# Smart sector Integration in the EnR network

## Assessment of implementation status, opportunities, challenges and priorities

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# 1 Executive summary

The EnR network has set up a task force on Smart Sector Integration (SSI), to provide more insights in smart sector integration activities by EnR members. Smart sector integration includes approaches in which efforts in two or more sectors are combined to generate a stronger impact, for example building facade integrated PV systems, in which PV panels form a part of the facade of a building, and local integration of renewable energy generation and vehicle charging. Such approaches can also be extended to include more sectors and create larger gains in environmental impact and societal benefits. EnR members have started exploring smart sector integration in their country and many have also participated in large-scale integrated projects tackling a wide range of green economy aspects including regenerating the built environment, creating sustainable industrial areas, transforming the electricity and renewable heat supply infrastructure and greening the transport infrastructure, with further links to the local economy and citizen and business involvement.

Smart sector integration, or the development of decarbonised, integrated energy systems, is part of energy transition strategies in almost all countries. It is also a core element of the European Green Deal. Sector integration links energy production, distribution, storage and usage across sectors and parties, optimising the system as a whole. An essential part of sector integration is that it shifts boundaries: between sectors, between public and private interests, between suppliers and consumers, between regulators and market parties, and between investments and running costs. One cannot address sector integration without defining new ways to encourage, regulate, fund and organise these new energy systems – and without redefining how public authorities interact with stakeholders about those initiatives. Energy agencies, with their central role in facilitating the energy transition, are at the heart of these developments and have learnt valuable lessons about smart sector integration initiatives and what is needed to let them flourish.

Experiences with smart sector integration point to eight shared opportunities and challenges for initiatives:

1. New business models: SSI requires business models suitable for multi-sectoral investments, and rewards commercial and societal benefits, including those generated in other sectors.
2. Regulatory restrictions and sandboxes: SSI involves new connections and transactions between sectors, often involving heavily regulated ones such as energy networks. These regulations protect consumers and the stability of the system; they can also create inertia.
3. The role of energy communities: Energy communities or cooperatives offer a new form of organisation, which can combine renewable energy generation, waste energy use and efficient consumption as well as the option to address other wishes of the community.
4. The identification of the "problem owner" and convenor of parties: Multi-sector solutions often do not have a natural leading party, which can initiate a project and bring others together.
5. Blending public and private investments and interests: SSI often combines public and private interests and needs several types of investment, each with their own type of risks and rewards.
6. The role of (heat) networks: SSI requires new networks, to exchange energy. Examples include local, dedicated renewable electricity grids and local heat exchange networks.
7. Social justice in energy transition (Just Transition): Energy transition requires investments and different parties have different capacities to invest and reap the benefits of energy investments.
8. The role of governments and energy agencies: Smart sector integration changes the traditional roles of various levels of government, as initiatives often involve a mix of new regulatory arrangements, combinations of instruments, goals, business and financial models and stakeholder collaborations.

This assessment further identified four priorities for the continued development of smart sector integration:

a. Researching and piloting new business models
b. Further exploring the key role of local energy exchange networks
c. Developing the framework for energy communities
d. Finding new ways to assure affordability of decarbonised integrated energy systems

Based on these findings, it is recommended that the EnR network continues this Task Force on SSI and:

- Regularly updates this analysis to continue knowledge exchange
- Shares policy implementation lessons with European and national policy makers
- Organises a series of workshops, focusing on the eight identified priorities

# 2 Introducing Smart Sector Integration for the EnR network

## 2.1 Smart Sector Integration in the Energy Transition

The European Green Deal puts the EU on a path to climate neutrality by 2050, through the deep decarbonisation of all sectors of the economy, and higher greenhouse gas emission reductions for 2030. Energy system integration – the coordinated planning and operation of the energy system 'as a whole', across multiple energy carriers, infrastructures, and consumption sectors – is the pathway towards an effective, affordable and deep decarbonisation of the European economy.

According to the European Commission, energy system integration refers to the planning and operating of the energy system "as a whole", across multiple energy carriers, infrastructures, and consumption sectors, by creating stronger links between them with the objective of delivering low-carbon, reliable and resource-efficient energy services, at the least possible cost for society. It encompasses three complementary and mutually reinforcing concepts:

- A more 'circular' energy system, with energy efficiency at its core
- A greater direct electrification of end-use sectors
- The use of renewable and low-carbon fuels, including hydrogen, for end-use applications where direct heating or electrification are not feasible

A more integrated system will also be a 'multi-directional' system in which consumers play an active role in energy supply. 'Vertically', decentralised production units and customers contribute actively to the overall balance and flexibility of the system – for instance, biomethane produced from organic waste injected in gas networks at a local level, or "vehicle-to-grid" services. 'Horizontally', exchanges of energy increasingly take place between consuming sectors – for instance, energy customers exchanging heat in smart district heating and cooling systems or feeding in the electricity that they produce individually or as part of energy communities (extracted from: *Powering a climate-neutral economy: An EU Strategy for Energy System Integration*, European Commission communication, COM(2020) 299 final).

Most countries have started to develop sizable renewable energy portfolios. Renewable energy now needs to be integrated in energy systems, which poses technological, spatial, organisational and regulatory barriers. Sector integration is highly relevant for future energy systems, since it provides a way to link energy supply and usage, exchange energy between sectors, and new opportunities for energy storage and distribution. This creates new decarbonisation pathways, however, the regulatory, business, financing and organisational aspects of smart sector integration need to be further improved. A wider business case, creating value within the energy system as well as in the local or regional economy, appears to be essential for successful smart sector integration. Some analyses of initiatives have pointed to linkages with the local economy, increased employment, health care, water management, green spaces, food production and mobility as areas relevant for value creation for smart initiatives.

The national energy agencies united in the EnR network are all tasked with facilitating the delivery of energy system integration in their countries. Energy agencies are at the nexus of policies, regulations, technology development and the local implementation in concrete initiatives and interact with stakeholders across sectors and regions to help parties take steps towards a decarbonised, integrated energy system.

## 2.2 The EnR network and Smart Sector Integration

The EnR network has set up a task force on Smart Sector Integration, to provide more insights in smart sector integration activities by EnR members. Smart sector integration includes approaches in which efforts in two or more sectors are combined to generate a stronger impact, for example building facade integrated PV

systems, in which PV panels form a part of the facade of a building, and local integration of renewable energy generation and vehicle charging. Such approaches can also be extended to include more sectors and create larger gains in environmental impact and societal benefits. Many EnR members have started exploring smart sector integration in their country and some have also participated in large-scale integrated projects tackling, for example, (regenerating) the built environment, (transforming) the energy supply infrastructure and (greening) the transport infrastructure, with further links to the local economy and citizen involvement.

The task force has produced this analysis, to provide an overview of initiatives in member countries, assess opportunities and challenges emerging in various countries and assess where and how energy agencies could further support smart sector integration in Europe, at local, national and European level. The analysis further suggests next steps to continue sharing lessons learnt and deepening the understanding of how smart sector integration can help achieve the energy transition, in line with the objectives of the Green deal.

# 3 Smart Sector Integration overview per country

The current status of smart sector integration developments varies between countries. A headline summary is presented here, with further information provided in country fact sheets (Annex Country Fact Sheets)

Smart sector integration is an important part of achieving climate neutrality in **Austria,** with a focus on the use of waste heat and the heating of buildings. Electrification of heating is assessed as an option to reduce the carbon footprint as well as increase flexibility of the grid.

**Finland** has a strong tradition in district heating and CHP, waste heat use is increasing and electrification of energy use is growing. Those are also core elements in its smart sector integration approach, focusing on the energy system and on sector integration in industry and in cities and regions.

**France** is addressing smart sector integration in many areas, targeting virtually every sector of the economy. Its focus on decarbonising the economy brings forward initiatives around renewable industrial heat, local heat networks and waste heat use, the integration of renewables in agricultural production and e-mobility.

In **Germany**, smart sector integration has been an important element of the country's strategy for five years. Germany's energy transition is no longer "just" about energy efficiency and renewables; it is about solutions that cover and optimise across multiple sectors.

Smart sector integration is a relatively new concept for **Greece**, however, it is piloting new approaches for renewable, locally integrated energy systems and the technical, policy and consumer issues involved.

In **Italy**, the national energy agency has set up a dedicated lab to research smart sector integration. Piloting the integration of various energy networks at its own facilities provides valuable lessons for further steps.

Smart sector integration is growing in **the Netherlands**, with a variety of initiatives targeting sustainable urban areas, the use of waste heat, local production and consumption of renewable energy and e-mobility. Value creation and the development of business model are important focal points in the approach.

**Norway** already has almost 100% renewable electricity production and continues to electrify large sections of the economy. It focuses on flexible grids to address larger power demands and the electrification of heating.

**Spain** is at an early stage of smart sector integration, building on its strong standing in renewable energy production. Electrification of heating and of transport are priorities, as is a new approach to energy grids built around flexibility. Many pilots and initiatives are ongoing to further these priorities.

**Sweden** has an elaborate strategy built around integrated industrial development and redesigning how industry operates. In many "strategy nodes", the energy needs of industrial activities are integrated with renewable energy production, local energy infrastructure and sustainable housing.

In **Switzerland**, smart sector integration is recognised though not yet included in policy planning. Self-generation and -consumption of renewable energy are priorities, as are sustainable "2000 Watt" communities.

