

InfraFair: Infrastructure Cost Allocation – 1st WS



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- 1 Introduction
- 2 Modelling
- 3 Installation

Introduction



The Problem

Infrastructure (network) cost allocation

- Who will pay the investment cost for new infrastructure projects?
- How do we recover the cost of existing network assets?
- ...etc.

Regulatory questions

- How do structure network charges?
- Do charge generators or only demand? How much each?
- ...etc.





Search Ctrl + K

Getting Started

Introduction
Installation
Quick Start

Examples

Electricity Networks ✓
Gas Networks ✓
Heat Networks ✓

Model Details

Mathematical Formulation
Input Data
Output Results

Help & References

Release Notes
Contributing
Research Projects
Contact Us



InfraFair™

"Fairness in allocating infrastructure cost"

InfraFair is an open-source modelling tool for infrastructure cost allocation that can be used for any flow-based energy infrastructure, such as the electricity, gas, heat and hydrogen infrastructure.

The tool has been developed at the [Instituto de Investigación Tecnológica \(IIT\)](#) of the [Universidad Pontificia Comillas](#).



Documentation

Getting Started

- [Introduction](#)
- [Installation](#)
- [Quick Start](#)

Examples

- [Electricity Networks](#)
- [Gas Networks](#)
- [Heat Networks](#)

Model Details

- [Mathematical Formulation](#)
- [Input Data](#)
- [Output Results](#)

Help & References

- [Release Notes](#)
- [Contributing](#)
- [Research Projects](#)
- [Contact Us](#)



Read the Docs

<https://infrafair.readthedocs.io/en/latest/#>



<https://github.com/IIT-EnergySystemModels/InfraFair/tree/main>

python

3.8 | 3.9

pypi package

1.1.0

License

AGPL v3

docs

passing

downloads

3k



Development goals

- **Simplicity** and **transparency**
- Code written to be read by humans
- **Scalability**: from small- to large-scale cases
- **Flexibility**: optional inputs and cost allocation criteria
- Strong orientation to computational **efficiency** using matrix operation
- **Verifiable** results
- Developed in **Python**
- Input data and output results in text format (csv)

```
1 # checking response.status_code (if you get 502, try rerunning the code)
2 if response.status_code != 200:
3     print(f"Status: {response.status_code} - Try rerunning the code!")
4 else:
5     print(f"Status: {response.status_code}\n")
6
7 # using BeautifulSoup to parse the response object
8 soup = BeautifulSoup(response.content, "html.parser")
9
10 # finding Post images in the soup
11 images = soup.find_all("img", attrs={"alt": "Post Image"})
12
13 # downloading images
14 for i in range(len(images)):
15     r = requests.get(images[i].src)
16     with open(f"image_{i}.jpg", "wb") as f:
17         f.write(r.content)
```



- 1 Introduction
- 2 **Modelling**
- 3 Installation

Modelling



InfraFair

InfraFair is a modelling tool aimed at computing the allocation of the cost of energy infrastructure according to the economic use expected to be made by users, in order to drive efficient investment decisions and facilitate agreements on new projects.



