OpenMod Africa

InfraFair: Infrastructure Cost Allocation – 1st WS

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November 07, 2024

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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.

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

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

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)

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.

InfraFair — Infrastructure Cost Allocation

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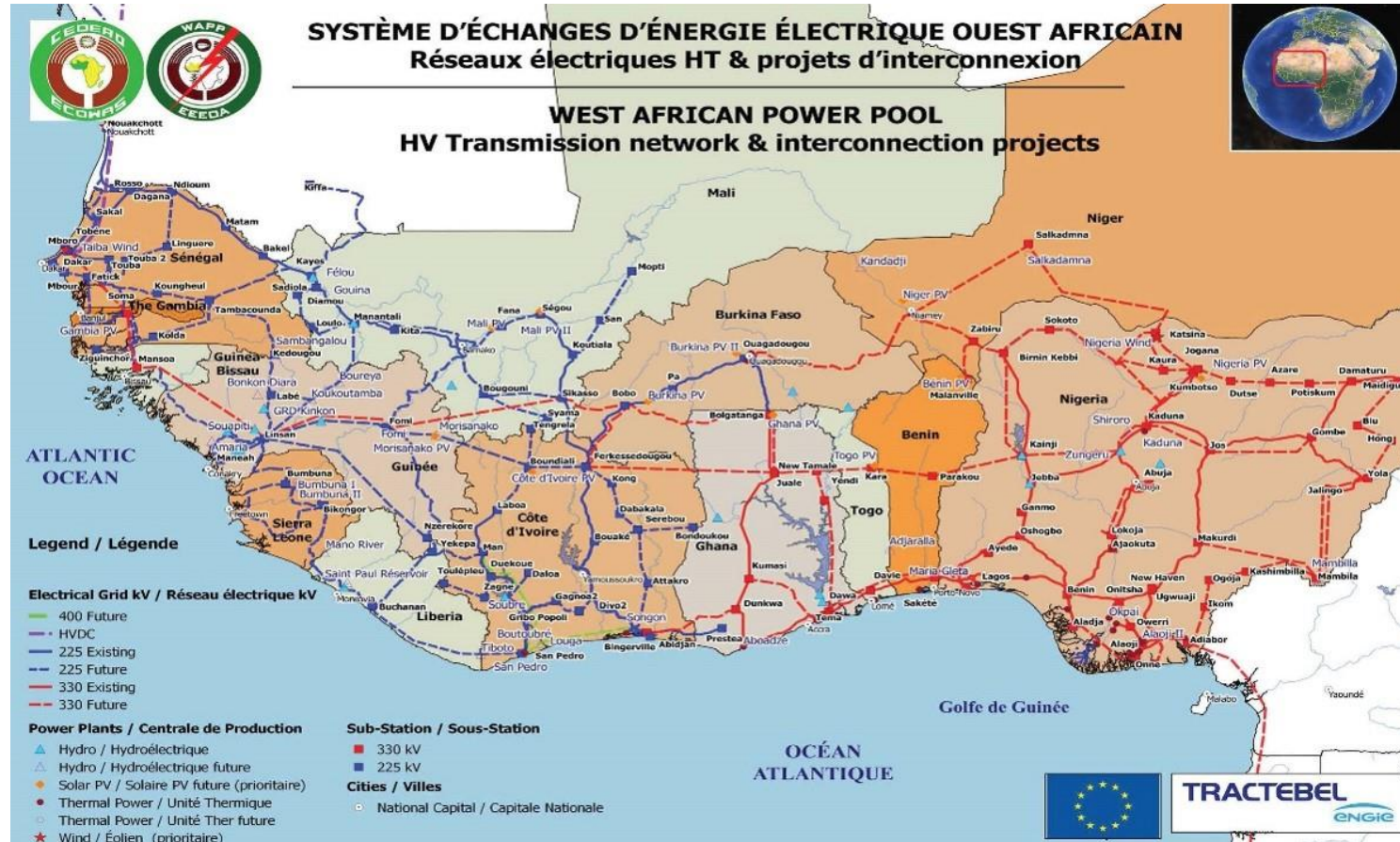
$$C(\phi_{(i,x)}, \phi_{(o,y)}) = \phi_{(i,x)} \frac{\phi_{(o,y)}}{\sum_{j=a}^{n} \phi_{(o,j)}}$$
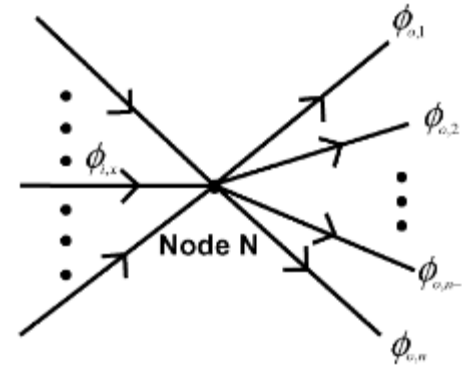
Modelling methodology
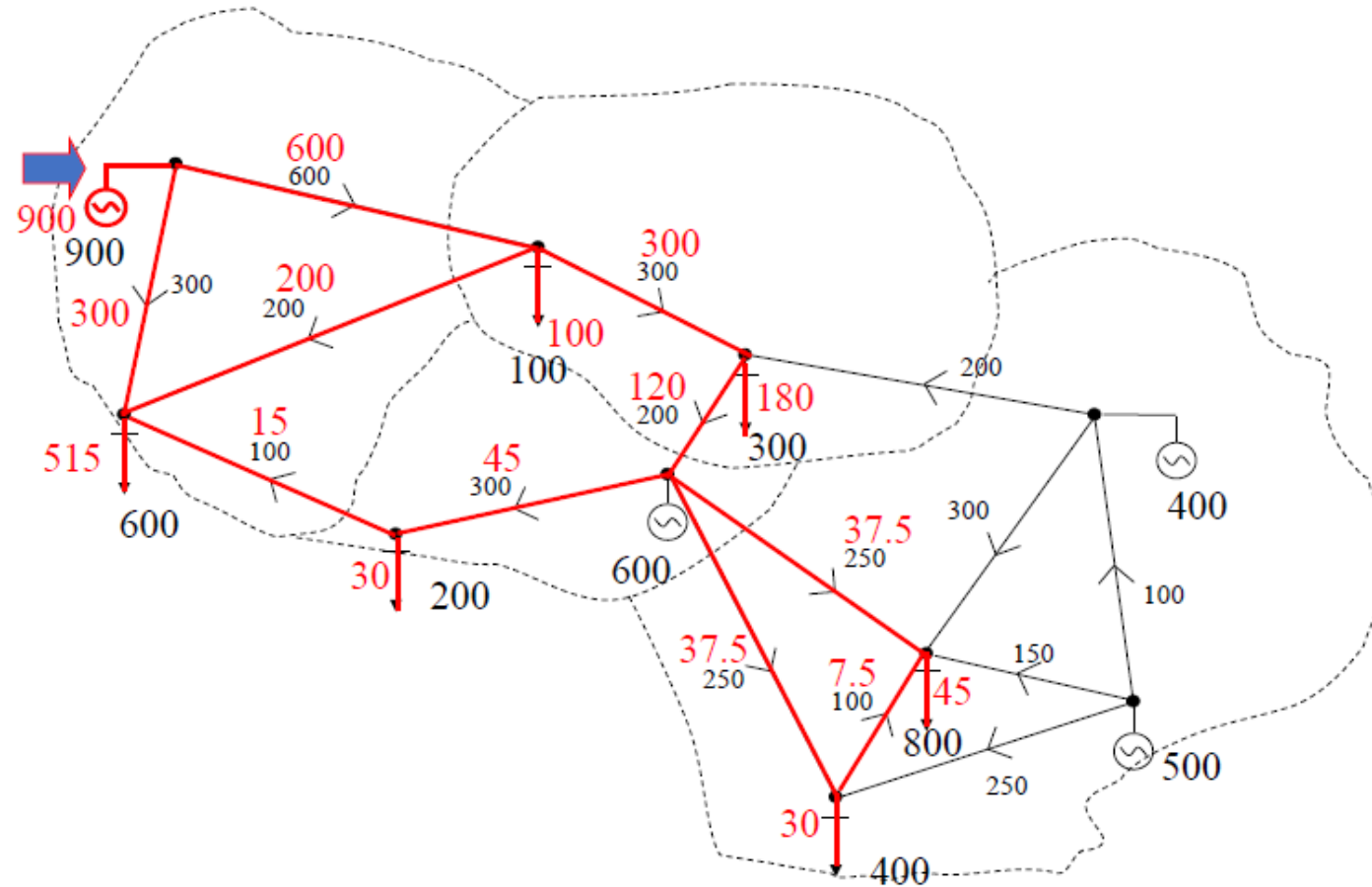
Geographical representation