The **United Kingdom** is fast developing its smart sector integration approach, with a leading role for network operators. There's a strong focus on community energy initiatives and the integration of PV power generation and vehicle charging.

In **Bulgaria**, smart sector integration is in earlier stages, building on experiences with local and regional energy planning. It is also relatively new in **Poland**, where decentralised energy generation and e-mobility are current priorities. **Croatia** and **Malta** are focusing on the integration of renewable energy production and creating more flexibility in the grid and preparations for further steps.

# 4 Opportunities & Challenges for Smart Sector Integration

## 4.1 New business models

SSI requires business models which are suitable for multi-sectoral investments, and that rewards commercial and societal benefits, including benefits and avoided costs which are generated in other sectors. The opportunity is that new business models can greatly expand the commercial potential for the energy transition and its public support; the challenge that there is little experience with business models crossing sectoral boundaries, money transfers between investors and participants and rewarding societal benefits (directly or indirectly, through taxation).

A good example of possibilities created with new business models can be found in Sweden, which implements “strategy nodes” in which industries developed new low-carbon processes, redesign how they generate, use and exchange energy – between industries, with buildings and using on- and offsite renewable resources, thus creating new employment and business opportunities. Private (industry) parties typically provide the investments needed. The Swedish Energy Agency facilitates these "strategy nodes" by providing a platform for cross-sectoral collaboration, pre-feasibility studies, regulatory support and strategic communication to explore options and reduce (investment) risks.

There are also several interesting examples in France, where national energy agency ADEME helps to develop new business models that integrate renewable energy use into existing business models. This includes, for example, initiatives in the agricultural sector in which farmers install PV panels, which provide crop shading and protection, as well as generate electricity. This generates a second income stream for farmers and increases revenues in the primary income stream (through increased agricultural production). A similar idea is applied for industrial heat, where industries can provide waste heat to other industries through local heat networks, generating additional revenues for the seller, as well as lower energy cost for the ones using waste heat, which attracts new business.

Switzerland has created regulation and standard contracts for selling and buying renewable energy locally, directly from neighbours. This allows for new business models for self-production of renewable energy and an incentive for local use of that energy.

## 4.2 Regulatory restrictions and sandboxes

SSI includes new connections and transactions between sectors, often involving heavily regulated ones such as energy networks. Distribution networks and energy systems are heavily regulated to protect consumers and the stability of the system; this can also create inertia. The challenge is to redefine the regulations needed to serve society’s goals for energy transition and define who safeguards the interests of all parties involved; the opportunity is that new regulatory regimes, piloted through regulatory sandboxes, can create new markets and put the power of business behind society’s needs.

Norway provides a good example for regulatory sandboxes, in its large-scale demonstrations of future energy systems. Enova, the Norwegian energy agency, was involved in the creation of eight such demonstrations, in which technologies and business models are developed that stimulate the use of latent flexibility resources, better efficiency and energy storage. A marketplace to sell and buy flexibility is part of the demonstrations, to better understand how flexibility can be created and priced in future. The Energy regulator has allowed temporary exemptions for regulations to allow these business models to be tested, since some solutions conflict with current energy market rules.

Another interesting approach to regulatory sandboxes is applied by Italy. ENEA, the national energy agency, uses its own facilities to test new technical solutions and observe their energy and business impacts. This

approach allows for more experimentation and invites solutions that might not work under normal market rules, thus creating its own sandboxes.

To tackle regulatory restrictions, CRES, in Greece, is developing and optimising a licensing framework and technical specifications for RES district heating networks, feeding of biogas into the natural gas network and the exploitation of geothermal fields. It is also developing a regulatory framework for the production of thermal energy from RES and the feeding of biomethane into the natural gas network. These regulatory frameworks help create an environment conducive to investing in renewable heating.

## 4.3 The role of energy communities

Energy communities or cooperatives offer a new form of organisation, which can combine renewable energy generation waste energy use and efficient consumption as well as the option to address other wishes of the community. The opportunity is that these communities can provide a structure in which novel forms of cooperation can be organised. The challenge is that regulations and business models for energy communities are not yet well developed, that business (continuity) risks are not always well-arranged and that there is little learning from one experiment to the next (reinventing the wheel over and over).

Almost all countries have examples of working with energy communities. The Netherlands, for example, has developed a comprehensive approach for energy communities to invest in local renewable energy generation, embedded in a regulatory framework and sufficiently standardised to allow for the financing of investments by such communities through regular financial institutions. The energy community approach is now being piloted for community-scale smart sector integration initiatives, for example in the natural gas-free neighbourhoods' programme.

In the UK, community energy initiatives offer good opportunities for sector integration, in particular in Wales and Scotland. Energy communities can benefit from UK market rules which result in a better price for PV electricity if it is sold directly to (the owners of) electric vehicles, or to rail operators (who run their own electric grids). In Spain, the Government has developed a new system for the auctioning of renewable energy, which allows to account for special features of energy communities.

A particularly interesting example of energy communities is emerging in Sweden, where "strategy nodes" link many industries together in a form of energy community. Helped by government support through the Swedish Energy Agency, industries individually and jointly invest in a local energy infrastructure which helps all to reduce their energy needs, increase the use of renewables and link energy flows in industrial activities to surrounding areas. A somewhat similar approach can be found in France, where ADEME is helping local industries form collaborations for local heat exchange networks. This shows that the concept of energy communities has wide applicability and be a key to smart sector integration in many sectors.

## 4.4 The identification of the "problem owner" and convenor of parties

Multi-sector solutions often don't have a natural leading party, which can initiate a project and bring others together. The opportunity is that, where there is not a natural leader, many can be initiating new approaches; the challenge is that there is no automatic mandate for an initiator to take the lead in a new smart sector integration initiative and that there is no natural source of funding for the – often expensive – design phase.

Many agencies have addressed this challenge through their convening power. In Germany, for example, Dena has brought together stakeholders from different backgrounds in innovations round tables and alliances, joint research projects as well as flagship initiatives. It has learned that it's important to bring new parties, such as start-ups, into the mix as this helps "break open" the setting of business models that don't align between sectors and help new ways to link up stakeholders.

Other examples include CRES, in Greece, which has been a partner in projects, and has brought together local and national parties together under the umbrella of its project. This has led to a new structure to realise a renewable energy system for a whole community, through an energy community that includes the

municipality, local utility as well as citizens. CRES' leadership role will in time transfer to the municipality, once the pilot phase is over. In Sweden, the Swedish Energy Agency actively uses its convening power to bring parties together. The simple presence of the agency, with its expertise, resources and its position between market and government parties, helps to convene parties, initiate a discussion and continue interaction. This is helped by the agency's ability to identify local barriers, assess regulatory hurdles that may lie behind these and translate these into suggestions for policy or regulatory solutions. Not everything can be solved this way, and clarity about what is possible and what not is essential, however, the role is crucial and helps projects move forward.

## 4.5 Blending public and private investments and interests

SSI often combines public and private interests and needs several types of investment, each with their own type of risks and rewards. The opportunity is that blended investments can be much more effective, in creating new projects and in managing risks. The challenge is that different forms of investment each have their own rules, often not aligned, that blending investments requires flexibility from all parties involved and that there is no established mechanism for money transfers which unburden inhabitants or tenants.

An excellent example of this challenge is seen in France, where there are many initiatives to use industrial waste heat in other industries and/or in buildings. This requires heat recovery technology, of course, however, more importantly, it requires a network between parties and the legal framework in which parties can commit for a long term. ADEME, the national energy agency, provides loan guarantees for the establishment of those networks, with the special provision that the loan does not have to be paid back if the heat supplier or customer disappears – thus eliminating a major hurdle for long-term investments. Many initiatives are prepared by municipalities, in which case ADEME also reviews how plans for a heat network fit with local and regional development plans, thus making sure that investments are futureproof.

Another interesting example can be found in Austria, where the Austrian Energy Agency is exploring alternative financial models for heating. Traditionally, houses are heated with oil boilers, with relatively low investment costs and high running costs. More sustainable alternatives, such as heat pumps, have lower running costs and can be cost-effective in the longer term, however, also require larger upfront investments that are out of reach of many households. Heating as a service is explored as an alternative, to shift investments away from the homeowner in exchange for a usage fee. Such models also shift the boundaries between typically public investments (such as a gas network) and private investments (building heating systems), which allows for new business models and different risk allocations.

## 4.6 The role of (heat) networks

SSI requires new networks, to exchange energy. Examples include local, dedicated renewable electricity grids and local heat exchange networks. The challenge is that there is often a limited regulatory framework for such networks, or even a regulatory ban, and that "normal" requirements for network operators such as guaranteeing continuous delivery of energy can be difficult to arrange. The opportunity is that local networks bring together partners in a powerful, mutually beneficiary way and can bring energy and financial efficiencies that are otherwise unavailable.

Heat networks feature prominently in smart sector initiatives in many countries. Finland, with its tradition of district heating, is exploring how such networks can be used to decarbonise energy use in the retail and commercial sectors, using local low-temperature heat sources to heat commercial areas.

In France, ADEME operates a heat fund, which supports communities in the large-scale use of renewable heat and cold in their territories. It combines this with support for local heat networks, using industrial waste heat, in a dedicated approach with dedicated loans for networks and support for the developers of projects. This addresses two core challenges for the development of renewable heat networks: Who pays for the network, and what happens if a heat client or heat producer disappears?

