***SMART GRIDS ECONOMIc aSSESSMENT***

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## Overview

The study presented provides a thorough analysis of costs and benefits over the whole value chain of selected smart grid functions between now and 2030. It aims at informing energy industry stakeholders as well as state authorities about the functions that have now reached an advanced stage of maturity, their possible economic value, their role in the energy transition, and the deployment plans associated with them. Ultimately, the aim of this study is to help Enedis, as much as other DSOs, optimize their grid investment strategies in order both to leverage the roll out of smart grid technologies nationwide and to speed up the implementation of local energy transition actions.

## Methods

The analysis makes particular use of Enedis’ in-house tool in its operations to make investment decisions. This tool includes the modelling of physical networks and can be used to conduct real-life studies. All results are therefore consistent with actual investment decisions and can foreshadow future action plans. The **technical smart grid functions** investigated include:

1. extension of self-healing capabilities of the network,
2. operational planning systems,
3. centralised voltage control,
4. self-adaptive reactive power control of distributed generation,
5. active power curtailment of distributed generation
6. the use of flexibility to alleviate demand constraints.

The **use cases for public distribution networks** were identified as follows:

1. reduction in energy not supplied,
2. reduction in curtailed energy,
3. reduction in losses in the networks,
4. postponed or avoided investments, etc.

## Results

**Improvement in the quality of supply**

Extension of self-healing capabilities on the grid improves its resilience and reduces outage durations. The benefit for society as a whole is estimated at **€35m by 2030**.

**Increased grid integration of renewable generation**:

Operational planning systems will improve the planning of maintenance works for the networks. Considering the integration of significant MV production by 2030, these systems will **reduce curtailed energy by 10%**, with no effect on the duration of the works or on the quality of the maintenance. The **cumulated net gain (savings vs costs) for the whole grid by 2030 could reach between €62m and €70m**. Self-adaptive reactive power control and active power curtailment of distributed generation can also improve the insertion of MV production, by controlling their effects on the network: the average net benefits are respectively **€100k and €90k/MW for the MV installations** concerned.

**Improved adaptation to local grid environment for optimised support to local energy transition:**

Voltage regulation and flexibility allow for management of situations with specific local constraints: nationwide forecasted additional renewable integration would reach around **220 MW of MV production thanks to self-adaptive reactive power control, and around 720 MW thanks to active power curtailment**, which corresponds to a **net benefit of €22m and €65m respectively by 2030**. The gains estimated for these two levers are complementary, and do not add up, each lever being activated according to local situation. Centralised voltage regulation could be deployed on 200 substations by 2030, with a gain for each substation (if the local situation justifies this solution) of as much as €125k.

**Flexibilities as a means to solve both demand and production constraints (active power curtailment).**

Regarding demand constraints, a focus was put on improved investment planning and real time grid operation and maintenance through flexibilities. Active power curtailment of MV production can reduce the amount of power injected by generation units during times when distribution networks face constraints related to the insertion ofproduction. This solution therefore increases the hosting capacity of existing networks and limits the cost for insertion of additional renewable generation.

**Flexibility for demand constraints** have been addressed in the following use cases:

* *Real time grid operation*: flexibility as an alternative or in addition to usual solutions, e.g. generators.
* *Investment planning*: flexibilities to postpone investment decisions for grid reinforcement, while maintaining constant quality and continuity of supply.

The value of flexibility is assessed from estimates of the maximum collective surplus that could be freed up by the flexibility solutions, ie maximum cost that the overall customer base could be willing to pay, and under which the activation of flexibility would achieve a new optimum cost/quality ratio in the functioning of the electricity system. Given the low frequency of power cuts, the activations at a given point in the network would necessarily be rare, which results in a maximum collective ‘capacity’ surplus of less than €30/kW/year of delay. However, since each of these activations can help cut-off customers to resume normal function, the corresponding ‘energy’ surplus is comparable to the value of the customer’s power cut. This results in a **cost equivalent to the value of lost load**, i.e. **€9,200/MWh for classic incidents and €20,000/MWh for incidents of more than 30 MWh** in France.

## Conclusions

This study is a key step in the industrialisation of initial smart grid solutions prior to the first large scale deployments and flexibility experiments. In addition, other smart grid solutions are still being developed, particularly for smaller areas and low voltage grids.

## References

Economic assessment of smart grids solutions – analysis carried out by the distribution network operators.