Flexsys End Conclusion

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Contents

1. Introduction

At the beginning of the project in 2021, we conducted a market analysis to identify challenges and barriers for the uptake of residential flexibility and formulated policy recommendations towards the governments, the grid operators and energy regulators to alleviate these barriers (Deliverable 3.6). Now we are at the end of the project reflecting on the initial barriers and how the market has evolved. In this project conclusion we elaborate on the learnings of the project and formulate new policy recommendations for the uptake of residential flexibility in the electricity markets.

2. Recap: Barriers and recommendations at the start of the project

At the start of the project, we identified 3 types of barriers for the uptake of distributed, residential flexibility: technological, regulatory and economic barriers. These barriers and their corresponding policy recommendation can be found in the table below coloured according to the following legenda:

Technological barrier
Regulatory barriers
Economic barriers

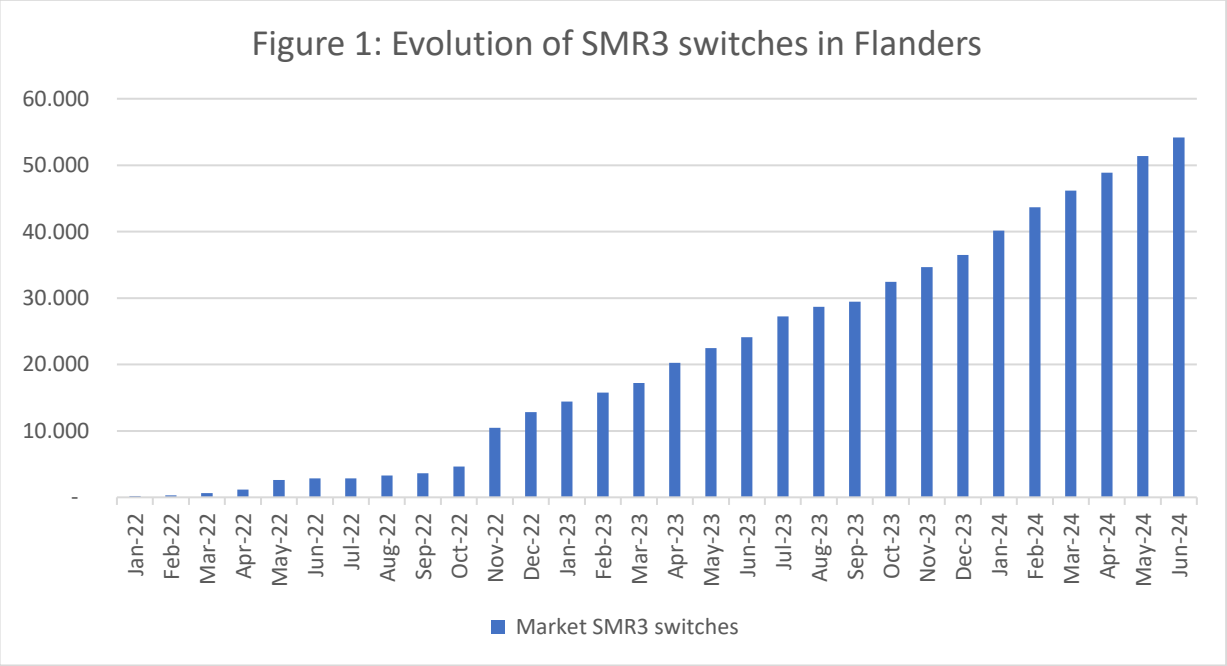
Barrier	Addressee recommendation	Recommendation
Slow roll-out of SMR3 while it is a minimum requirement for low-voltage flexibility.	Government	Inform end-consumer about the advantages and opportunities of SMR3.
To participate in the reserve power markets (FCR, aFRR, mFRR), flexible assets must comply to too many and too demanding technological requirements during prequalification and procurement/bidding.	Elia	Alleviate requirements and increase the scalability of the prequalification process.
Optimal use of the digital meter is hindered by the lack of standardisation and market competition that enables the deployment of private metering activities connecting to the digital meters.	Government	Open the market for measuring and metering activities and standardize protocols.
End consumers or owners of flexible assets don't have the ownership of their data and are forced to pay additional fees to asset manufacturers to make the flex data available. This is jeopardising the business case of low voltage flexibility. In addition, data to evaluate the business (e.g. congestion) is not always publicly availability, making innovators hesitant to invest in new flex solutions.	Government	Bring data ownership to asset owner according to European legislation and make more data available to evaluate business case.