In Spain, the Government has just released a strategy for energy storage, focusing on a change of perspective from "renewables are a problem" to "a grid built around flexibility". There's a need for a decentralised model for electricity grids, in which DSOs would have a more complex and also more important role. IDAE is designing the support programme to implement at least five pilots to test whether distributed services can provide competitive solutions for flexibility. These pilots test the technology, and also the economic competitiveness, business models and the regulatory setting.

## 4.7 Diversification of energy carriers and e-fuels

The future energy system is characterised by integration, of energy producers and consumers, cascading or re-using energy and energy flows of different types. New types of fuels are being explored (often referred to as Power-2-Fuels), such as hydrogen, ammonia, methanol and other synthetic hydrocarbons, to store and transport energy. The opportunity is that new types of fuels create new opportunities to green energy use, in particular in parts of industry and the transport sector. The challenge is that technologies are still being developed and that there is a lack of business models.

New energy carriers to link renewable energy generation and integrated energy use are a priority for many energy agencies. IDAE, in Spain, for example, is investing in hydrogen production from renewable sources to better understand the challenges, business opportunities and energy potential of this new energy carrier. ADEME, in France, is exploring the role of new energy carriers and their potential to support integrated, decarbonised energy systems. Dena, in Germany, has identified a wider mix of energy carriers as enabler of cost effective and robust energy transition pathways.

The role of new energy fuels, such as hydrogen, e-fuels and biofuels should be further explored and their links to energy uses, distribution as well networks, further investigated.

## 4.8 Social justice in energy transition (Just Transition)

Energy transition requires investments and different parties have a different capacity to invest and reap the benefits of energy transition investments. The opportunity is that smart sector integration shifts the boundaries between public and private investments, which creates new ways of balancing individual and public investments and benefits. The challenge is that there is no set policy or business framework for a new balance between sectors, parties and society.

Affordability of investments in energy transition is a concern for all energy agencies. All countries apply subsidy mechanisms, typically implemented by energy agencies, to help reduce the cost of investments. Subsidies are typically tailored to the needs of a specific project in a specific setting, and many energy agencies are involved in designing and fine-tuning the details of subsidy mechanisms as well as in assessing individual applications. This role not only bring important sectoral and regional knowledge into the design and application of subsidy mechanisms, it also provides national governments with an important feedback mechanism to better understand the on-the-ground impacts of their support programmes.

Many energy agencies also develop and apply other financial mechanisms to improve affordability of investments and make these accessible to all parts of society. The Spanish energy agency, IDAE, for example, takes a role investing in new renewable technology businesses, providing much-needed capital. The French agency, ADEME, provides dedicated guaranteed loans for investments in local heat networks, providing capital as well as transferring risks. This not only reduces the capital cost of such investments, it also transfers risks and makes investments available to parties that cannot easily provide the long-term investments needed on their own.

The Austrian Energy Agency is developing approaches for heating as a service, which shifts capital investments away from private households with limited means and onto utility partners much better placed to provide long term investments and absorb long term risks involved with a technology switch. The Swedish Energy Agency doesn't provide direct funding for its "strategy node" initiatives, however, it provides risk management and financial guarantees, which make investments available to many businesses, and can be particularly relevant for SMEs.

## 4.9 The role of governments and energy agencies

Governments traditionally set the rules for energy systems, often based on a sectoral approach; energy agencies manage programmes and implement different policies. Local governments are typically also organised in a sectoral manner. Knowledge, instruments and (sectoral) networks meet each other at energy agencies. Smart sector integration complicates traditional roles, as initiatives often involve a mix of new regulatory arrangements, combinations of instruments, combinations of different goals, new business models, stakeholder collaborations and financial models. The opportunity is that combining national government, local government and agency roles can bring much more effective interventions. The challenge is that there is no "rule book" for such interventions and that most agencies have a pivotal role in this, however, are not yet fully organised for multi-sectoral, multi-aspect initiatives and could learn from promising initiatives in many countries.

The role of energy agencies in bridging national and local priorities, combining sectors and priorities is exemplified by many agencies. For example, ADEME, in France, has long been working with local authorities to implement public policies for ecological transition in the fields of energy, the circular economy and the sustainable city. It has set up a framework for sector coupling including many aspects, such as energy efficiency, renovation wave, energy poverty, social aspects, and strengthens and supports local authorities in mastering digital technology tools that will help the energy, ecological and societal transition. At its central office it supports progress within sectors, and through its regional offices it supports parties in bringing together (expertise from) various sectors to projects.

In Germany, Dena supports a better public understanding of smart sector integration through research, publications, stakeholder outreach and public appearances. Dena positions itself as a neutral player between politics and the corporate world, to maintain its position and bring together other parties. IDAE, in Spain, works on national developments as well as regional ones. Its Sustainable Urban Development programme, for example, combines 17 measures for energy efficiency and public infrastructures in municipalities and cities, sustainable urban mobility and the use of renewable energy systems for heating and electricity in buildings. This supports local partners to build cross-sectoral collaborations across multiple themes, with integrated national support. It coordinates and integrates its approach through its regulatory office, which has a good overview of opportunities and requirements across sectors and can combine measures to create effective support packages.

RVO, in the Netherlands, supports multi-sectoral projects involving multiple aspects. It helps local and regional partners in combining support instruments to make initiatives work and brings in expertise from various backgrounds. It helps projects link to national government and to work around regulatory barriers, for example by creating regulatory sandboxes for electricity market regulations. The Energy Saving Trust, in the UK, brings experiences from individual projects up to the policy level and shares these lessons with policy makers. In Sweden, the Swedish Energy Agency has organised itself in sectors and streams to better address the challenges that local parties and project initiators face. It also looks into organising itself around "strategy nodes", to make sure that it efficiently delivers the support local initiatives needs most and can be effective as a bridge between local parties, business participants, and national and European policy makers.

# 5 Conclusions

Smart sector integration, or the development of decarbonised, integrated energy systems, is part of energy transition strategies in almost all countries. It is also a core element of the European Green Deal. Sector integration links energy production, distribution, storage and usage across sectors and parties, optimising the system as a whole. An essential part of sector integration is that is shifts boundaries: between sectors, between public and private interests, between suppliers and consumers, between regulators and market parties, and between investments and running costs. One cannot address sector integration without defining new ways to encourage, regulate, fund and organise these new energy systems – and without redefining how public authorities interact with stakeholders about those initiatives. Energy agencies, with their central role in facilitating the energy transition, are at the heart of these developments and have learnt valuable lessons about smart sector integration initiatives and what is needed to let them flourish.

## 5.1 Findings about implementation status and priorities of Smart Sector Integration

Smart sector integration is becoming an essential element in national strategies for a decarbonised, integrated energy system in many EnR member countries. Most countries and agencies have also already been taking significant steps to further smart sector integration, in various sectors. In some countries, the integration between sectors has been used as a starting point (e.g., vehicle charging and local renewable energy production), whereas others have taken local and regional initiatives as their starting point (e.g., local waste heat use, cascading industrial heat use). Initiatives in all countries, however, have a local or regional development angle and include the local integration of energy use in two or more sectors.

Networks are a crucial element in all smart sector initiatives, and in all initiatives, agencies have been working on ways to further smart networks as a means to integrate energy flows. For electricity, this typically focuses on flexibility and the integration of local renewable production and consumption. For heat, the local exchange of (low temperature) waste and renewable heat are typical focal points. In most projects, there are challenges around the ownership of networks, risk allocation and regulatory barriers as well as business models that can reward investors in the short and long term. Agencies have found different ways to help overcome those barriers, and there is potential to learn from other agencies and countries about which approach works best in which setting.

Energy communities are important for most smart sector initiatives. These can take different shapes and forms, depending on the setting, and can include citizens, small businesses, municipalities and industries. Energy communities are essential, however, for bringing and binding together local stakeholders and creating a framework for longer-term collaboration. Some communities include one type of participant, whereas other ones include a range of participants of different backgrounds. Energy market regulations often still pose challenges for energy communities, as the boundaries between traditional market roles (such as supplier, distributor and consumer) are different in energy communities and rules don't always fit well with those changing roles. There are also still challenges in making sure that communities have (access to) the necessary knowledge and in arranging the public-private cooperation and investments that are needed to be successful. Interestingly, energy communities are also being created for industrial developments, such as sustainable business parks or waste heat exchange, and even though these are not typically called an "energy community", the structure and type of collaboration has many similarities with the better-known energy communities of citizens. Countries regulate energy communities differently, agencies provide different kinds of support and there is potential to further explore which approach has the most potential for various settings and purposes.

Finding business models for integrated energy systems remains a challenge in all countries and for all energy agencies. Traditional business models are not a good fit for integrated energy systems, in which the borders between sectors shift and costs and revenues are often occurring in non-traditional places. Network investments are often a large part of the investment needed for smart sector integration, and there is a lack of

established business models that reward investments in one part of the energy system for gains generated in another part. This is also an issue for network flexibility, which is in high demand, however, without established business models for delivering flexibility in an integrated energy system.