InfraFairTM
Infrastructure Cost Allocation

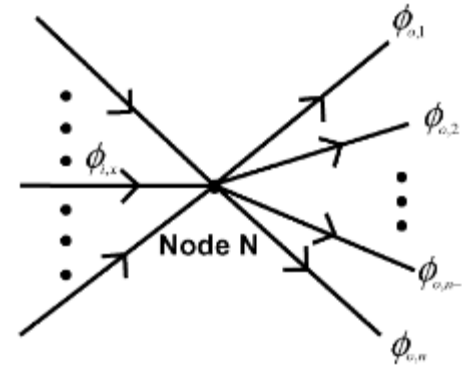


Modelling methodology

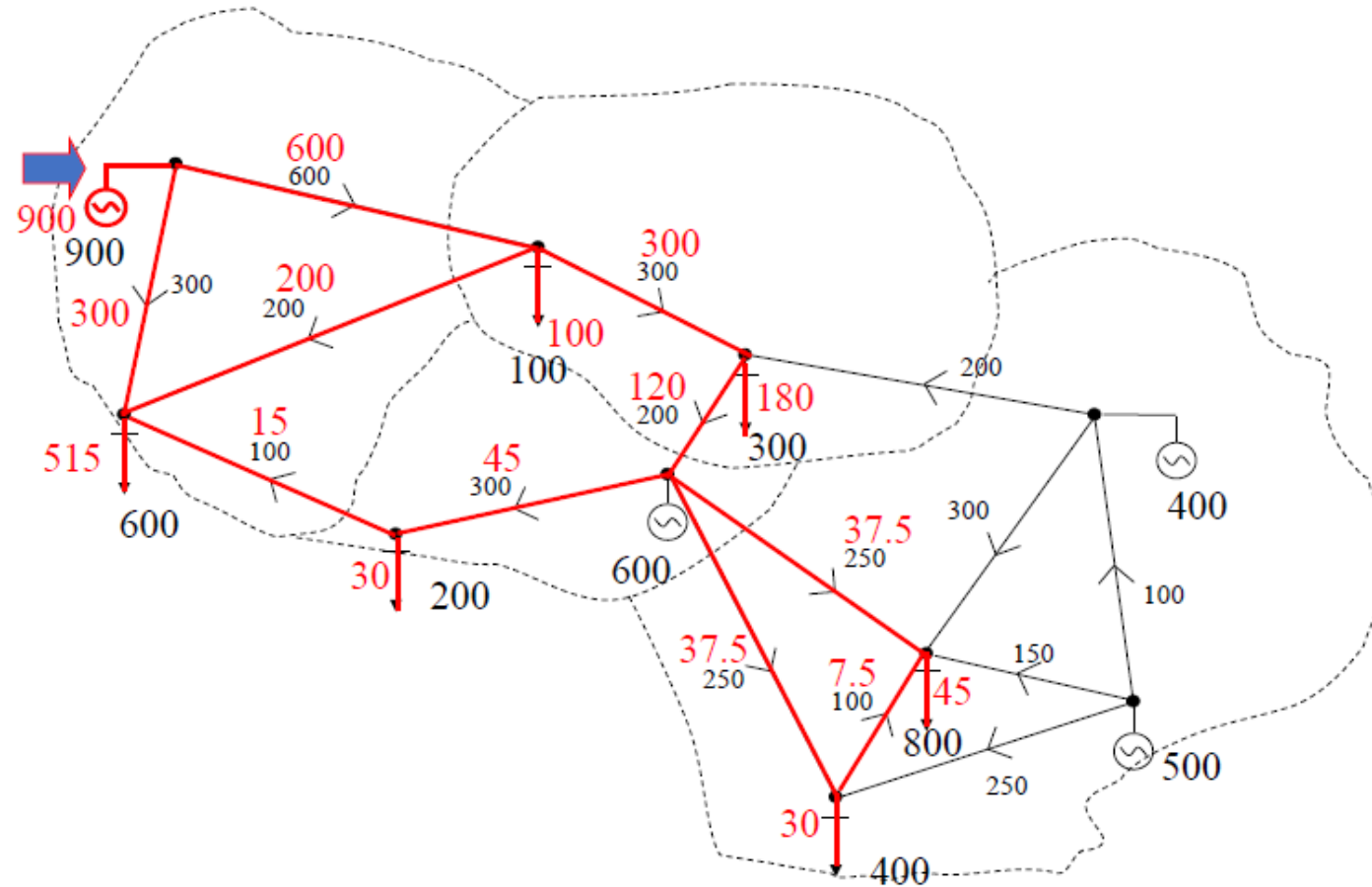
The modelling tool employs the **Average Participations Method (APM)**, which allocates the cost based on the usage that each user makes of each infrastructure asset as a reasonable proxy to the benefits.

The basic intuition behind the **APM** is that energy consumed by demands and produced by generators, as well as the responsibility for causing energy flows, can be assigned by employing a **simple heuristic rule** that only uses the actual pattern of flows in the infrastructure network.