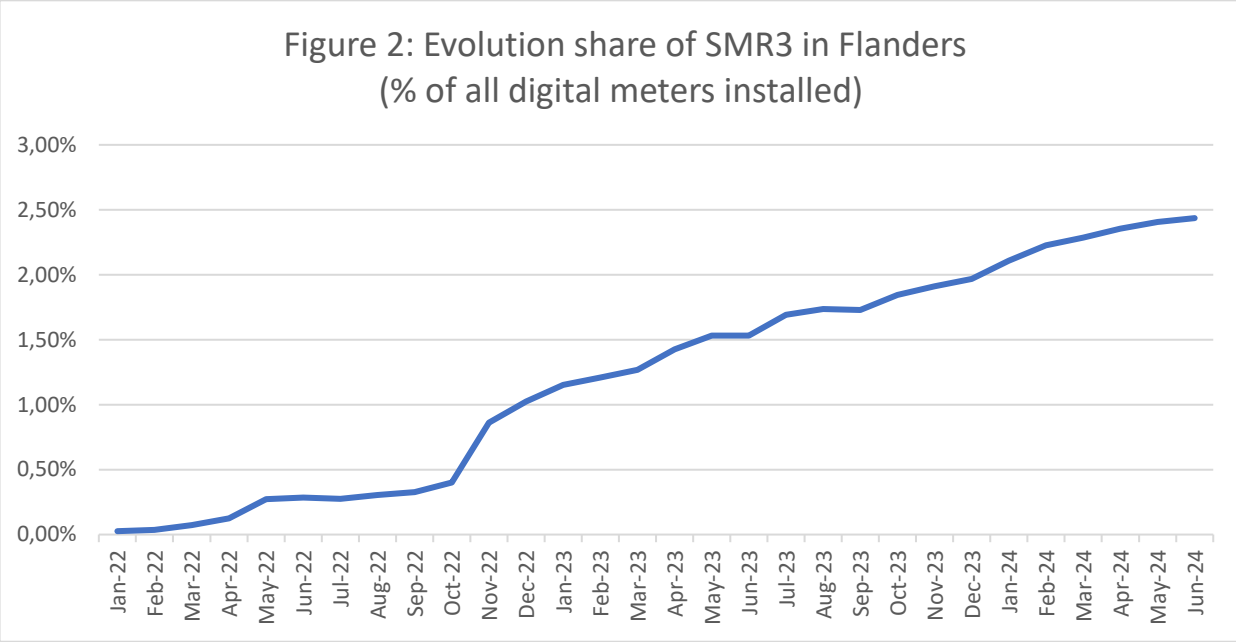
A clear regulatory framework for situations where end-consumers work with separate energy suppliers and third party aggregators lacks. Such framework is, however, needed to correctly consider the impact of flexibility activations for an asset on supply. Addiontally, it remains unclear which party will be responsible for passing through transmission and distribution grid fees to the end-customers and on which volumes taxes and other levies will be raised.	Energy market regulators	Provide a clear framework.
Participation of LV assets in the aFRR and mFRR products is forbidden.	Grid operators	Open the FRR products for low-voltage assets.
	Government	Enable cross sectoral consultations to avoid lock-ins by certain stakeholders.
The Consumer Centric Market Design (CCMD) as designed and developed by Elia could distort the market competition as there exists a risk that the seperation between the natural monopoly of grid operators and the market based activities becomes distorted.	Government	Protect free market competition.
Limited number of dynamic contracts in the market while this type of contract is needed for implicit flexibility to give price signals where flex assets can react on.	Energy market regulators	Enable multiple contracts behind the meter to allow households assigning dynamic tariffs only to the flexible assets and as such spreading risks
Flexibility provision can lead to injection or offtake peaks which is punished in the system of capacity tariffs	Energy market regulators	Reflect the cost of flex provision in the tariff structure

When providing FCR services with home batteries or EV, there are double grid tariffs and levies, i.e. on both off take and injection, which could jeopardise the business case.	Energy market regulators	Tackle the problem of double levies in the tariff structure design.
High costs for installing and deinstalling smart energy hardware conflict with costless and fast contract cancellation	Energy market regulators	Consider the challenge of fast and costless aggregator switch when designing the new retail market for flexibility.

