Shaping the Smart Sector Integration Strategy

smartEn contribution to the European Commission's consultation

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About smartEn - Smart Energy Europe

smartEn is the European business association integrating the decentralized solutions of the clean energy transition. We create opportunities for every company, building and car to support an increasingly renewable energy system.

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The positions expressed in this document represent the views of smartEn as an association, but not necessarily the opinion of each specific smartEn member

smartEn welcomes the initiative by the European Commission to shape a comprehensive Strategy on Energy System Integration. With our replies to the Commission's questionnaire, we would like to provide further inspiration for this strategy.

Introduction: a crucial Strategy for a post-COVID-19 reality

The ongoing COVID-19 crisis is hitting Europe hard. While the urgent health crisis is obviously at the very top of the agenda, and will be for some time, the economic challenges society will face should not be underestimated. This will require a comprehensive recovery plan and unprecedented investments all across Europe.
In this process, key is to keep pursuing Europe's climate and energy objectives, to shape new measures that will foster sustainable growth and support a future without fossil fuels.
This is therefore not the time to delay the clean energy transition, but an opportunity to invest in this transition, while ensuring that Europe is more resilient and competitive in the future. The Smart Sector Integration Strategy should therefore fit into the proposal for a Roadmap for Recovery, as requested by the European Council.

What would be the main features of a truly integrated energy system to enable a climate neutral future? Where do you see benefits or synergies? Where do you see the biggest energy efficiency and cost-efficiency potential through system integration?

In order to reach climate neutrality by 2050, the demand-side flexibility of different energy sectors needs to be enhanced in order to increase the reliability, resilience and efficiency of the entire energy system. Only then can sector integration truly be defined as smart sector integration. This should be the main feature of a truly integrated energy system.

In the past years the focus has been on bringing down the cost of renewable energy, while increasing investments and innovation in the power sector, now the Smart Sector Integration Strategy should keep pursuing such goals and at the same time concentrate on:

- accelerating the integration of renewable, carbon neutral energy into all sectors of the economy, including specifically transport, industry and buildings;
- running a resilient energy system with a very high share of renewables and maximising demand-side flexibility from transmission level to behind-the-meter;
- ensuring a fair and just transition within an energy system inclusive of all consumers.

The vulnerability of the centralised power system should be overcome by the use of demand-side resources and smart sector integration to reduce the number of single points of failure and increase the overall resilience of the system.
The dynamics of the energy system with more variable renewable electricity are shifting to the point that the balance of the system and security of supply can no longer be guaranteed by the generation side alone. The deployment of innovative technologies on the demand side, smart infrastructures and allowing new participants in the energy landscape can address this rising issue.

As distributed energy resources increase, energy users are becoming active participants to the clean energy transition. More and more Prosumers are able to shift their electricity demand and/or self-generate, inject, store or consume their own energy production, thus providing important flexibility to the system at its edge.

New electric loads such as heat pumps, building load management systems, smart charging infrastructure for electric vehicles and storage solutions will be essential drivers for this demand-side flexibility, making it possible to smartly manage a decarbonised energy system with a large share of variable renewables.

Large amounts of demand-side flexibility can be also provided by energy-intensive industries with high consumption. As there is high energy demand at the industrial sites, further integration of these flexibility assets can significantly reduce the necessary grid enforcement.

As already calculated by the European Commission, increased demand-side flexibility could lead to savings of €5.6bn/year from reduced back-up capacity, network and fuel costs in Europe[1]. And by enabling decentralised flexibility resources to participate in the European electricity system, the social welfare can be increased by up to €2.8 billion annually[2]. These are some of the benefits of an increased system efficiency achieved by smart sector integration.

To achieve all benefits a truly integrated system can provide, it is key that all actors have fair and equal access to the markets. This is especially true for the demand side. Market-based flexibility options are urgently needed to unlock the full potential of demand-side flexibility. Cost-based and regulated mechanisms do not create incentives for the development of load-side flexibilities as the value of demand-side flexibility cannot be fixed in a regulated way. Since it is not possible to define costs for these load-side flexibilities, they can only unfold their potential through a market with free bids and not through a cost-based mechanism. However, flexibility on the load side is urgently needed to make the energy transition cost-efficient and thus contribute to acceptance by the citizen through low costs for end consumers. The integration of load flexibility, which can only be achieved by a market, is also a step towards the democratic participation of consumers in the revenues of the electricity market and the energy system transformation.

