Simulation of Energy-Autonomous Regions
24/7 Intelligent Project[1]

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1 Background

This graduation project is part of the 24/7 Intelligent project: a joint project between all eight faculties of TU Delft in cooperation with The Green Village.

On The Green Village, infrastructure will be created for a fully self-supporting local energy system. The energy system will contain a hydrogen, an electricity, and a heat network. The motivation for this project is the decarbonisation of the built environment and the focus on sustainable energy supply and use in this environment.
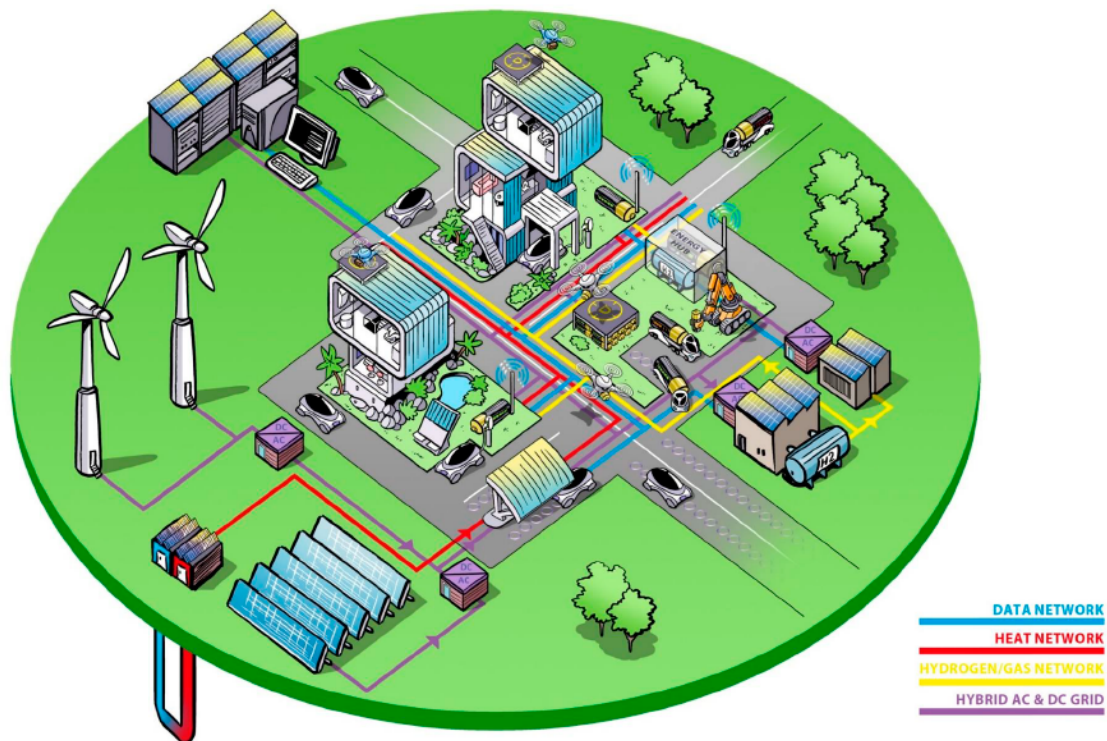

Figure 1: Intelligent 24/7 Green Autonomous site

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[1] https://thegreenvillage.org/24-7-autonomous/

2 Goal of the project

One of the challenges within this project is to simulate the flow of gas, power, and heat in this autonomous environment, given demand and supply. The goal of these simulations is to determine the voltages and pressures of the different energy carriers in the network. These give insight into the state of the energy system and helps to safely operate the system.

It involves solving the loadflow problem, which is a steady-state problem containing a set of non-linear algebraic equations. It is often solved using modified versions of the Newton-Raphson method.

The 24/7 Intelligent site gives us the unique opportunity to validate mathematical theory in practice, which is normally a difficult task as data is often not available. You will work in close contact with TGV to make sure the tool is easy to understand and use.

3 Who are we looking for

We are looking for a student with interest in the energy transition, who enjoys working in collaboration with people from different backgrounds and on a real-life problem. The recommended programming language is Python.

4 The Green Village

The Green Village is a field lab for sustainable innovation in the urban environment, located on TU Delft Campus. Knowledge- and educational institutions, entrepreneurs, government bodies and civilians can research, experiment, validate and demonstrate their sustainable innovations related to the energy transition and climate adaptation. By paying attention to technical, corporate, social and policy-based challenges, it helps innovative parties accelerate from theory to practice. The Green Village is a place where people live, work and learn, exempt of standard rules and regulations, since the construction code is partially inactive. With access to the innovation ecosystem of TU Delft, science is literally around the corner.

5 Literature

Markensteijn, A. S., Romate, J. E., & Vuik, C. (2020). A graph-based model framework for steady-state load flow problems of general multi-carrier energy systems. Applied Energy, 280, [115286]. `https://doi.org/10.1016/j.apenergy.2020.115286`

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