Social justice remains a concern for the energy agencies working on smart sector integration. Integrated energy systems often require large, long-term investments, which often cross the boundaries between what used to be a public investment (e.g., network) and a private investment (e.g., end-use equipment). Agencies have taken initiatives to explore new financing models, in which some private investments are brought into the public domain, as network cost or through loans and financial guarantees. There are various promising approaches, however, more collaboration is needed to learn what can work in which situation.

## 5.2 Priorities for the continued development of smart sector integration

The further development of smart integrated energy systems and the role of energy agencies in that development can be characterised by four interlinked priorities:

*Researching and piloting new business models*
A better understanding of business models that enable sufficient investment in integrated, cross-sectoral energy systems is needed, for investments involving private parties as well as public-private partnerships. Questions for those business models include:

- How can risks be allocated between parties? How can benefits be distributed? Who can best absorb short- and long-term risks?
- What is the boundary between public and private sector investments?
- What are examples of successful business models crossing sectoral boundaries?
- Which legal or regulatory barriers exist for promising business models?

*Further exploring the key role of local energy exchange networks*
Networks are the linking pin for sector integration, and local networks, for electricity and heat, are a necessary condition for exchanging renewable energy. New approaches are needed to make sure that the necessary local energy networks, flexible and with a focus on reducing energy demand across sectors and regions, are put in place. Questions for the further development of local energy networks include:

- Which networks are needed for which sectors?
- What parts of local energy networks is of public interest, and what of private interest?
- How can networks be financed? Which party can pay what, and at which moment in time?
- What are good regulatory regimes for local energy exchange networks?
- What role can networks have in making the energy transition affordable and socially just?

*Developing the framework for energy communities*
Energy communities are an important organisational tool for smart sector integration. Without (some form of) energy communities, it is difficult to bring together parties across sectors into a joint integrated energy system. The further development of energy communities requires more insights in:

- What is the need for energy communities in various sectors?
- Which ways exist to organise and to regulate energy communities?
- What is the role of energy communities in an inclusive energy transition?
- How can energy communities help with the affordability of energy transition?

*Finding new ways to assure affordability of decarbonised integrated energy systems*
The investments needed for the transition to a decarbonised, integrated energy system can be prohibitive. Costs and benefits may not (yet) be well-aligned and, equally important, parties vary in their capacity to invest in new systems, accept technology and commercial risks and offset future savings against current cost.

New ways of assuring the affordability of the energy transition are needed, which go further than subsidising short-term cost-benefit shortfalls. An exploration of new ways to ensure affordability needs to include:

- Assessing which parties currently participate in smart sector integration projects, and whether these represent the full spectrum of stakeholders
- A focus on the investment needs and investment capacity of various stakeholders
- Costs and benefits of investments over time, and the capacity of different kinds of stakeholders to absorb financial, economic and technical risks and time differences between costs and benefits
- Boundaries between public and private investments and how shifting boundaries can benefit or hinder a socially just transition.

## 5.3 Crucial role of energy agencies in smart sector integration

The role of energy agencies in the smart integration of energy systems is also transforming: agencies' roles is moving from being an agent of change in one sector, helping with the introduction of one or more (technical, economic, social) innovations, to that of a connector and integrator between partners. In their new role, energy agencies form the linking pin between national and European policy makers and regulators, local and regional authorities, citizens, businesses, banks, network operators, homeowners, car users, industrial energy users and all other parties (with each party often wearing more hats). This new role requires new skills and a new way of organising, to have the ability to bring parties across sectors together, support each step in the collaboration process with the right skills, provide and integrate technological expertise as well as expertise in many other disciplines (financing, regulation, business development, etc.) as needed and the ability to be engaged for a longer time. The convening power and expertise of energy agencies are important tools to bring parties together, facilitate a dialogue and give credibility to collaboration processes.

Energy agencies have a central role in enabling and implementing the energy transition, and fulfil four essential bridging roles, between:

- Individual versus collective interests, with consequences for how instruments can be designed and how collective entities such as municipalities and energy communities can have a role in the energy transition
- Individuals versus companies / market parties, and how these interactions are structured
- National and European policies versus drivers for individual actors, and how policies and programmes effectively trigger those drivers
- Sectors, and what is needed to enable various sectors to collaborate effectively.

Energy agencies additionally have an important role as agent for feedback about the on-the-ground effects of policies, programmes and regulations, providing lessons for their improvement and evolution.

# 6 Recommendations

The analysis presented in this report, the opportunities and challenges identified and the findings and priorities for the further development of smart sector integration have led to recommendations for follow-up action. First and foremost, it is essential to continue exchanging knowledge between energy agencies, and with policy makers. A platform for knowledge exchange, within the EnR network, would enable an ongoing exchange om experience with smart sector integration, sharing of lessons learnt as well as to gather feedback about the on-the-ground impacts of national and European policies and regulations. It is recommended that the EnR Task Force smart sector integration remains in place after this analysis to facilitate this knowledge exchange, and until a more permanent EnR platform is developed.

Recommended activities for the task force are:

1) Continue sharing lessons, as done with this analysis, and update the analysis from time to time. This includes regularly updating country fact sheets with recent developments, and re-assessing opportunities and challenges to track challenges that have been resolved, opportunities that are developed and new ones that have emerged.

2) To share policy implementation lessons with European and national policy makers, about experiences so far with the transition towards decarbonised, integrated energy systems and how policies, regulations, programmes and instruments could be refined to better fit with the needs and capacities of the various stakeholder groups. The task force can facilitate this by sharing this report with (national and European) policy makers and briefing those policy makers on shared experiences of energy agencies.

3) To organise a series of workshops, focusing on the four priorities identified for the further development of smart sector integration:
   a) New business models: examples, risk allocation, regulatory hurdles and public vs. private sector
   b) Local energy exchange networks: needs, public vs private interest, financing, regulatory regime, role in affordability
   c) Energy communities: needs for various sectors, organising and regulating, inclusiveness
   d) Affordability of decarbonised integrated energy systems: participation, investment capacity, tolerance for risk and time differences, boundaries of public and private investments

   In addition, workshops would be useful for topics of shared interest:
   e) Regulatory sandboxes, and how these can generate lessons for future policies and regulations
   f) Financing methods for smart sector integration, and their strengths and weaknesses
   g) Stakeholder engagement and collation building for local initiatives
   h) The role of new energy fuels and their use, distribution and exchange networks

# 7 Annex: Country Fact Sheets

## 7.1 Country: Austria (AEA)

*Status of Smart Sector Integration*

Smart sector integration is considered to be an important part of achieving climate neutrality, in particular for improving energy efficiency and reducing demand. Core aspects of Austria's approach include:

- Affordability, which is about the cost of measures and also about who pays for what.
- Flexibility options, and in particular whether thermal storage of heat in buildings can be used as a flexibility mechanism
- Using waste heat as an option to achieve sector integration

One specific focus in Austria are options to heat buildings. This includes power to heat, as a flexibility and decarbonisation option. Dynamic tariffs might be needed to help increase flexibility. Solar PV and heating are not an optimal combination, since PV can't provide sufficient electricity when heating is needed. It also includes assessing alternative heating solutions for low-income families, currently relying on oil heating. Such alternative solutions could include "heating as a service", in which a utility would invest in and build the (heat pump) heating system, and consumers would pay a service fee.

*Possibilities for smart sector integration*

Austria is currently looking at small regions: what is needed there? It is focusing on a broad range of measures, including industry and transport.

*Role of the energy agency*

The agency focuses on:

- Advising the ministry (for example on hydrogen strategy, green gas)
- Developing "model regions"
- Advising regional governments on heating strategies (which is a regional responsibility in Austria)
- Exchanging experiences in Europe
- Assessing electromobility options

*Organisational aspects of promoting smart sector integration*

The agency's organisation is not yet focused on sector integration. Various sectoral teams are working on parts of sector integration though. New mechanisms are needed for agencies to develop new smart sector integration approaches, perhaps using task forces to bring experts from various sectors together.

*Lessons from implemented projects*

There can be a conflict between the "energy efficiency first" principle and the need to create more flexibility in the energy system. Some flexibility options reduce energy efficiency, such as large electric resistance heaters – these could be an option to add flexibility to grids though.

Smart sector integration has to include many aspects, such as the energy system, equality, economic opportunities and organisational challenges. There is no single financial solution for smart sector integration. Affordability requires more attention, for various parties.

## 7.2 Country: Finland (Motiva)

*Status of Smart Sector Integration*

Finland has a strong track record in introducing energy saving measures and the efficienct use of energy, thanks to digitalisation and the update of new technologies. It also has a strong tradition of using district heating and CHP. A key topic going forward is the use of excess heat. The Government has initiated a

working group on energy sector integration tasked with presenting concrete solutions for promoting sector integration. The working group will, between August 2020 and June 2021, explore the needs for different forms of energy and the opportunities they offer and obstacles for sector integration. Topics addressed include energy sector integration, sector integration in industry and sector integration in cities and regions.

*Possibilities for smart sector integration*
Possibilities exist in:

- Engaging consumers
- Promoting energy efficiency
- Create new value for energy producers
- Using digital solutions (also given Finland's strong position in app development)
- Making use of instances with negative energy prices

The commercial/retail sector is considered a prime opportunity for smart sector integration, for example for its potential to use waste heat.

*Main obstacles for smart sector integration*
Obstacles are primarily about the intersection of technology and economy, more than purely technological. Finnish municipalities (around 300) are independent in their decisions about energy networks, and there are large differences between parts of the country, in particular between the Helsinki area and other parts.