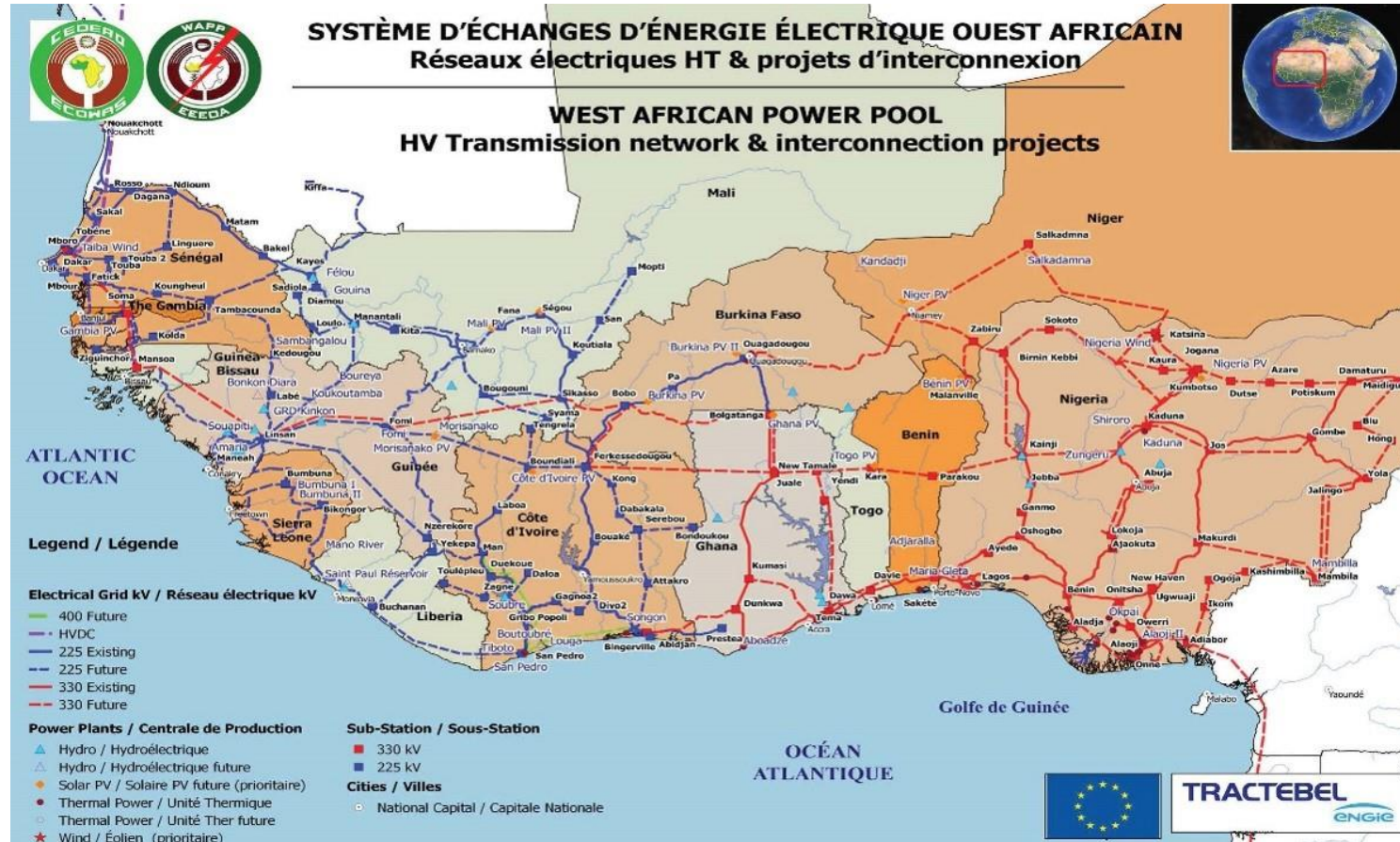
$$C(\phi_{(i,x)}, \phi_{(o,y)}) = \phi_{(i,x)} \frac{\phi_{(o,y)}}{\sum_{j=a}^n \phi_{(o,j)}}$$







Modelling methodology



Geographical representation



-  Node
Electrical node
-  Zone
NUTS2, NUTS3
-  Area
Country
-  Region
CSW, CSE, CCS