The current COVID-19 crisis further highlights the crucial role of new forms of demand-side flexibility, which can be provided by smart buildings, electric vehicles, electrolysers and smart industry, to ensure a resilient electricity system even in unexpected and unprecedented situations.
As stated by IEA Executive Director Fatih Birol[3], in most economies that have taken strong confinement measures in response to the coronavirus, electricity demand has declined by around 15%, largely as a result of factories and businesses halting operations. While renewable energy output remains high, the decreased use of thermal generation represents a “fast-forward” of the energy system, highlighting the crucial importance of more flexibility resources for stable system operation.

What are the main barriers to energy system integration that would require to be addressed in your view?

Energy system integration is currently hindered by:

- Barriers to market access and participation, e.g. barriers to demand-side flexibility (often from transport, heating and industry) to participate in electricity markets (see e.g. the 2018 smartEn Map on Balancing, similar barriers exist for other electricity markets, products and mechanisms),
- Inconsistent taxation, e.g. leading to a bias in favour of fossil fuels instead of cleaner alternatives based on renewable electricity,
- Price signals blunted through fixed components (taxes, charges and levies), failing to reflect the value of flexibility that could drive sector integration,

[1] European Commission, “Impact assessment of the revised rules for the electricity market, ACER and risk preparedness,” 2016
[2] “Mainstreaming RES Flexibility portfolios: Design of flexibility portfolios at Member State level to facilitate a cost-efficient integration of high shares of renewables” (page 70) https://ec.europa.eu/energy/sites/ener/files/mainstreaming_res_-_artelys_-_final_report_-_version_33.pdf
[3] www.linkedin.com/pulse/coronavirus-crisis-reminds-us-electricity-more-than-ever-fatih-birol/

- Insufficient inclusion of external costs (price of carbon) and uneven reflection of the cost of carbon in different sectors,
- Distortive market interventions (e.g. some ill-designed capacity mechanisms that support certain technologies at the expense of other solutions, sometimes counteracting the needs of the system,
- Regulated mechanisms for end consumer flexibility that lock assets and flexibility in a monocausal and regulated mechanism, exclude their participation to aggregation and other smart business models that might foster further system integration and prevent the free choice of the final consumer in marketing its flexibility at a fair and transparent price,
- Inconsistent incentives for system operators when procuring flexibility, such as CAPEX-based cost recovery that distort the choice between grid extension and non-wire alternatives,
- Slanted focus for large infrastructure projects that skews interest, policy and financing towards large energy assets instead of small, diffuse, yet massive myriads of distributed energy resources,
- Continued support to fossil-based infrastructure instead of a clear shift towards cleaner alternatives e.g. smart electricity grids.

How could electricity drive increased decarbonisation in other sectors? In which other sectors do you see a key role for electricity use? What role should electrification play in the integrated energy system?

Sector integration combined with direct electrification is needed for a cost-efficient EU decarbonisation. As stated by the IPCC report[4], emissions reductions are driven by a strong electrification of the energy system.

While the decarbonisation of the energy sector is and will continue to be driven by a massive deployment of renewable electricity, ambitious electrification policies of building, road transport and industry offer the key solution to achieve significant CO2 emission reduction in the most cost-effective way, while unleashing significant flexibility potentials for a robust energy system.

The benefits of direct electrifications have a cost-efficient EU decarbonisation impact on different sectors.

For example, heating in buildings is responsible for almost a third of total EU energy demand. Most of that heat is generated by burning fossil fuels. This can be decarbonised through direct electrification, and this leads also to much greater energy efficiency. For example, a heat pump typically converts electricity to heat with an efficiency of around 300% and is 4 times more efficient than a traditional gas boiler. The same logic applies for the direct electrification of road transport. Battery electric vehicles have a conversion efficiency of 80-90% from tank to wheel, compared to 20-30% for fossil fuel combustion.

What role should renewable gases play in the integrated energy system?

Europe's decarbonisation pathway has been led by decarbonising the electricity sector. The potential of renewable energy sources to drive Europe's decarbonisation even further and into new sectors is still very large. Generally, using this electricity directly is more efficient than converting it into other energy carriers (e.g. hydrogen), giving it a natural advantage in the market. The European policy framework should focus on ensuring carbon reduction in line with the climate-neutrality target.

