161 – A risk-based planning tool for integrated urban energy systems

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Introduction

The **uncertainty** introduced by RES can generate **contingencies not previously considered**. To overcome this issue, one solution is to exploit the flexibility of energy resources taken from elements of the electrical network but also from other energy systems exploiting the **sector coupling paradigm**. To deal with such plethora of resources an alternative solution is to adopt **robust optimization**.

Integrated gas and electricity flexibility model

The paper aims to develop a *model* that is *robust to uncertainties*, ensuring the Distribution System Operator (**DSO**) can **resolve contingencies** that may occur in the network. To do this, the optimization model wants to **reduce** the **costs of flexibility services** offered by the various resources distributed in the network. These resources result from a **multi-energy system** model.
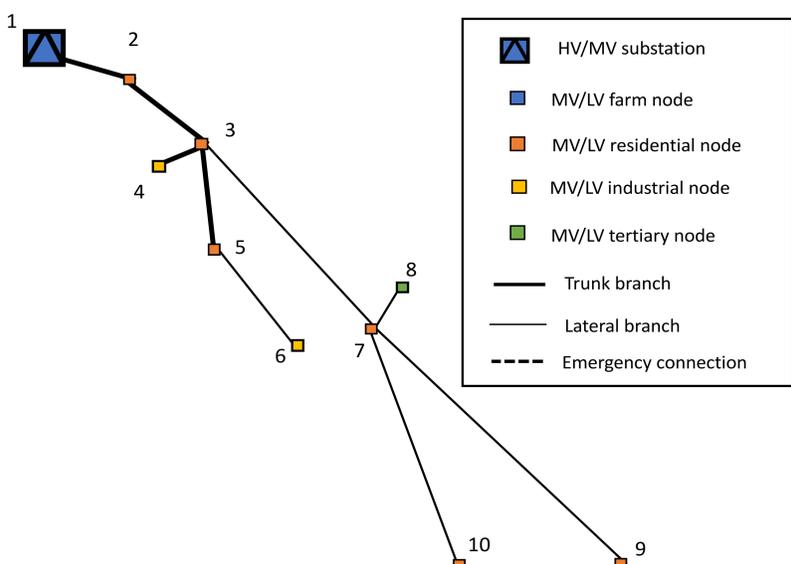
$$\min\left\{\sum_{t=1}^{T}\sum_{i\in N_{EH}}\left[c_{i,t}^{up,\mathbb{R}}\cdot\Delta P_{i,t}^{up,\mathbb{R}}+c_{i,t}^{down,\mathbb{R}}\cdot\Delta P_{i,t}^{down,\mathbb{R}}\right]\right\}$$

$s.t.:$

Electricity grid constraints
Gas grid constraints
Linepack constraints
Resources constraints
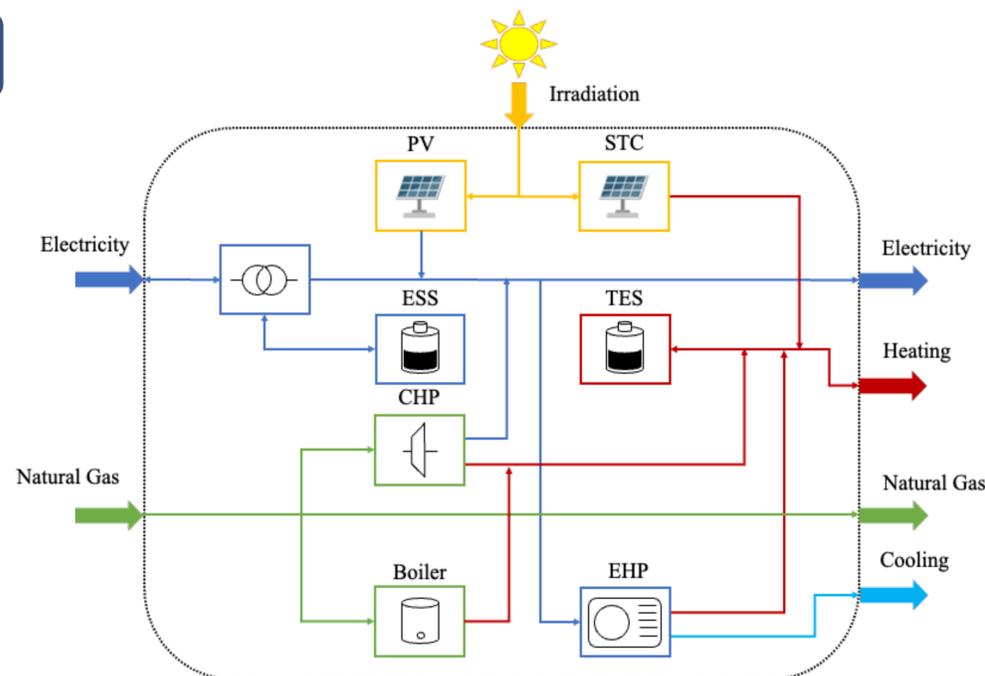
Given the multiple models of multi-energy systems, the **energy hub concept** is the tool adopted in the paper. This tool *represents the interactions and constraints of the resources involved* in a multi-energy system.

Case Study and Conclusion

The methodology is tested on a MV distribution network. During normal operating conditions, **excessive voltage drops** and **pressure drops** may appear in the peripheral nodes.

The methodology correctly identifies the flexibility services able to solve contingencies of electrical and gas networks. The *methodology* proposed can *dealt with uncertainties from different energy resources*.