Specific obstacles include:

- The time and resources needed for transition
- Most obstacles techno-economical instead of technological
- Uncertainty about which technological solution will prevail hindering investments to certain solution
- Scarcity of finance and the lack of financial models for new technologies (with higher risks)
- Split incentive problems in some cases
- Difficulties to understand/manage systemic approach
- Differing planning and permitting practices within regions
- Lack of knowledge (especially households/consumers but also experts in different sectors)

Specific challenges exist around self-generation of PV electricity, with a lack of bidirectional meters and no system for aggregating PV electricity.

*Instruments to be used to promote smart sector integration*
Instruments Motiva applies to promote smart sector integration include:

- Operating as a neutral state-owned company of sustainable development
- Networking and connecting different stakeholders and authorities
- Promoting enabling elements and technologies such as demand response, RES installation and smart technologies for buildings, smart mobility
- Actively participating in working groups developing enabling legislation
- Raising awareness and educating people on the issues
- Sharing and scaling up knowledge on best practices across sectors
- Participating in pilot projects

*Role of the energy agency*
Motiva's role includes, primarily:

- Communication, knowledge sharing and networking

- Support the scaling up of different technologies, experimentation and developing ecosystems
- Being a neutral intermediary between government regulators and practitioners
- Aiming to represent all angles of an issue (neutrality)

*Lessons from implemented projects*
The phrase Smart sector integration appears to mean different things to different people. In Finland, it is based on a wide range of different approaches, including voluntary actions and agreements, long persistent work and high trust and collaboration between parties.

There are several good examples of initiatives in Finland. One particular example is the Smart Aland project, in which 16 sub-projects on different aspects of energy supply and demand are linked together.

See www.smartenergytransition.fi/en for an overview of lessons from a cross-country comparison of initiatives. Critical recommendations from this review include:

1 Create a stable policy framework for renewable energy investments.
2 Eliminate regulatory barriers.
3 Promote training and access to information
4 Provide early-stage funding.
5 Provide long-term and low-interest investment funding schemes
6 Support community energy projects considering the benefits for society.
7 Promote cultural change.
8 Establish the right conditions for support organizations to operate.

## 7.3 Country: France (ADEME)

*Status of Smart Sector Integration*
France targets many aspects of smart sector integration, in various sectors, including industry, agriculture, buildings and mobility. Its post-Covid recovery plan focuses on decarbonising the economy, in particular in industry. This includes subsidies for renewable heat in industry, plans to combine energy efficiency with renewable heat, and a heat fund which provides support for heat recovery equipment.

Other priorities include:

- Cogeneration and the electrification of industry
- Integrating renewable energy production in the agricultural sector, providing a more diversified business case for farmers and options to generate multiple benefits, for example through crop sun and/or frost protection with PV panels (NB converting agricultural land to only renewable energy production is forbidden)
- Integrating renewable energy production with e-mobility, through linking PV electricity generation to charging points in commercial buildings and promoting the installation of PV panels on car parks.
- Local district heating networks, to make use of industrial waste heat, have been promoted using a special approach. Special companies are created to provide heat to other industries and manage risks (e.g., of the network breaking down or the heat supplier disappearing). Industrial parks with such a network attract more business since energy is less costly there.

The crucial element in promoting smart sector integration are energy networks and smart sector integration can be financed by financing those networks, in particular district heating networks. Two important questions always arise:

- Who pays for the network?
- What happens if a heat client or a heat producer disappears?

ADEME has developed special guaranteed loans, with the provision that loan doesn't have to be (fully) paid back in case a heat client or heat supplier stops business or becomes otherwise unavailable. This mitigates an important risk for project developers. Many heating networks are developed and financed by municipalities. ADEME then demands a 10-year development plan to se how the heat network fits in with local developments around housing, industrial areas and transport.

An important lesson is that it's quicker to start projects alone, however, it's more resilient to collaborate and build a partnership.

*Possibilities for smart sector integration*
Many possibilities – see below & section on instruments

*Main obstacles for smart sector integration*
Mainstreaming large-scale implementation projects and scaling-up solutions should be increased, and special attention should be paid to pricing issues. For cities, overcoming simple experimentation phase and building a coherent and holistic low-carbon city model is necessary, early integrating energy issues in urban planning, but financial resources and governance issues can hinder the sector coupling development. In addition, citizens' and consumers' readiness for and acceptance of new innovative solutions is also important.

It is important to have a holistic approach to achieve a harmonious smart integration and carbon neutrality objectives: amplify the energy renovation of buildings, promote electric and hybrid mobility, increase energy efficiency in industry and accelerate the deployment of renewable heat for households as well.

Smart integration involves different types of stakeholders and represents various challenges at the local, regional and national levels and thus requires measures of all types (regulatory, economic, fiscal, communicational, etc.) and of all kinds (incentive, coercive, informative).

*Instruments to be used to promote smart sector integration*
ADEME applies several large initiatives to promote (aspects of) smart sector integration, including:

Heat fund: Important measure for the development of renewable heat production. It targets communities and businesses to support them in their energy transition through the massive use of renewable heat and cold in the activities on their territories. ADEME has a double role: the agency provides guidance to project leaders and supports for implementation through its funding for the design of high-performance projects: studies, training, communication, evaluation, observation and support for investment. For the 2009-2016 period, the heat fund supported nearly 4,000 projects and total production of 2 million tonnes of oil equivalent (TOE).

Environmental approach to urban planning: The Environmental Approach to Urban Planning (AEU2) is a methodology for the use of local authorities and urban planning stakeholders to help them take into account the principles of sustainable development in their projects.

Transport sector: ADEME leads several activities supporting the development of electromobility, including the development of studies and analyses of an emerging sector; experimentation and evaluation of technological concepts; support for the deployment of recharging infrastructures through investment programme "Investissements d'Avenir" (and in particular the "Vehicle of the Future" sub-programme).

Excess heat in industry: Supporting industry efforts to reduce energy consumption is crucial for the energy transition. Synergies can be created within industrial processes: heat recovered from one process can be used to power another one. An ADEME-EDF study evaluates the potential of three new sectors: Household Waste Incineration Plants, Wastewater Treatment Plants and Data Centres.

Energy storage: ADEME supports research and development on storage systems with the main objective of lowering their costs. In the framework of Investissements d'Avenir programme, ADEME supports projects

implementing storage technologies which contribute to the improvement of technologies and the integration of storage systems into energy networks.

Hydrogen: ADEME has been supporting research and innovation work in the field of hydrogen for more than 15 years. The hydrogen carrier brings new solutions, complementary to the control of energy consumption and the development of renewable sources: ensuring electricity storage, managing energy networks and supporting cleaner mobility. Hydrogen thus provides new opportunities for self-consumption of local energy at the scale of a building, an island or a village, especially for areas not interconnected to the power grid. Since 2012, 22 projects have been selected in the framework of ADEME's calls for research projects. These projects concern both technological building blocks (membranes, bipolar plates, storage tanks, etc.) and demonstrations in real conditions of use. The Investissements d'Avenir programme has also been supporting the structuring of the industrial sector by co-financing large-scale demonstrators, such as those involving power-to-gas or innovations by SMEs.

Influencing public policy through an expert role: ADEME has an important role of influencing public policy development and supporting local and regional authorities through its forecasts and studies on public policy measures for low carbon scenarios. ADEME has, for example, published scenarios in different climate and energy related fields, including:

- "Evolution trajectories of the electricity mix by 2020-2060" covers different trajectories for the evolution in the electricity mix from economic perspective covering cost/benefit analysis.
- "Towards energy autonomy in non-interconnected areas – Horizon 2030". This study is intended to be a decision-making tool for local authorities to support them in making choices for their energy policy. The technical and economic feasibility of island electricity systems based mainly on renewable energies is studied in a scientific approach, using optimisation and simulation models.
- ADEME's proposals for the public debate on multiannual energy programming (PPE) focusing on the renewable energy sector (renewable heat and power, biofuels and biogas). The PPE aims to define France's energy objectives by sector for the years 2023 and 2028.
- Currently, ADEME is working on a forecasting study presenting scenarios in the climate-energy field within different sectors (transport, buildings, etc.) to support public and political debates during presidential campaign in 2021.

*Role of the energy agency*
ADEME, as a state operator, has long been working with local authorities to implement public policies for ecological transition in the fields of energy, the circular economy and the sustainable city. Sector coupling in the framework of smart and sustainable cities is a cross-cutting concept and includes many aspects (energy efficiency, renovation wave, energy poverty, social aspects, etc.). In order to strengthen and support local authorities in mastering digital technology tools that will help the energy, ecological and societal transition, ADEME has set up a number of projects centred around three main themes: data, governance and inclusion.

Specific roles include:

- Bringing parties together and encouraging interaction
- Researching new solutions, fostering innovation
- Supporting projects, for which a coalition of parties is required, including production, distribution and end-user parties (e.g., for hydrogen projects).

*Organisational aspects of promoting smart sector integration*
ADEME has a central office, primarily in Paris, which is organised by sector. In addition, it has regional offices with sectoral experts, however, these experts are also responsible for a region for which they address issues across all sectors. This matrix structure provides a way to bring knowledge together around specific projects.