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.
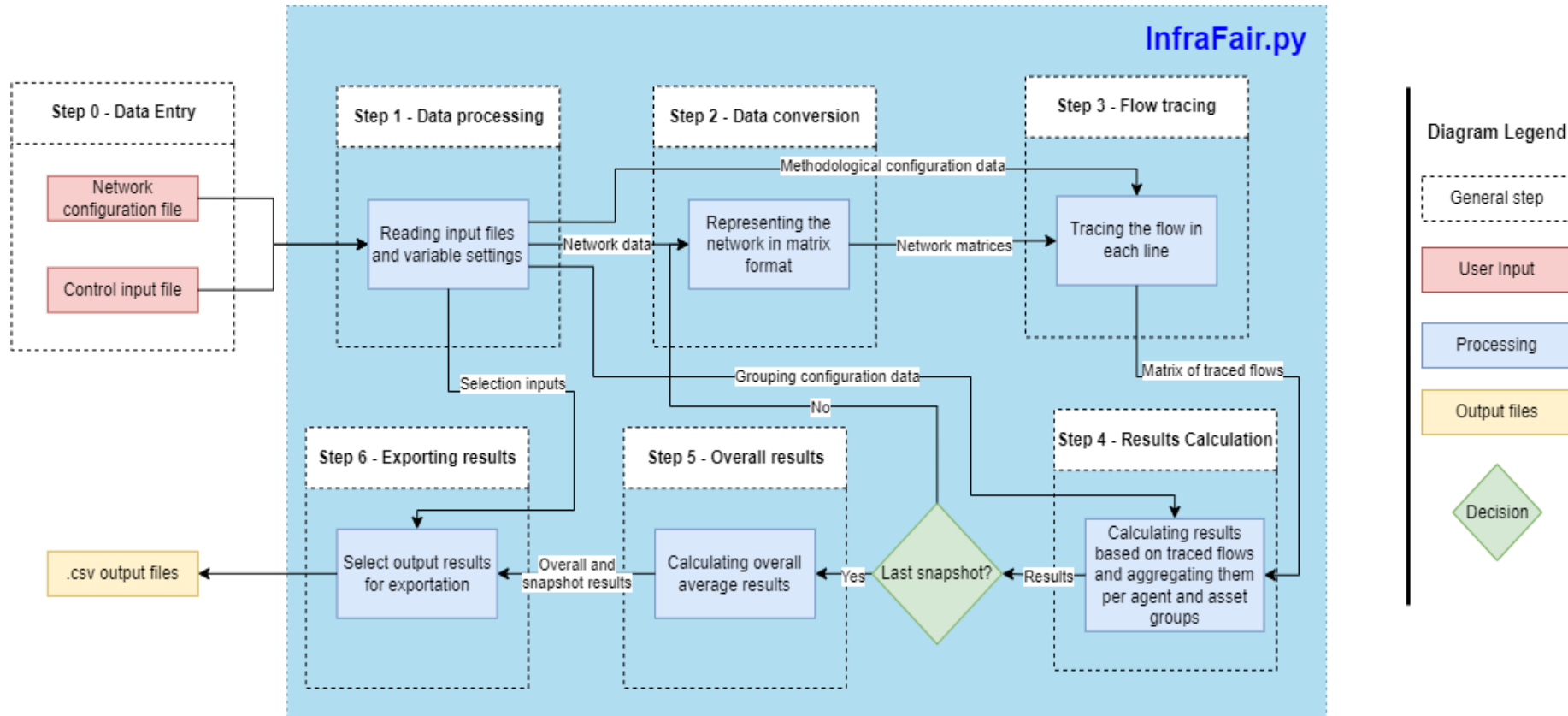
Output results
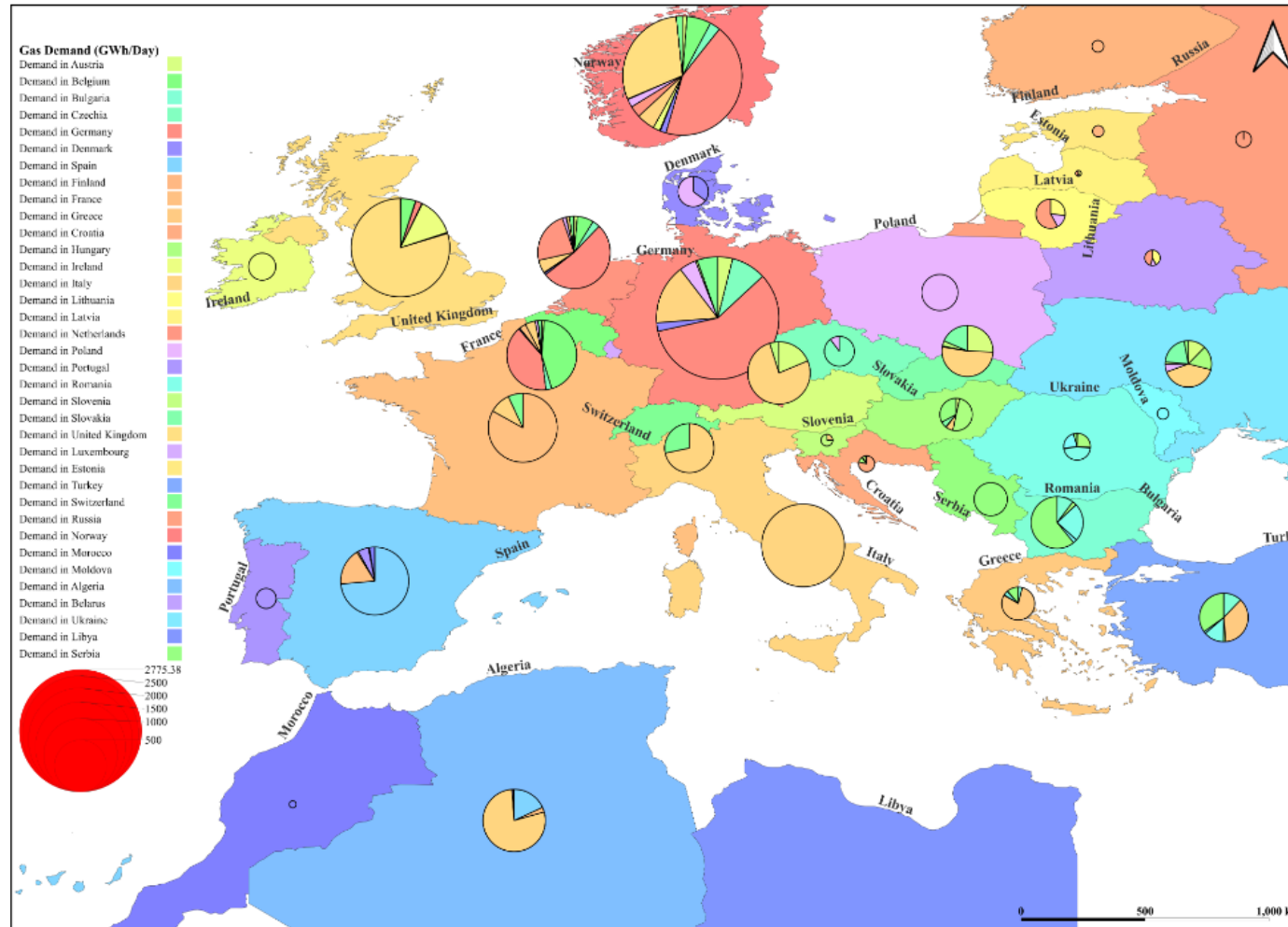
InfraFair structure

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

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