[4] Global Warming of 1.5C, 2018: https://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf

The use of renewable gases (like biogas or biomethane) from sustainable feedstock, can ultimately play a role in the future energy system however they have limited scalability due to constrained biomass availability.
Indirect electrification solutions such as gases or liquid fuels produced from renewable electricity (like hydrogen), will play an important role in "harder to abate" sectors where direct electrification could not be technically feasible, less cost-efficient, or cannot be employed fast enough to meet the carbon-neutrality target.
To support market development for renewable gases, standardised principles and rules should be applied for their trading such as the European Energy Certificate System (EECS) that is already established in the power sector.

What role should hydrogen play and how its development and deployment could be supported by the EU?

The development of hydrogen is very capital intensive, with the cost-competitiveness depending largely on the price of electricity. A key factor to use hydrogen to carry renewable energy into new sectors is the business case. Green hydrogen will only develop if regulation creates a premium that pays the gap between fossil and carbon-neutral solutions.

Due to the inherent nature of the conversion processes, the efficiency of hydrogen is low and might divert renewable electricity from uses with more decarbonisation impact. Climate neutrality requires Europe to massively invest into renewable energy because ultimately, it is largely about replacing fossil energy with renewable energy. To avoid the risk of diverting renewable electricity, Member States should increase their RES build-out targets in line with the newly installed electrolyser capacity. .
As mentioned above, hydrogen is likely to play an important role in the decarbonisation of sectors where direct use of renewable electricity and heat is not considered feasible, such as heavy industries and some transport sectors, notably shipping and aviation.
A particular scenario for its off-shore production could be contemplated for the excess electricity from the expected 450 GW off-shore wind, where the massive investment needs for cables could otherwise create an important bottleneck.

Within this context, a price signal is needed to set the right incentives for the most efficient use of electricity and production of hydrogen. In this light, a market for flexibility can provide the appropriate incentives, and also provide profit opportunities for sector coupling technologies. For example, the first trade on the enera flexibility market was between a power-to-x asset and a system operator. The power-to-x asset was paid 45.50 EUR/MWh to increase its consumption, thereby avoiding the curtailment of renewables.

How could circular economy and the use of waste heat and other waste resources play a greater role in the integrated energy system? What concrete actions would you suggest to achieve this?

When cost-effective, the use of waste heat from industrial plants could be channelled in district heating projects to homes and offices located nearby. Investments channelled for these projects should follow a proper local planning based on the assessment of available resources.
Making the best use of every unit of energy consumed, building energy management systems prevent investment in unnecessary, additional infrastructure in the energy system.

How can energy markets contribute to a more integrated energy system?

Energy markets have already contributed to foster system integration and will continue to do so in the future, in particular through meaningful price signals setting the right signals for

investment, generation and consumption from behind the meter to the transmission level.[5] This applies both to the electricity price signal and the gas price signal, but also to the price of CO2 emission certificates. Sector integration is already taking place today in various forms, especially on markets. Organised trading on the exchange, for example, brings together a wide range of market participants from different sectors and with different business models. The market participants trade a wide range of different goods, such as electricity, gas and emission allowances. These are the basic ingredients for sector integration.

The market is used to reacting to developments on different market segments and to optimizing its behavior based on price signals. For example, better linkage between the electricity and gas sectors can open up new trading opportunities in the future, such as long-term trading opportunities through spreads between the electricity and gas sectors.

A streamlined EU-wide CO2 pricing system across sectors, e.g. based on EU emissions trading, could be an efficient market-based measure for achieving decarbonisation targets in the long term, including decarbonisation of the gas sector. The value of sector-specific instruments should not be undermined.

Energy markets allow to provide meaningful price signals for different products and thereby to reveal their value. This allows to value all different characteristics of electricity, such as flexibility or green property, but also to give a value to the very process of sector coupling (for example through spread products between the price of electricity and gas). In this way, flexibility providers can market their asset where it provides the biggest value, which in the end increases social welfare. Markets provide a crucial coordination function in this regard.

However, the structures of energy tariffs and taxation in different energy systems vary nationally and across the Member States, which can constrain energy conversions across the energy systems. These are also limitations in consumers' right to choose the energy solutions they want to use.

How can cost-efficient use and development of energy infrastructure and digitalisation enable an integration of the energy system?

Increasing the variable renewable electricity share in Europe's energy mix and flexible demand-side resources will require smart grid infrastructures. The level of grid investment in grids envisaged by the European Commission decarbonisation strategy is towards €100 billion on average per year.