3. Barriers and recommendations at the end of the project

Now that we are at the end of the project, we revisit the barriers that existed at the start of the project and evaluate their latest status. It is unfortunate to conclude that in the 3-year duration of the project, not much has changed as still many barriers exist. Yet, many initiatives and projects have been launched to solve the barriers, which gives good hopes for an effective uptake of residential flexibility in the market.

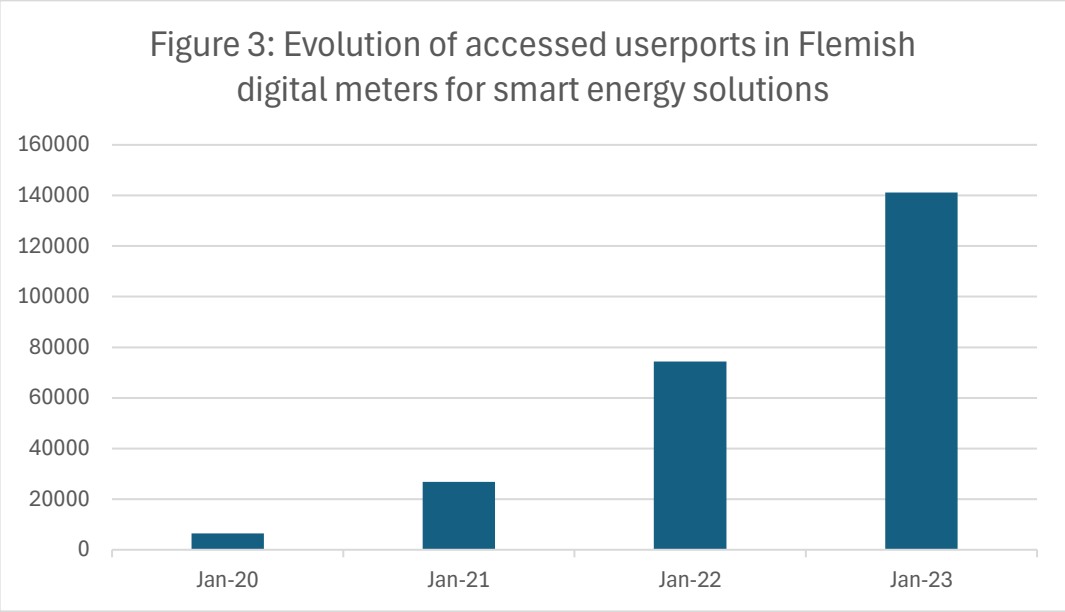
Status barrier at the start of the project	**Status barrier at the end of the project and project learnings**
Slow roll-out of SMR3 while it is a minimum requirement for low-voltage flexibility.	Although the absolute number of SMR3 switches has increased significantly, this metering regime still holds a low share compared to all digital meters installed (see Figure 1 and 2 below).  Source: VREG energy dashboards



Source: VREG energy dashboards

Based on the results of the Flexsys research project, we conclude that SMR3 should become default in the market. SMR3 guarantees the use of actual offtake and injection volumes in market processes contrary to profiled volumes which incentivized flexibility more. SMR3 as a default does not mean that all end-consumers must have dynamic contracts. A supplier can still offer fixed or variable contracts. Yet, the use of real quarter hourly data could increase consciousness of end-consumers about their energy use and help making rational decisions about investments in green technologies (e.g. additional PV panels, home battery). In addition, it makes the end-consumer ready to participate in flexibility initiatives and incentives energy suppliers, aggregators and Balance Responsible Parties more to use residential flexibility for optimization of their portfolios. Yet, the business case is often hampered by incomplete and delayed metering data delaying settlement and forcing aggregators and energy suppliers to hold large cash buffers to compensate for these delays. As such, we urge Fluvius to increase resources to tackle error identification and missing data issues faster.