*Lessons from implemented projects*
One exemplary project is the Lyon eco-district. It has an innovative energy management programme. Renewable energies are used significantly, namely, solar energy (with water heaters, sensors, photovoltaic panels) and biomass (a wood co-generating boiler room per island). 80% of the heating and domestic hot water consumption in private homes thus comes from the use of renewable energies in the housing units. A pilot Sustainability Action Plan is structured around 10 objectives, including Zero Carbon (energy efficiency), Zero Waste (reducing the share of non-recycled waste to 30%), and the development of natural habitats and biodiversity, making it possible to reconcile both the reduction of the ecological footprint and quality of life.

## 7.4 Country: Germany (Dena)

*Status of Smart Sector Integration*
Integrated energy transition is an important topic for Dena and has been an important topic in Germany in the past five years. German energy transition is no longer just about renewables, it is about solutions that also cover mobility and other sectors. Digitalisation, cost-efficiency and efficient resource usage are important aspects of "energy transition 2.0".

*Possibilities for smart sector integration*
EnR could focus on maintaining an open communication around smart sector integration, gathering examples, keep a dialogue going with the European Commission and looking for joint projects.

*Main obstacles for smart sector integration*
Obstacles for smart sector integration include:

- (not) having an integrated view on what needs to be achieved
- (not) having integrated policies and political priorities
- The need to develop know how in different sectors about other partners
- Different data formats: information structures and data sets vary between sectors.

*Instruments to be used to promote smart sector integration*
Dena has focused on bringing stakeholders together, to facilitate a conversation between stakeholders coming from different worlds. This includes conversations bringing the mobility and property sectors together, and around digital innovations for energy transition.

When bringing stakeholders together, it is important to (1) have a balanced mix of stakeholders, (2) be willing to take a position between stakeholders and (3) discuss centralised as well as decentralised solutions and ways to make both work. Stakeholders can be brought together in joint research projects, flagship projects, innovation round tables and alliances, depending on the needs and the topics concerned.

*Role of the energy agency*
Research is an important aspect of Dena's role, with own research, publications, stakeholder outreach and public appearances to help build a better public understanding about smart sector integration. Dena positions itself as a neutral player between politics and the corporate world, and maintaining that neutral position is crucial to Dena's profile.

*Organisational aspects of promoting smart sector integration*
Dena is well-positioned to participate in public debate and host collaboration projects, such as flagship projects.

*Lessons from implemented projects*
Important lessons include the need to involve a broad range of stakeholders, to use advisory boards to validate results of projects. Stakeholders are often driven by the desire to make energy transition work, as well as to have access to policy makers. They are kept apart by the different business models that drive their work, which often don't fit a new approach with new players. Having start-up businesses in the stakeholder

mix and actively searching for new business models can help overcome barriers and create opportunities for all partners. Start-ups are often important for the success of a collation of stakeholders as these can provide important new links, e.g., integrating data from the energy and heating sectors in one approach. In particular in the building sector, there are often many stakeholders with different agendas, and split incentives.

## 7.5 Country: Greece (CRES)

*Status of Smart Sector Integration*
Smart sector integration is a fairly new concept in Greece, however, there are several existing initiatives which target sector integration. Further development of smart sector integration is needed to improve the use of waste energy in grids and use of renewable energy.

*Main obstacles for smart sector integration*
A holistic approach to energy generation and use is needed, with a legislative framework which support holistic solutions. This also requires closer cooperation between government units and departments. It also requires funding, since capital costs for renewable, integrated solutions are typically higher than for traditional systems.

Specific challenges include:

- Technical issues, for the electrification of energy use, alternative fuels and the use of waste heat
- Policy issues, and in particular energy taxation which promotes efficient holistic solutions and decision making based the overall efficiency in the system
- The role of the energy agency in sector integration

*Instruments to be used to promote smart sector integration*
CRES implements various measures to promote the use of renewable energy systems, energy coupling between sectors and the development of relevant pilots and innovative applications of new energy systems. Specific measures include:

- Development and optimisation of licensing framework and of technical specifications for RES district heating networks, feeding of biogas into the natural gas network, exploitation of geothermal fields (correlation with the measures referred to in the section on waste management).
- Development of a regulatory framework for the production of thermal energy from RES and the feeding of biomethane into the natural gas network.
- Development of supply chains for residual biomass/biodegradable matter and support for the development and implementation of optimal environmental and energy-efficient bioenergy applications.
- Utilisation of RES power generation for heating/cooling as well as for the operation of storage systems.
- Completion of the necessary energy infrastructures for recharging electric vehicles.
- Development of a framework of incentives for the use of electric vehicles.
- Pilot actions for the use of RES gaseous fuels in the transport sector.

*Role of the energy agency*
The energy agency has several main roles:

- Introduce a holistic view on optimising the whole system in technical and policy decision
- Promote technical innovation as well as new business models
- Review policies and regulations
- Prepare and implement pilot projects

*Organisational aspects of promoting smart sector integration*
The agency's organisation is currently not ready for sector integration. It remains to be seen which form of organisation would fit best with the needs of smart sector integration.

*Lessons from implemented projects*
One specific project experience relates to the transition of a whole island to renewable energy, which CRES has implemented for the Green island "Ai Stratis" project. The project's scope is to make Agios Efstratios, an isolated and non-interconnected island (NII) as green as possible, concerning its energy consumption, deploying various mature Renewable Energy Sources (RES) technologies along with electrical and thermal storage and initiating simplified energy management and control schemes.

The project targets a high share of RES, at more than 85%, in the electrical and heating system of the island, the energy efficiency upgrade of municipal buildings and the demonstration the use of RES charged electrical vehicles. Additionally, it aims to achieve a reduction in the share of curtailed RES energy, a reduction of oil-based heating by at least 75% along with reduced cost for heating for residents by 50%. An energy community was created to implement the system integration project, consisting of the public power cooperation, municipality, citizens and energy agency CRES. The legal standing of this energy community continues to raise legal questions though, since electricity market regulations are not in line with such an energy community.

The project presented several challenges, including:

- Technical challenges related to the very high share of renewable energy in the island's grid, for which there are no easy to use, reliable and proven technologies available.
- The need for a special regulatory regime and energy management schemes, as the pilot demonstrates that sector integration raises legal issues, in particular conflicts with electricity market legislation
- Security of supply of electricity, which was guaranteed by the power company in a traditional system, however, in a community approach, there is not automatically a single responsible party for this. Specific legal arrangements are needed to make sure that consumers are guaranteed power at all times.
- Ownership of the communal energy system needs to be arranged; the municipality will take ownership once the pilot has finished.
- The need for new business models to make smart sector integration work, built around an energy cooperative or community approach, linking all stakeholders and with some form of consumer engagement.

## 7.6 Country: Italy (ENEA)

*Status of Smart Sector Integration*
For Italy, smart integration is key to achieving NECP goals. Realisation of pilot projects to test and validate the use of innovative technologies is considered an important method for promoting innovation. Indeed, pilot projects can generate valuable knowledge relating to methodologies, guidelines and techniques for applying novel solutions in significant environment. They can also provide essential information for new regulation (e.g., TERNA Pilot Projects). Among the different research areas, Italy is focusing on smart microgrids integrating electricity and heat networks, and hydrogen integration in real-life conditions. For this, ENEA develops several pilots at its own research facilities.

The focus in Italy is on electricity and heating; e-mobility has less priority. Research is advancing well, focusing on the efficiency of integrated systems and comparing different forms of distributed energy systems, as well as on the performance of energy storage systems. ENEA has created a dedicated lab for research into smart energy grids, since 2011.

*Possibilities for smart sector integration*
The best possibilities for smart sector integration lie in better integration of renewable energy systems and in more interconnections between countries.

*Instruments to be used to promote smart sector integration*
Priority instruments used include:

- Designing and introducing user-friendly systems
- Good user interfaces, offering an effective way of interacting with systems

*Organisational aspects of promoting smart sector integration*
ENEA is well-organised to address smart sector integration, with different laboratories covering several topics (e.g., renewable, storage, smart cities, smart grids, electric mobility, enabling technologies, hydrogen, etc.). For ensuring interdisciplinarity in projects, teams of experts from different labs are formed. Interaction between labs and with other teams primarily takes place via heads of departments.

*Lessons from implemented projects*
A Good example is the "ComESto" project, which ENEA developed together with grid operators (for electricity and gas) and a telecom operator, to create a platform for nano-grid systems. Issues included:

- Technical interoperability
- Public perception, since the project required smart meters and customers were reluctant to share their data
- Collective systems for the heating of buildings, to replace the current individual heating systems, as customers were not convinced of the economic benefits of collective systems
- ICT connectivity, since parts of Italy have low internet speeds
- Tax and subsidy structures, which are focused on solutions within one sector only, hindering integrated solutions
- Lack of standardisation between sectors, hindering interoperability and integration

## 7.7 Country: Netherlands (RVO)

*Status of Smart Sector Integration*
Smart sector integration is growing in the Netherlands, with a variety of initiatives targeting sustainable urban areas, the use of waste heat, local production and consumption of renewable energy and e-mobility.

