Artelys | OPTIMIZATION SOLUTIONS

Of the use of multi-sectoral considerations in infrastructure planning

Translating values into €

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Contribution to the GIE workshop *Energy Crisis* - 25 February 2022

From values to €

Going from targets to actual investments depends on the market design and regulatory framework:

1. Decarbonisation scenarios can help inform what is *desirable* from a *holistic* point of view.

2. However, the deployment of technologies, and of infrastructure assets in particular, is triggered by *exogenous constraints* such as carbon budget restrictions, need to meet GHG reduction targets, etc.

3. If these exogenous constraints are not translated into *market design features* (price signals) or into the *regulatory framework*, it is unlikely that such developments will occur.

How to tackle this challenge?

Introducing the “Identification – Characterisation – Translation” workflow:

1. **Identification** of values or services brought by the technology
2. **Characterisation**/quantification of the values brought by the technology
3. **Translation** into market design proposals / modifications of the regulatory framework where values are not internalised

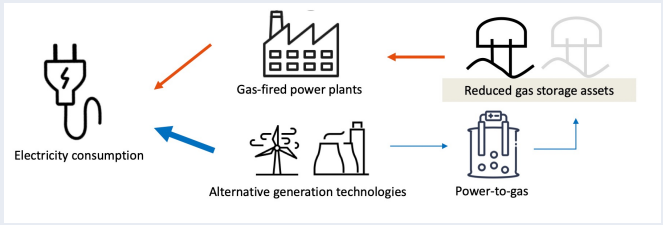
Step 1 – Identification of values – Examples

Methane storage

Cross-sectoral capacity value

In order for gas-fired power plants to contribute to electricity generation, the presence of gas storage assets is required to supply gas to these assets.

In the absence of gas storage assets, other assets would have to replace gas-fired generation assets.

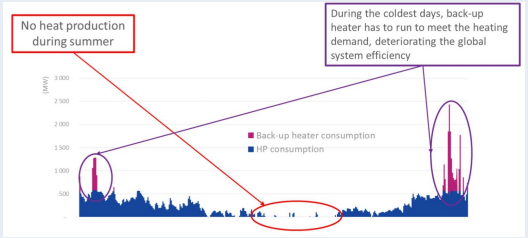


In other words, the presence of gas storage assets helps **avoiding investments in alternative generation capacity**.

Hybrid heat-pumps

Cross-sectoral capacity value

Classic heat-pumps, using an electric heater as a back-up for low-temperature episodes, result in very high peaks of electricity demand.



By using a gas boiler as a back-up, one can **avoid investments in electricity generation generation and electricity grids**.

Resilience value

In extreme conditions, a multi-energy system can be shown to be **more resilient** than a system only relying on electricity.

Hydrogen storage

Kick-start value

The presence of hydrogen storage assets helps avoid over-investments in RES capacity in order to comply with an additionality principle, thereby facilitating the emergence of an hydrogen ecosystem.

Environmental value

The presence of hydrogen storage assets helps avoid consuming electricity generated from fossil-based generation technologies and to **reduce RES curtailment**.

Step 2 – Characterisation/Quantification

In order to inform the third step (policy proposals), a characterisation of the values is required. One typical way to proceed is to perform *sensitivity analyses*:

Starting point

Situation where the asset is playing its ”optimal role”

Sensitivity analysses

Decrease the capacity of the assets being investigated

-10%

-20%

-30%

...

KPIs

The set of KPIs depends on the value being characterised

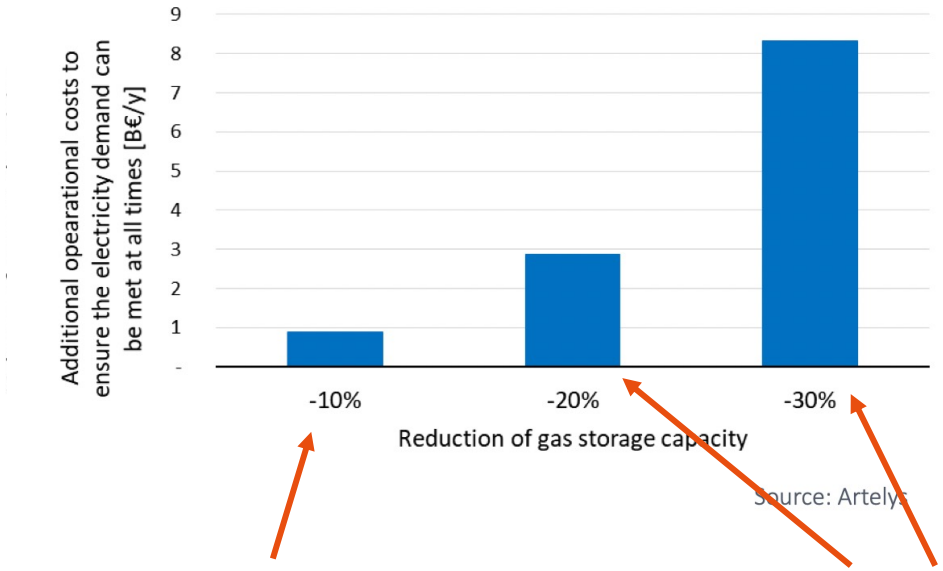
Increase of electricity generation by carbon-intensive technologies

CO2 emissions

Investments

Step 2 – Characterisation/Quantification

Example based on study on methane storage (Artelys, 2019):



Source: Artelys

1

The reduction of gas storage capacity prevents CCGTs and OCGTs to run during high electricity demand episodes in winter due to the lack of readily available gas. The production costs of alternative generation units are found to increase.

2

A further reduction of gas storage capacity would result in **electricity demand curtailment**. This signals a need for investments in electricity flexibility or generation technologies to allow the system to meet the demand.

Conclusions

- We have a **huge challenge** in front of us to accelerate decarbonisation. We need to scale up our efforts, with only a limited number of investment cycles remaining between today and 2050. We need to get the market design and regulatory framework right.

- A "*Identification – Characterisation – Translation*" workflow can help inform the design of policy proposals aligning price signals / obligations with the desired outcomes.

Study on methane storage
released in 2019

Study on hydrogen storage
to be released in 2022

Thank you for your attention!

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