

Master Thesis Proposal 2023-2024

Preliminary studies on the capacity of natural gas networks to store energy from renewable electrical sources and to generate electrical energy to the electrical grid

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Context

The decarbonization of energy leads to an increasingly massive connection of electric generators powered by renewable energy sources, mainly solar and wind, to the electricity grid. The production variability of solar and wind sites requires the systematic association of high-capacity energy storage in order to be able to respond to fluctuating energy demands. The hundreds of thousands of kilometers of natural gas pipelines provide an important energy storage system that deserves closer analysis (concept of linepacking) since the energy stored by the gas can, for example, be adjusted by the pressure of the gas inside the conduits. By replacing the gas turbines that drive the compressors with electric motors, it is possible to ensure an electric to gas conversion by increasing the gas pressure in the ducts. Moreover, by installing electrical generators connected to turbines placed at the gas expansion points, it is possible to ensure a gas-to-electric conversion function.

Figure 1 proposes an example of the proposed topology to be studied.

Objectives

- Analysis of the international initiatives on this topic
- Numerical modelling of test benches (Matlab-Simulink)
- Validation of the models using existing data
- Development of energy management strategies with different objectives (Maximum efficiency, availability, ...)

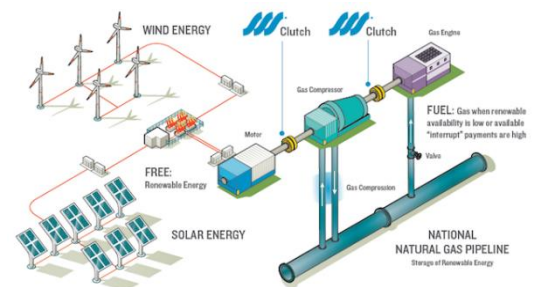


Figure 1: Example of studied topology [1]

References

- [1] [Could the Pipeline Network Solve the Renewable Storage Problem? \(renewableenergyworld.com\)](https://renewableenergyworld.com)
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