The smart sector integration strategy should therefore support electricity network and deployment of smart (micro) grids to improve operating efficiency and increase in digitalisation to allow the growing penetration of distributed generating and integration of demand-side flexibility resources.

However, grid reinforcements should be carefully assessed to avoid unnecessary investments in stranded assets. As calculated for the UK, the application of flexible technologies to electricity grids could reach £8 billion/year savings in 2030 in operating and investment costs[6].

[5] See e.g.: Siemens/EPEX Spot: Taking markets to all levels. Valuing flexibility to achieve market-based sector integration, http://static.epexspot.com/document/41050/2019-09-25_EPEX%20SPOT-Siemens%20common%20paper.pdf

[6] UK National Infrastructure Commission

Are there any best practices or concrete projects for an integrated energy system you would like to highlight?

The following best practices are highlighted:

- The German Land Brandenburg is a pioneer in the implementation of the energy transition. Around 75% of electricity consumption in Brandenburg is already covered by renewable energies - significantly more than the national average and even more than the national target for 2030 (65%). Brandenburg brings TSO, DSO, local industry and flexibility providers together to establish the Brandenburg flexibility model together. The efforts in Brandenburg are one of the reasons why US electric car pioneer Tesla has chosen this Land for its new European production line.

- Electric vehicles are parked over 90% of the time and the capacity of their batteries could be used to help the grid integrate more variable renewable energy and provide ancillary services.
  For the last three years in Eastern Denmark, the cooperation between the TSO and an independent energy service company has allowed the aggregation of individual and fleet vehicles for market participation while meeting the individual driver's charging and mobility needs. A group of EVs are transformed from an unpredictable load to a stable capacity appropriate for ancillary services, with a model of buying and selling energy from behind a retail meter without net metering facilitated by Denmark's decision to exempt EVs from the 49% Elaftgift tariff on retail energy.

- In the town of Järvenpää (Finland) the first industrial energy management system at a new distribution center of a major food supplier will use demand response, run on 100% renewable energy and target more than 50% energy cost savings. This will be achieved thanks to a smart microgrid that consists of a solar power plant, energy storage, bi-directional district heating and an innovative advisor control system. The heat recovered from the distribution center's refrigeration equipment and systems will be used for the building's energy needs and supplied to nearby residents, heating water for approximately 500 private homes. An open building management solution will be deployed to integrate multiple systems for centralized, real-time control and management.

- The integrated energy market concept – ranging from buildings to countries – extends the role of the market to make full use of flexibility while facilitating sector integration, decarbonization and supporting the grid. Energy markets can be opened to decentralized market players, down to the level of a single building. This will be possible using Building Energy Management Systems and optimization algorithms and connecting them to the flexibility and wholesale markets. Buildings are more and more equipped to self-supply their electricity needs and even store power for future use. Energy Management Systems for buildings combine these assets with data on forecast and energy use, on a building level. Building Energy Management Systems can interact with other such equipped buildings to achieve local optimization, in order to generate additional revenues for the owner. The concept foresees that the system automatically generates offers to other buildings and market participants expressing the willingness to buy, sell or give access to flexibility. This flexibility can then be made available locally to other participants, covering local areas such as villages or city districts. The role of the local optimization is to aggregate individual offers through peer-to-peer transactions and to offer the remaining flexibility on the regional or the wholesale market.

- New innovative markets and products can further strengthen trading of flexibility and allow the market to resolve congestion in a cost-effective manner. The enera project set up a flexibility market, worth 360 MW of tradable and certified flexibility since its launch in early 2019, to eliminate physical congestion. It involves wind farms, biomass plants, batteries, power-to-gas plants and industrial loads. The project demonstrates that the curtailment of renewables can be avoided and new flexibility potentials can be opened up. As an example taken from the first trade between a power-to-gas facility and a wind farm, 2 MW were traded at a price of -45.50 €/MWh which created a real market price signal that cannot be provided by cost-based redispatch. The buyer, in this case owner of the power-to-gas facility, was reimbursed the corresponding amount. For a network operator, this means that in the event of congestion, no producer (e.g. a wind farm) has to be curtailed and the produced electricity can be used for gas production instead. An energy system with coupled sectors and without distorting sector-specific tariffs and charges can greatly facilitate the integration of renewables and the achievement of climate targets. The technologies for this, such as Power-to-X, are already available, but currently do not have enough marketing opportunities. A flexibility market will create revenue opportunities for sector-coupling technologies that can also be used for congestion management.