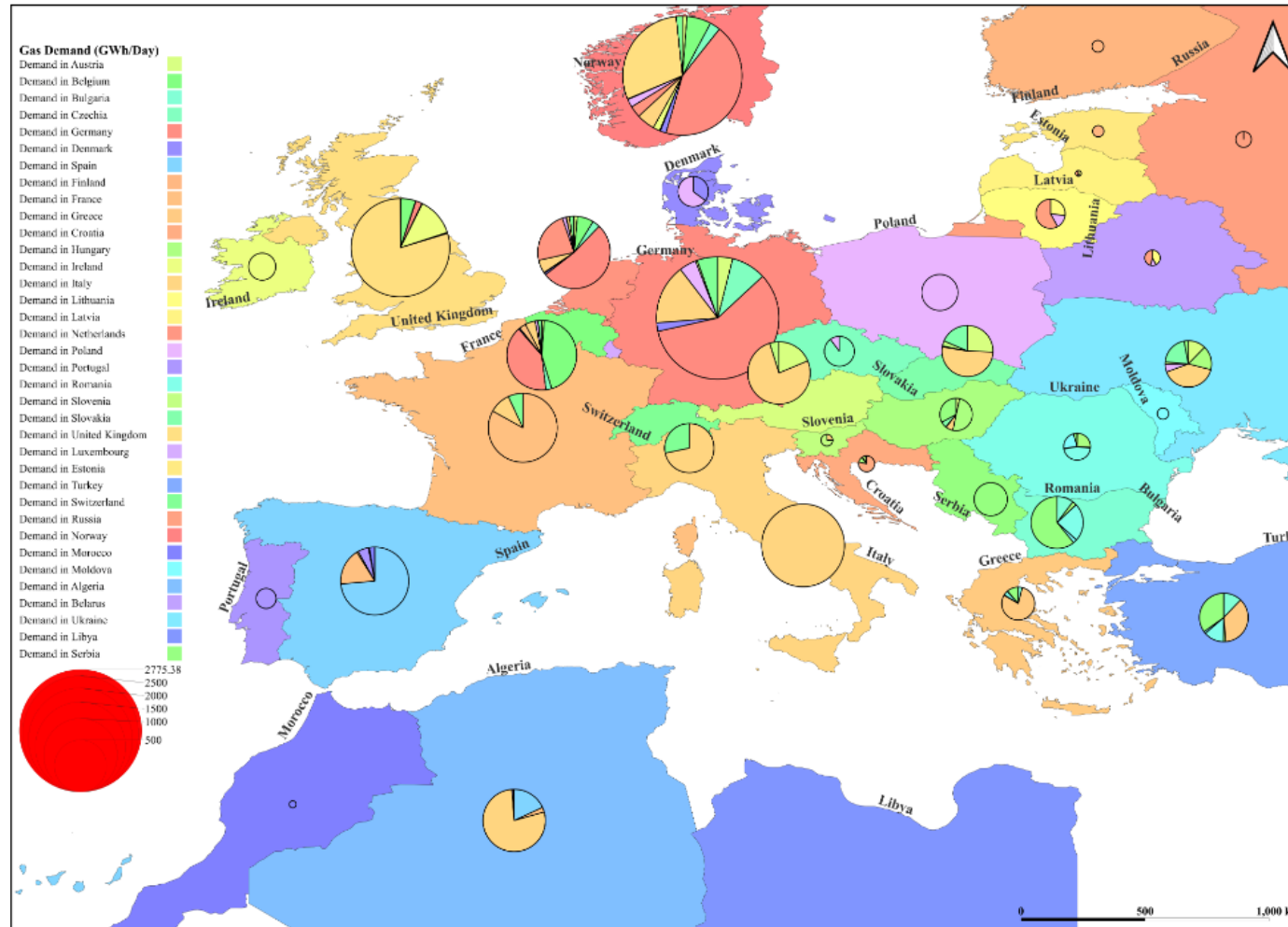
Functionality

When provided with hourly representative snapshots, **InfraFair** can calculate (per snapshot and overall annual weighted average):

- Individual agent or country **flows, losses and cost contributions** to each asset in the network.
- Individual agent or country **utilisation** of each asset in the network.
- Individual Agent or country **flows, losses and cost contributions** to similar aggregated assets.
- Individual agent or country **utilisation** of similar aggregated assets.
- Individual Agent total **cost contribution** to be paid.
- Individual agent or country **utilisation** of the whole network.
- Country **flows, losses and cost contributions** made of the use of each other country.
- Country **total flow and cost contributions** made of the use of the rest of the network.
- Country **flows, losses and costs** incurred from the use made by the rest of the countries.



