Ongoing synergies between gas and electricity grids: back to the future?

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Overview

The energy sector is experiencing massive evolutions: support of self or local renewable production (e.g. solar, wind, biomethane…) and development of new uses (e.g. self-consumption and electric & gas mobility). The smart grid solutions aim to make distribution grids more flexible and to cope with variable renewable energy sources and new loads. They also intend to enable active consumers and (local) energy communities, supporting their participation in the energy markets (Verbong, Beemsterboer, & Sengers, 2013). Digital technology is at the heart of this evolution as smart grid is an upgraded energy network to which two-way digital communication between suppliers-consumers and intelligent metering and monitoring systems have been added. Hence, its deployment induces new services and creates new business opportunities for both incumbent and new stakeholders.

In this regard, the 'Clean energy for all Europeans' package, (also known as the Winter Package) proposed late 2016 by the European Commission, relies on smart technologies, solutions and concepts to accelerate, transform and consolidate the EU economy's clean energy transition. Over the last few years, investment in smart grid research and development (R & D) and demonstration activities have grown considerably in Europe. Most of them concerned smart **electricity** grid projects while smart **gas** grid projects are still marginal: by default, smart grid is often synonymous of smart electricity grid in the existing literature (see for instance Joint Research Center, 2017). One reason may be that expected customers benefit are lower in ther case of smart gas grids (Di Castelnuovo & Fumagalli, 2013). Still, the smart meter roll-out also concerns gas and some smart gas grid projects are currently under exploration and some will become soon operational.

The ambitions of this paper are twofold. First we want to explore what is (or could be) a smart gas grid and what are its potentials. Second, taking advantage of the abundant ongoing and existing research on smart electricity grids, we question to which extent the smart gas grid can learn and profit from the smart electricity grid and vice versa. More generally, we discuss the interests, needs or requirements for these smart grids to develop in synergy to another.

Methods

This paper focused on the French context given that French gas actors are among the first to push for the conceptualisation of a smart gas grid. This paper drew on both primary and secondary data. We first gathered secondary data (corporate reports and reports from industry associations, participation to industrial workshops) to explore how industrial actors frame smart gas grid and what they include/exclude from the concept. We then conducted semi-structured interviews with various experts from the gas sector. The interviews contained two parts. The first aimed to further refine our understanding of what smart gas grids are or could be. The second questioned experts about whether/where they think that smart gas grid can learn from smart electricity grid and vice versa and about the possible synergies/dependence between both grids. This second set of questions was used to also interview experts from the smart electricity grid. Inspired from the Delphi method, we then confronted the experts to the perspectives of other experts and asked them to refine their arguments about whether (or not) both grids can benefit from one another.

Results

This research is still at the data collection phase. We can however already identify some preliminary results. Even though the experts' interviews do not all agree on the exact definition of smart gas grid, three overarching themes could be identified. First a smart gas grid will be one that can accommodate for an increasing production of decentralised gas, such as bio-methane, synthetic natural gas, or hydrogen. Similarly, to the electricity grid, the smart gas grid will have to become bidirectional with increasing amounts of gas injected in the grid at the distribution level. Beyond accommodating these new gases, a smart gas grid will actually have to facilitate their injection in the

grid. This implies the development of solutions to measure the quality and calorific value of the gas and to clean and upgrade locally produced gases. Second, similarly to smart electricity grid, the smart gas grid is rolling out smart gas meters. Implementation just started and at this stage a lot of uncertainties and open questions remain as to what these smart gas meters could mean for end-consumers besides providing data about their energy consumption. Emerging themes include the identification of households that are energy poor and the possibility to trace where the gas that one consumes has been produced – an aspect that could gain in importance the more local gas is produced. Third, an important topic for the smart gas grid is its capacity to offer flexibility to the electricity grid. This could take place both upstream and downstream. Upstream, it is about facilitating the integration of renewable electricity and its potential storage and flexibility by using new gas technologies such as power-to-gas. Downstream, it can offer flexibility to demand through the deployment of smart gas solutions (microgeneration, hybrid boilers, etc.)

In all these three themes, digital technologies play an important facilitating role and we think that it is around their deployment and their uses that smart gas and electricity grid could learn from one another. This is one aspect on which this research will further focus.

Conclusions

Gas is often mentioned as an intermediary solution in the process of decarbonising the energy sector. However, the longer term future of the gas sector is more uncertain. Collected data revealed that gas experts are conscious that the electricity grid does not need a smart gas grid to continue its development while the smart gas grid needs the smart electricity grid to defend its existence. French gas actors are engaged in important lobbying activities to protect their existence in the years to come. While they were integrated up to the early 2000's, the 2003 European Directive enforces the separation of gas and electricity activities. They are now trying to push actors to collaborate once more with one another. While this seems vital for the gas sector, it is not for the electricity sector. What is more, electricity actors have been so focused on finding solutions by themselves that collaborating with the gas sector is very unnatural for them.

References

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