To participate in the reserve power markets, flexible assets must comply to too many and too demanding technological requirements during prequalification and procurement/bidding.	This barrier still exists with real time data communication on a per-second basis for FCR and 4 second basis for aFRR being the largest hurdles. Yet, in our neighbouring countries, the TSO's do not pose such strict requirements, which proves that alleviation of the requirements is feasible.
Optimal use of the digital meter is hindered by the lack of standardisation and market competition for private metering activities.	While at the beginning of the project we pledged for standardization of protocols that enable private metering activities, we nuance our point of view by rather pleading for a mandatory interoperability that obliges manufacturers to document their used protocols and make it publicly available. It has been proven that standardization of protocols often suffers by a 'Design of Committee' (i.e. overcomplicated and ineffective design), which could hamper the freedom of manufacturers in developing and installing smart assets. Yet, increased transparency and availability supports both manufacturers and third-party companies that want to offer smart energy solutions in their business activities and developments. During the project, we could see that the market for private metering activities (of amongst others P1 dongles) is growing steadily (see also Figure 3). This shows interest of commercial companies in offering and end-consumers in applying smart meter solutions, which has a positive impact on the market uptake of residential flexibility.

	 Source: VREG energy dashboards However, we don't see a reason why physical submetering should be a regulated activity carried out by the grid operators. We encourage the development and installation of physical submeters by private companies to increase market competition for this activity. Market competition should lower costs and have a positive impact on the business case for flexibility provision. Manufacturers of heat pumps, electric vehicles and other flex assets should be allowed to have their internal energy measurements accepted as valid submetering, assuming they meet certain requirements (e.g. MID 1 or equivalent). We also believe that privatizing physical submetering could boost the roll-out of smart energy solutions.
End consumers or owners of flexible assets don't have the ownership of their data and are forced to pay additional fees to asset manufacturers to make the flex data available. This is jeopardising the business case of low voltage flexibility. In addition,	On the one hand, we have seen a trend of decreased data availability at the asset level as the result of asset manufacturers closing local interfaces and as such force cloud-based solutions against data retrieval fees towards end-consumers. On the other hand, Elia is investing in data availability solutions, e.g. their improved Open Data Portal and the development of the real-time price as part of the CCMD. The Elia Open Data Portal can be accessed here.

data to evaluate the business (e.g. congestion) is not always publicly availability, making innovators hesitant to invest in new flex solutions.	
A clear regulatory framework for situations where end-consumers work with separate energy suppliers and third party aggregators lacks. Such framework is, however, needed to correctly consider the impact of reserve power activations for an asset on supply and imbalance. Addiontally, it remains unclear which party will be responsible for passing through transmission and distribution grid fees to the end-customers and on which volumes taxes and other levies will be raised.	Grid operators in collaboration with market parties have been working on a Transfer of Energy mechanism that should account for reserve power activations on supply and imbalance. A final design, however, is still lacking. Synergrid has published a study in which they investigate a Transfer of Energy design on low-voltage. Market parties are not eager to implement an Opt-out agreement similar to the one on medium or high voltage (see D3.6 section 3.2 for more information about Opt-Out agreements). The most important reaction of market parties are listed below: - Some parties expect no participation to aFRR LV with current opt-out framework - Imposition of Opt-Out is seen as a barrier as FSPs report difficulties to agree on an Opt-Out agreement with suppliers - Request for simple and less costly solution with limited/no administration - Request for default ToE mechanism which avoids contractual framework between FSP/Supplier/BRP - Integrate in regular market processes of Atrias Source study Synergrid: https://www.synergrid.be/nl/marktoverleg/pdg-flexibiliteit
Participation of LV assets in the aFRR and mFRR products is forbidden.	The aFRR and mFRR markets are still not opened for low voltage assets, although opening of the aFFR market was scheduled in February 2024. mFRR LV go-live is scheduled in December 2024, but will most likely also be delayed because it awaits the learnings from the aFRR LV go-live.
The CCMD as designed and developed by Elia could distort the market competition as there exists a risk that the seperation	The risk still exists.

