kW

### Scenario-B: Flex. 20%

Upgrades		Hosting Capacity
Name	Hosting Capacity (kW)	
Total	3,780.00	
[Image]	630.00	
[Image]	630.00	
[Image]	400.00	
[Image]	400.00	
[Image]	400.00	
[Image]	400.00	
[Image]	400.00	
[Image]	160.00	
[Image]	160.00	



- The **OPENTUNITY Planning Tool** provides DSOs with a **fast, interactive** and **user-friendly methodology** for **distribution grid planning** under increasing demand and RES penetration.
- By combining **fast power-flow calculations, scenario clustering** and **advanced optimization techniques**, the tool enables multi-year and multi-scenario planning over practical computation times.
- The developed methodology supports **essential DSO planning objectives**:
  1. Investment deferral
  2. Cost reduction
  3. Maximization of RES hosting capacity.
- The integration of **flexibility services** into the planning process can reduce or postpone the need for conventional grid reinforcements.
  - ✓ **Higher flexibility** availability can **help avoid network upgrades** that would otherwise be required.
  - ✓ **Increased flexibility** can enable **higher integration of renewable generation** in distribution networks.
- The planning tool contributes to the **wider OPENTUNITY objective** of enabling **decarbonization** through **smarter grid operation and planning**
  - ✓ By supporting the **cost-efficient, flexible** and future-oriented **grid planning**



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## THANK YOU!

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