*Possibilities for smart sector integration*
Smart Sector Integration is seen as a huge opportunity to combine different goals of the government and municipalities, attract more public support and achieve profitable and feasible (public-)private business cases. This is brought forward in, for example, the Transform project, which is aimed at redesigning 4 districts in 4 cities in the North-east of the Netherlands, covering 40,000 houses. An inclusive approach is used to improve the business case, with larger-scale impacts, synergies and co-benefits for the local economy, and raise public support by addressing the demands of inhabitants for improving their neighbourhood.

*Main obstacles for smart sector integration*
The main obstacle for smart sector integration is the difference between short term and long-term gains. Additionally, trade sectors experience uncertainty about future directions in government policy (e.g., should all houses move away from natural gas-based heating and what is the long-term role of hydrogen gas?), which hinders investments in capacity and new technology. Despite the multi-departemental climate agreement, cooperation between government departments is still weak, with sectoral goals that are not yet fully aligned and non-integrated departmental budgets.

The most successful integrated Dutch projects already include SSI
(https://english.rvo.nl/sites/default/files/2020/06/Reinventing-Multifunctionality-2020-Jurgen-van-der-

Heijden-Denise-de-Blok.pdf). This is probably due to the Dutch cultural tendency to apply "poldering" (bringing stakeholders and shareholders together because of an urgency). These projects exist despite the fact that at the moment this approach is hardly facilitated by instruments. It is hoped that green recovery plans will provide more support.

*Instruments to be used to promote smart sector integration*
Most instruments are part of the Dutch long term climate agreement. Instruments used include:

- Green Deals (www.greendeals.nl)
- The Mission Driven innovation programme, which stimulates cooperation between sectors
- The mission Driven innovation programme "system integration"
- The Main Energy Infrastructure programme which supports the development of regional energy strategies
- The National Loading Infrastructure (NAL) programme in which national and local governments collaborate on (planning) new energy grids
- The natural gas free neighbourhoods programme, which is a subsidy and knowledge-sharing programme for municipalities and local partners to transfer neighbourhoods to heating without natural gas.
- The National Support Expert Centre (ECW) which assists municipalities and cities technically and economically in heat transition to shift away from natural gas by 2030
- National Support Centre for Electric transport and municipalities Zero-emission 2030 EV's, public transport/bus, light electric trucks/lorries.
- The Netherlands' circular 2050 programme which provides funding and knowledge exchange for circular economy initiatives
- The Top sector Energy innovation programme focused on CO2 free heating for industry
- Tax incentives scheme for gas and electricity

*Role of the energy agency*
The energy agency's focus is on:

- Bringing stakeholders together
- Organising and providing knowledge on national and international learning experiences
- Providing grants / subsidies, and increasingly also providing financial guarantees
- Developing a localised knowledge-framework: what is possible in a location and its specific boundary conditions, what not?
- Regulatory sandboxes

RVO is implementing its "Agenda 2022", which is focusing on a customer-driven approach. Implementation is progressing, though challenging.

*Lessons from implemented projects*
Smart sector integration revolves around value creation. When sectors are well-aligned, one advantage leads to a next. It often takes time, however, for those advantages to emerge. One option is to organise projects through communities – citizens as well as businesses and other organisations – which can commit for a longer period.

Integrating all possible aspects makes projects too complex. It is important, however, that programmes and subsidy schemes leave room and rewards integration of aspects of projects.

Multi-sectoral projects combine multiple aspects, therefore, multiple instruments are needed. Aligning those various instruments is a challenge. Persons who are part of a (government) hierarchy and can find new ways often achieve most in developing integrative approaches.

## 7.8 Country: Norway (Enova)

*Status of Smart Sector Integration*
Norway already has almost 100% renewable electricity and the country's focus is on electrifying fuel-consuming sectors. This always involves a look at the sector and the energy system. There is a need for a flexible energy grid to absorb large power demands, such as electric vehicle charging. Battery storage is a solution for such high power demands (for example for electric ferries and buses).

Another focus is on transforming buildings to become ready for electrified heating; in practice, this means preparing buildings for heating at low temperatures and creating small-scale heat exchange networks between buildings. In a large-scale heat network (Tromse), there is also seasonal heat storage.

*Possibilities for smart sector integration*
Electrification of the maritime sector (ferries, ships, fishing industry) is a priority for Norway. There already is a lot of attention in installing shore power, so that ships can cut engines when docked.

*Main obstacles for smart sector integration*
Technology for electrifying consumption is still limited in some sectors, for example for heavier transport (for example ferries and ships). The flexibility of the electricity grid is a limiting factor, and in particular the ability to supply high power demands quickly, such as the power needed for charging overnight. Grid upgrades are often the most expensive part of electrification. Historically, there has been more attention for energy efficiency than for limiting power demands.

Flexibility is currently not valued at end-user level, and end-user can't gain much from providing flexibility solutions to the grid. Aggregation of users / demand reduction options and new business models are needed to create a business case for making energy demand more flexible, as well as larger scale demonstrations of flexibility options.

*Instruments to be used to promote smart sector integration*
Norway applies a number of instruments to promote smart sector integration, including:

- Funding schemes
- Information
- Regulations, e.g. banning unwanted solutions, such as fossil fuel boilers in private households (banned from 2020, regulated by building code) and awarding wanted solutions, such as advantages for electric vehicles including toll-free passing and free parking
- Fiscal measures

*Role of the energy agency*
Two specific approaches help demonstrate Enova's role in promoting smart sector integration:

Electrification of personal transportation: Norway offers several advantages for electric vehicles (EV) such as lower taxes than for conventional vehicles, free parking, free passing of tolls, lower costs of ferry transportation and fast track lanes. Enova's contribution toward electrifying personal vehicles has been to support a comprehensive and otherwise market-driven development of infrastructure for fast charging. So far, Enova has contributed to the establishment of a first-generation infrastructure for fast charging along national transport corridors. Since 2015, Enova has supported 478 fast charging points. By now, professional companies are establishing charging points without subsidies in most regions of Norway. Most charging points in Norway, including those established without Enova support, are registered in a central database, allowing EV owners an overview of which charging possibilities exist.

Large-scale demonstration of energy systems: Enova prioritises working toward flexibility solutions that help reduce the need for energy and peak demand. This includes developing technology and business models that stimulate the utilisation of latent flexibility resources, better efficiency and storage. The award of NOK 210

million to eight projects for large-scale demonstration of the future energy system was important for Enova to drive new flexibility solutions. Projects that received support have led to collaboration across disciplines and sectors, emphasising technological and commercial innovation. The demonstration projects provide experience with and increase competence in storage options, a marketplace to purchase and sell flexibility, load balancing, alleviation from thermal systems, management systems, digitalisation and local production. Norwegian Energy Regulatory Authority has allowed temporary exemptions from regulations to allow some of the projects to test new market models. The projects will be studied during and after implementation to share experience with the rest of the market.

*Organisational aspects of promoting smart sector integration*
Enova supports projects; it is not involved in regulation. Thanks to the small size of the organisation, collaboration between sectors is easier and experts find each other when needed.

*Lessons from implemented projects*

- Cooperation and coordination across stakeholders at early stages of the project are keys to success. While the competition large-scale demonstration of energy systems was a cooperation between two governmental bodies, participation in the competition required establishing consortia between at least 3 partners.
- Case based exceptions to regulatory rules ("regulatory playground") allows for marked based learning that will inform future regulatory changes and future business models.
- Open source information allowing customers to discover key infrastructure in the transition to electrification of transportation is useful.

## 7.9 Country: Spain (IDAE)

*Status of Smart Sector Integration*
Spain is at an early stage of smart sector integration. There are three priority areas: energy efficiency, electrification of transport and heating and the promotion of renewable gases (with a Hydrogen Roadmap published in October 2020 and a Biogas Roadmap in preparation). These initiatives are implemented in parallel to expanding Spain's supply of renewable energy, with 60GW renewable electricity as well as renewable gas (hydrogen and biogas). More flexibility in energy grids (transport as well as distribution grids) is needed to accommodate these changes, and energy efficiency improvements to lower demand. IDAE supports smart sector integration with grant programmes for and participation of the agency in strategic projects. It also assesses the role of new parties in the energy system: energy communities, self-consumption and energy storage. The upcoming Recovery and Resilience Plans would be an opportunity to boost smart sector integration.

The Ministry for Ecological Transition and Demographic Challenge has just released a strategy for energy storage, focusing on a change of perspective from "renewables are a problem" to "a grid built around flexibility". There's a need for a decentralised model for grids, in which DSOs would have a more complex and also more important role. There are currently at least five pilots in preparation to test whether distributes services can provide competitive solutions for flexibility. These pilots test the technology, and also the economic competitiveness, business models and the regulatory setting.

*Possibilities for smart sector integration*
Smart sector integration is included in several of IDAE's grant programmes, such as:

- Energy renovation of building programme (PAREER), which includes energy renovations including the replacement of conventional energy supply with solar and geothermal energy for heating, air conditioning and domestic hot water.
- Sustainable Urban development Programme (DUS), which includes 17 measures for energy efficiency and public infrastructures in municipalities and cities, sustainable urban mobility and the use of renewable energy systems for heating and electricity in buildings.

- Incentives for efficient and sustainable mobility (MOVES), which has two tracks: (1) incentives for alternative vehicles, electric vehicle charging infrastructure and innovative electromobility solutions leading towards technological maturity and commercialisation; (2) innovative investment projects with an innovative, unique approach to energy efficiency, renewable energy and storage and energy demand management.