between the natural monopoly of grid operators and the market based activities becomes distorted.	
Limited number of dynamic contracts in the market while this type of contract is needed for implicit flexibility to give price signals where flex assets can react on.	Dynamic electricity contracts and residential flexibility are experiencing a chicken-and-egg problem. People are not interested in or irrationally skeptical about dynamic contracts as long as making use of them with easy-to-use flexibility for their heat pump or electric vehicle (EV) remains largely unavailable. At the same time, having more people actively use dynamic contracts will help bring more flexibility to the market. People can benefit from the financial incentives while helping the energy system. At the start of the Flexsys research project, we recommended to facilitate having multiple contracts behind the meter to allow households assigning dynamic tariffs only to the flexible assets and as such spreading risks. During the project, the legal obligation for company cars to be fully electric from July 2023 onwards has increased the number of electric vehicles in Belgium significantly and has unlocked an important use case for the 'Multiple contracts behind the meter' scenario as settlement between employees and company is currently quite complex. Currently, the solution has only been rolled out with 2 grid users on the Elia grid. No information is available yet on how a supply split per asset at the low and medium voltage level would be implemented. For these grid users, it is however already possible to have all injection and all offtake contracted at different energy suppliers.
Flexibility provision can lead to injection or offtake peaks which is punished in the system of capacity tariffs	We still hold our opinion. Because the capacity tariff could increase the electricity bill as the result of peaks generated by flexibility provision, it is a barrier for demand response and participation in the reserve power markets. Activations would need to have a return of more than 150 EUR/MWh to be break-even due to high grid tariffs and taxes and levies. In addition, owners of heat pumps and electric vehicles, technologies which are perceived to support and accelerate the energy transition, are confronted with higher costs in the system of the capacity tariff. Therefore, we recommend Fluvius to rethink the current capacity tariff design and exempt peaks that help balance the grid from the capacity tariff. Furthermore, to reach the climate goals, electrification of the heat sector by a roll-out of heat pumps (in cases when heat networks are not possible) is unavoidable. Yet, the electricity bill is too expensive compared to gas. Therefore, we recommend the government to clean up the electricity bill by removing

	those components that make the bill unnecessary expensive and jeopardize the business case of heat pumps compared to gas heating.
When providing FCR services with home batteries or EV, there are double grid tariffs and levies, i.e. on both off take and injection, which could jeopardise the business case.	Double grid tariffs and levies for symmetric flexibility services such as FCR still exist. Yet, grid operators have all data available to exempt the affected access points as these points are being exempted during the stress tests when compatibility with FCR market requirements are being tested.
High costs for installing and deinstalling smart energy hardware conflict with costless and fast contract cancellation	This is still the case. Explicit flexibility requires the installation of specific hardware that enables asset steering. Such hardware is costly. Costless early contract cancellation and fast switches could jeopardise the business case for the aggregator or FSP which is why flexibility contracts are often long-term, i.e. 2-3 years (to make sure hardware costs are earned back). Yet, it is known that long-term contracts risk to end up as 'sleeping' energy contracts. Moreover, such contracts reduce the incentive for aggregators and FSPs to make competitive offerings towards the end-consumer.

4. Key take aways

Below, we summarize the 6 key take aways from the Flexys project.

1. **Household flexibility will play a pivotal role in the future electricity system.**

   To make the energy transition towards a zero-carbon energy system happen, the share of renewables and electrification of the heat, transport and industrial sector must be increased. Yet, our electricity system is not built to produce enough electricity to serve a consumption peak of 20, 40, or 60 GW caused by simultaneously making all heat pumps peak and charging all cars at maximum speed. It is also not built to transport peak loads of that magnitude, neither at the transmission nor the distribution level. Flexibly operating heat pumps and charging cars in a smart, flexible way are not just "nice to have" but "must have". Dumb heating and dumb charging are absolute no-go's. Choosing to 'not transition to heat pumps and EVs' is also not an option, because they are the best ways available to decarbonize heating and transport and to improve overall energy efficiency. We need to embrace the transition, but if we don't do it in a smart way, the system will be in trouble.