What policy actions and legislative measures could the Commission take to foster an integration of the energy system?

An ambitious implementation of the plans outlined in the Communication for a European Green Deal offers an immediate opportunity for Europe's citizens and industries to invest in growth that is truly sustainable, based on green jobs, industrial innovation, digital competitiveness, improved well-being and quality of life. The Smart Sector Integration Strategy offers the opportunity to coordinate the different actions and initiatives securing jobs, creating new employment and business opportunities from the Green Deal and digital transformation.
Three main priorities are identified:

1. Support the deployment of all decentralised energy resources

A forward-looking boost in investments needs to be triggered. Europe needs a comprehensive strategy to prioritize and rapidly deploy all decentralised energy resources for the benefit of energy users and the energy system as a whole. The success of a sector integration strategy will depend on the uptake of new sources of demand-side flexibility.
Particularly households with limited sources of capital will need financial support to invest in decentralised energy resources and comply with regulations phasing out carbon-intensive devices as ICE vehicles or natural gas heating systems, which must not be delayed further.

The Commission should support the market uptake of smart energy solutions among energy users through:

- innovative financing schemes, such as Energy Performance Contracting, on-tax or on-bill programmes;
- a revised proposal for the MFF 2021-2027 to acknowledge the post-COVID19 reality and allocate a considerable amount of dedicated EU funds to enable energy users to become active participants in the clean energy transition while phasing out subsidies for fossil-fuel-based solutions;
- the revision of the State Aid Guidelines and the TEN-E Regulation to support a pool of small-scale, decentralised projects on the demand side.

2. Implement the existing EU regulatory framework to unlock demand-side flexibility

The Electricity Market Design targeted some of the regulatory barriers to decentralised energy resources and flexibility business models. The Commission should monitor and support the

timely and correct implementation at national level, essential to eliminate existing regulatory barriers and foster demand-side flexibility.
Among others, Member States and regulators should be encouraged to:

- design tariffs to reward much-needed flexibility: dynamic price contracts should encourage the use of electricity when it is most beneficial for the power system and for reducing carbon emissions. This would be one immediate approach to encourage flexibility and deliver economic benefits to consumers for their willingness to shift their consumption, review the revenue model of system operators to level the playing field between hardware network reinforcement solutions and non-wire flexibility alternatives,
- promote the development of local flexibility markets to create new revenue opportunities for sector coupling technologies, such as power-to-gas, and offer an additional flexibility provision source for market-based congestion management.

The effective implementation of the EPBD, including concrete Long-term Renovation Strategies and the Smart Readiness Indicator (SRI) for buildings, should lay the foundations and enable buildings to play an active role in the energy system.

To conclude, solid and reliable NECPs should guide Member States in the energy conversion towards more direct electrification of different sectors as well as the integration of the energy systems to increase system efficiency.

3. <u>Target new challenges to the participation of the demand side in the clean energy transition</u>

The promotion of direct electrification and empowerment of energy users should be the fil rouge of different initiatives already announced by the Commission:

- the Renovation Wave should boost the integrated, efficient, renewable-based and flexible refurbishments of the existing building stock. The demand-side flexibility potential of smart and active buildings should be recognised, valued and unlocked;
- the EU Industrial Strategy should foster the active participation of all energy intensive industries to the clean energy transition by activating their demand response potentials;
- the revision of the Alternative Fuels Infrastructure Directive (AFID) should ensure the wide-spread deployment of smart (normal-power) charging infrastructure for the integration of electric vehicles in the power system;
- the European Climate Pact is a prominent bottom-up initiative which should raise awareness on the opportunities for all energy users to flexibly adapt their consumption and contribute to the clean energy transition;
- interoperability and cybersecurity should be fostered to reflect the increased digitalisation in the energy sector;
- the revision of the Energy Taxation Directive should aim to minimise the blunting effect of taxes on energy price signals. Crucially, it should also remove implicit incentives to fossil fuels and create tax exemptions for carbon-neutral alternatives. Today, electricity is heavily taxed compared to gas. This needs to be reversed;
- the revision of the State Aid Guidelines should reflect the integrated perspective of system efficiency and take full account of the crucial role of flexibility assets. While demand-side flexibility is typically a cost-effect resource in itself, its uptake is hindered if other technologies benefit from support or capacity mechanisms that do not reflect the full value and capabilities of flexibility resources.