Output results



InfraFair structure

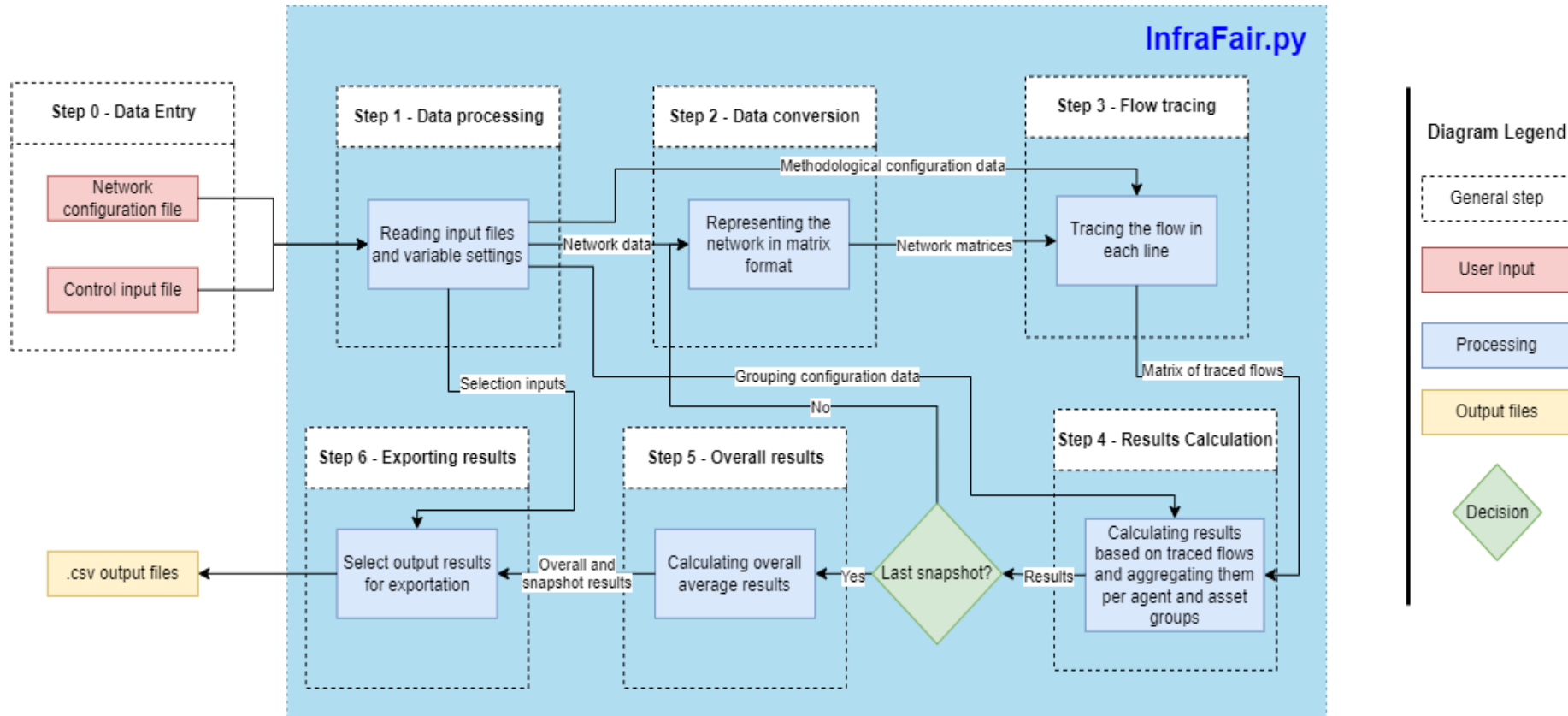


Figure 1: InfraFair architecture showing the execution steps with an arrow representing the movement of data between them.

- 1 Introduction
- 2 Modelling
- 3 Installation

Installation



Installation

1. Install Python (3.8 or 3.9) using the **cmd** or **Miniconda** or **Anaconda**.
2. Type:

```
> pip install InfraFair
```

2. Alternatively, download the repository from GitHub and run the source code.

Dependencies

- [pandas](#) for storing network data.
- [numpy](#) for calculations, such as matrix manipulation.
- [matplotlib](#) for aggregating results.





Thank you for your attention!

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