   Residential assets are both part of the cause and the solution of the problem. If heat pumps temporarily reduce their electricity consumption during the very rare moments when our electricity system is facing severe scarcity and the lights are at risk of going out, this can make a meaningful difference at the national level. Most of these scarcity events last for a very short time (only a few hours) and require load reductions of 'only' a few hundred megawatts, which is well within the range of possibility once we have a heat pump fleet of one to two million heat pumps in Belgium, consuming gigawatts during cold winter days. Temporarily reducing that large load for a few hours does not meaningfully impact anyone's comfort but it does help out the electricity system a lot during critical moments.

2. **The technical set-up to enable flexibility at households is a tailored solution, for which financial gains are often too small.**

   To participate in flexibility, every dwelling needs a basic technical infrastructure, i.e. a digital meter, SMR3 and smart assets that have built in flexibility options. Unfortunately, the basic infrastructure is often not yet in place. Yet, it is unacceptable anno 2024 that manufacturers still install heat pumps and PV invertors without smart energy functionalities and that digital meters are by default not operating in smart regime.
   Despite having the above-described basic infrastructure for flexibility, households could still experience many obstacles for flexibility provision:
   - Connection issues: Poor internet connection that sometimes breaks down, bad connection between assets and digital meter due to long distance (attic vs basement)
   - Obstacles on the hardware side: Connecting to the asset's local interface is often difficult (e.g. heat pump has to be opened up and unscrewed to attach cables, local networks have to be scanned to find IP addresses, ...). In addition, more and more asset manufacturers remove local APIs to force the usage of their cloud application (for which they often impose a usage fee towards end-consumers).
   - Obstacles in the cloud: Some devices can be read out via the cloud and, although to a lesser extent, controlled via the cloud. Usually, these cloud services come with additional fees jeopardizing the business case of residential flexibility.

All of these examples show that the technical set-up for residential flexibility is tailored, and the project learnings teach us that the financial gains are often too small to account for that.

3. **Households are willing to operate their assets flexibly if (1) it is easy, (2) respects comfort preferences and (3) reduces the electricity bill.**

The basic willingness to provide flexibility is present for most households. Surveys point out that people are willing to operate their heat pump and EV flexibly, as long as flexibility is easy to use, respects their comfort preferences and reduces their annual electricity bill by 10-30%.

- Easy flexibility provision:
  Easy flexibility provision goes hand in hand with automation of the service. We cannot and should not expect users to be constantly thinking about the flexible operation of their heat pump or EV, let alone that they should have to take manual actions on a daily or weekly basis to provide the flexibility. We live in a world dominated by software doing all the tedious and hard work for us, and it should be no different in the world of flexibility. In addition, only automated flexibility services allow to capture the financial benefits to the fullest and enable business models around flexibility. Flexibility is something the asset needs to be doing automatically in the background 24/7 and 365/365.

- Respect comfort levels:
  User behavior matters. We should not forget that flexibility is as much about what users are OK with and how their comfort preferences influence the whole story, as it is about the technical story of what the assets are capable of and how to automate their flexible operation. An example of behavior mattering is the fact that if you give people the ability to overrule flexibility every once and a while, they make extensive use of it. We see this directly from the real-world experiments we did in the project. People have all kinds of reasons to overrule, for example forbidding heat pump flexibility from causing any change in indoor temperature for a while, because a family member is sick or because people are having guests over for dinner.

- Electricity bill reduction:
  In the survey people indicate that a bill reduction of about 10-30% incentives them to provide flexibility. It is necessary to manage expectation here. Our analysis shows that bill reductions effectively occur, but in many cases will not amount to the expectations of these people. On the other hand, without practical hurdles of “manual user intervention” in providing flexibility, bill reductions occur automatically without user efforts.

A societal problem could arise if the financial benefits that come with flexibility only go to a select group of households. Households able to shift their electricity consumption in time can offer flexibility and will receive financial benefits. Vulnerable households may not have the financial capacity

to invest in the necessary assets to offer this flexibility while precisely they are the ones that could benefit most from a lower electricity bill. On the other hand there is a risk that vulnerable households give up comfort or wellbeing when participating in flexibility in order to reduce their electricity bills. Easy flexibility provision and easy to understand smart steering could provide stress-free access to flexibility without the pressure to give up comfort in exchange for a lower energy bill.

4. Knowledge and information sharing is key to involve and empower households in flexibility.

To unlock the flexibility potential, it is important that households are well informed about SMR3 and Energy Management Systems (EMS) as requirements for flexibility provision. In addition, the market should increase transparency and understanding of flexibility by providing price comparisons and quality check for flexibility providers.

- SMR3:
  SMR3 is a minimum requirement for flexibility because it guarantees the use of actual offtake and injection volumes in market processes contrary to profiled volumes. At the same time, it could increase consciousness of end-consumers about their energy use and help making rational decisions about investments in green technologies (e.g. additional PV panels, home battery). Anno 2024, most end-consumers don't know what SMR3 is nor understand its benefits and have unrealistic fears of doom scenarios mainly as the result of bad media attention.

- EMS:
  Having an EMS is one of the requirements for an automated flexibility provision. Unfortunately, for the end-consumer it is not always clear which EMS suits best in his dwelling. The website 'maakjemeterslim' allows consumers to see how they can connect smart applications and energy management systems (EMS) to the user ports of the digital meter to make the best use of their digital meter. To make the choice of EMS even more transparent, the website could be expanded with a list of potential suppliers and aggregators, and the contracts they offer, that match with the EMS hardware to avoid lock-ins for the end-consumer.

- The need for price comparison and quality check of flexibility providers:
  When the energy market was liberalised, price comparators were set up by regulators. No doubt there are going to be many flexibility service providers promising all sorts of things. It would be good that these promises are tested against reality by either regulators or independent third parties.

5. The market uptake of residential flexibility requires a clear and simple electricity market design which doesn't discriminate based on voltage level connection

In order for households to offer their flexibility in electricity markets, all markets should be open for low-voltage assets. Once residential, low-voltage flexibility is allowed on all markets, market players will explore the business case. Simplification in the market is key for rapid penetration. CREG

complains in its pre-election memorandum that the division of powers in Belgium creates a lot of ambiguity. In theory, Flanders is competent for the supply of low-voltage flexibility, but is federally competent for the services to be purchased and their conditions. In practice, this results in platforms being built side by side, and obligations and contracts piling up. To offer a service for Elia with a low-voltage point, an FSP-DNB contract with Fluvius in addition to a contract with Elia and the flex assets need to be registered at both the distribution and transmission grid. One set of rules, with one access and contact point and, above all, one central marketplace would remove a huge number of barriers. Furthermore, despite the great efforts Elia is doing to empower residential flexibility through CCMD, the design with Exchange of Energy Blocks and Multiple BRP's behind an access point, increases the risk of having more (complex) roles in the energy system and of overengineering the market.

6. The business case for residential flexibility can be improved with a redesign of the electricity bill

First, two third of the electricity bill consists of non-energy components such as grid costs and taxes and levies. These components increase the electricity bill significantly, which pushes households towards investments in gas boilers instead of heat pumps. The electricity bill needs to be cleaned up by removing those components that make the bill unnecessary expensive and jeopardize the business case of green technologies such as heat pumps. We should however pay attention to vulnerable households who might not have the possibility to invest in the necessary assets like heat pumps. We should avoid leaving them behind with relatively higher energy bills and more dependent on fossil energy sources than other households. On the other hand the redesign of the electricity bill could be taken as an opportunity to increase the inclusivity or vulnerable households in the energy transition and in flexibility.

Second, the capacity tariff which is part of the electricity bill since 2023 to cover grid costs as result of offtake peaks, could also increase the electricity bill because green technologies such as heat pumps and EV's and flexibility provision (e.g. in the context of FCR, aFRR and mFRR) could initiate larger peaks. The capacity tariff, although designed aiming to incentivize flexibility (in the form of peak reduction), could have the opposite effect as it blocks flexibility provision in other contexts.