*Main obstacles for smart sector integration*
A regulatory framework is missing for the aggregation of renewable energy (from multiple self-generating consumers or suppliers). Further, regulations for self-consumption require fine-tuning to increase flexibility in how consumers can use self-generated electricity.

*Instruments to be used to promote smart sector integration*
Spain's new regulation allows for regulatory sandboxes, which are set-up to test new regulations for a few years, in a small setting. It is also discussing more appropriate taxes and levies for energy (although this is a complicated financial discussion).

To promote hydrogen, IDAE is taking part in a company that will be producing hydrogen from renewable electricity on Mallorca island. IDAE will be a minority shareholder, which gives it a larger role in the company and first-hand experience in operating this new business.

New systems have been set-up for the auctioning of renewable energy, with a possibility to create a special role for energy communities. The Spanish NECP foresees a special office to support energy communities. Further instruments include a heat pump programme, providing grants for heat pumps linked to energy efficiency.

*Role of the energy agency*
Traditionally, IDAE's role is to advice government, be an intermediary for the management of EU structural funds and providing information, dissemination and communication. There is a further role in networking, connecting parties nationally and internationally, as well as capacity building.

*Organisational aspects of promoting smart sector integration*
IDAE is structured in technology-specific departments (solar, wind, etc). Smart sector integration is addressed by the regulation department, as that is the only cross-technology department. The interest of the regulation department lies also in assessing how flexibility and aggregation can be integrated in regulation for the energy sector.

*Lessons from implemented projects*
IDAE implements a programme of special grants for innovate transport projects, which promote cooperation between parties. This is based on the understanding that projects are broad and require expertise from different sectors. EU frameworks support this approach, by allowing higher grants when parties collaborate. IDAE meets and connects various parties and supports building coalitions.

## 7.10 Country: Sweden (SEA)

*Status of Smart Sector Integration*
Sweden started 3-4 years ago with a government task force to set up sectoral strategies, to contribute to Sweden's 2030 goal of 50% energy efficiency improvement. The objective was to develop integrated strategies, crossing sectoral borders, and not to find savings only within sectors. Many sectors have already implemented straight-forward energy efficiency measures within their own facilities; the new opportunity is to redesign how the business operates and integrate industry with the local energy infrastructure. New ways of operating industries can be introduced when businesses are redeveloping factories and/or investing in new processes. The approach is expected to result in a stronger industry. The approach is accompanied by a large programme to renovate old buildings.

For industry, the EU energy audit requirement (EED art 8) was developed together with industry, which worked as an invitation to energy-intensive industries to reduce their energy demand. Cross-sectoral issues started emerging already during that process and new approaches were developed, for example "strategy nodes" which is starting this year. In this approach, the government (through the energy agency) provides cross-sectoral collaboration, pre-feasibility studies, regulatory support and strategic communication, however, investments are left largely to private parties. So far, five "strategy nodes" have been developed, and 5 to ten more are under development.

A good example of smart sector integration, through a "strategy node", is the Boden Business Park. This business park:

- Is a redevelopment of a former military site
- Has a large supply of hydropower (with 14 hydropower plants in the area) and a new wind farm is constructed nearby
- Looks at cascading energy use: how can energy first be used to power a data centre, then greenhouses, and finally be used for fishing industries?
- Has a regional angle, focused on creating regional employment opportunities to enable the local community to find employment in the region
- Has a goal of creating self-sufficiency for the community, for example for vegetables. Food residues are to be converted to biogas.
- Battery storage will be added to help manage hydropower plants
- The business park development includes more than 20 individual projects.

*Main obstacles for smart sector integration*
Regulatory barriers have come up for "strategy nodes". Sweden currently doesn't allow for sandboxes to experiment with new regulatory regimes.

*Role of the energy agency*
The Swedish Energy Agency uses a number of approaches to further smart sector integration:

- Knowledge transfer
- Research, working with local universities
- Scanning the market for already existing initiatives, which can be pushed to become regional energy-system business developments
- Being involved in projects; the strong brand of the energy agency alone helps projects move forward
- Identify which regulatory changes might be needed to help projects succeed, and discuss these with government
- Assess which future grants might be needed
- Assessing business models (such as for data centres to provide heat to neighbouring facilities)
- Developing new business models
- Conducting pre-feasibility studies, to test new technical and business model solutions
- Acting as an intermediary between local projects and the national government (with a focus on future regulations and what would be needed for projects to succeed)

*Organisational aspects of promoting smart sector integration*
The agency is organised in sectors and streams. Previously, it was organised in traditional units like industry, buildings etc. It is now looking at organising itself around "nodes". The internal debate about a new organisational structure is ongoing and one section will start organising around "nodes" soon.

*Lessons from implemented projects*
Testing new solutions with smaller industries in "strategy nodes" has much smaller risks (than nationwide)

It takes time to build trust in the agency's role as a partner with whom to discuss new approaches, and not just an implementor of regulation. This requires being open and honest about what the agency can do, and what not.

The approach to support "strategy nodes' is still under development. So far, the agency has been able to provide enough resources to keep the development of those "nodes" going, however, more resources will be needed soon.

## 7.11 Country: Switzerland (SFOE)

*Status of Smart Sector Integration*
Smart sector integration is recognised in Switzerland, however, is not yet at the heart of policy planning. The Swiss approach mainly uses subsidies to promote energy efficiency and renewable energy. A new programme cycle, starting this year, will also promote sector integration.

In SFOE's industry programme, audits are an important tool to identify integration aspects, as well as pinch analyses to identify process optimisation options. A new heat strategy, under development, will also look at the role of local heat networks.

*Possibilities for smart sector integration*
The preferred model in Switzerland is self-consumption of energy, with standard contracts. Consumers can sell excess self-generated energy to their neighbours. Up to 6-7 years ago, PV systems had a good business case selling electricity to the grid, however, now local consumption of electricity is needed to make the business case work.

Switzerland is home to "2000 Watt" communities, which focus on self-sufficiency and local consumption of generated electricity. These communities have a wider focus, for example including local transport modes.

*Organisational aspects of promoting smart sector integration*
Coordination between government departments lacks flexibility.

## 7.12 Country: United Kingdom (EST)

*Status of Smart Sector Integration*
Smart sector integration is moving fast at the moment, with network operators and regulators probably taking the lead. Important aspects are demand shifting and community engagement. Network operators are looking at the electrification of heating and transport. Communication remains a big challenge, including on basic issues such as explaining the need for smart meters.

*Possibilities for smart sector integration*
Community energy initiatives offer good opportunities for sector integration (e.g., in projects being planned for the Welsh and Scottish governments). Under UK market rules, PV electricity gets a better price if sold directly to (the owners of) electric vehicles. Rail operators in the UK run their own electric grids and offer a good opportunity for selling renewable electricity.

*Main obstacles for smart sector integration*
The flexibility market is entirely driven by the needs of the network; there currently is no value for avoided CO2 built into that market. There still is a lack of suitable business models, that reward the interests of all parties and that can answer the question: "What's in it for me?"

Interoperability (in particular of smart meters) was an issue, initially, as suppliers each used their own type of meter, causing problems for switching suppliers or allowing other parties to get involved. Government policy currently follows, at some distance, the developments in the market, which result in regulatory hurdles and uncertainty, in particular for the flexibility market. Further hurdles include the fragmentation of

the market, with many stakeholders, budgets, levels of government and split incentives, and the lack (in England) of a national framework for smart sector integration.

*Instruments to be used to promote smart sector integration*
A lot of effort is going into developing business models for energy communities. These business models often can work through sector integration. Commitments often need to be long-term, which doesn't always align well with the business practices of the parties involved (e.g., long-term commitments from building owners and facility managers for power purchasing agreements). In Scotland, a "challenge fund" has started also targeting smart sector integration projects.

Further instruments include a regulatory sandbox (Ofgem innovation sandbox), to test new and innovative approaches and models for how future energy systems might work; the Energy Systems Catapult, which is an independent, not-for-profit centre of excellence set up to accelerate the transformation of the UK's energy system and ensure UK businesses and consumers capture the opportunities of clean growth; and the Connected Places Catapult (previously the Future Cities Catapult), which focuses on growing businesses with innovations in mobility services and the built environment that enable new levels of physical, digital and social connectedness.

*Role of the energy agency*
Typical roles for the energy agency include (setting up, managing) funding schemes, funding initiatives and building coalitions or consortia. The Energy Saving Trust, at the moment, is mainly focused on consumer engagement for smart sector projects, in particular surveys. Focal points include questions around the incentives consumers would need to be able to take up electric vehicles, whether people can see the benefit (of EVs) and which business models might work. One specific role around smart sector integration is to bring experiences from individual projects up to the policy level and share these lessons with policy makers.

*Organisational aspects of promoting smart sector integration*
EST is silo-d, as is EnR; to further smart sector integration you'd need to look across sectoral borders and develop a holistic approach.

*Lessons from implemented projects*
Experiences so far point to possible differences within the country in purchasing power (more in cities), air quality concerns (more in cities) and access to vehicle charging (better in rural areas).

## 7.13 Country: Bulgaria

*Status of Smart Sector Integration*
First steps towards smart sector integration were taken with the 2018 NECP, with several departments and stakeholders discussing priorities and visions for the whole energy system. The country learned a lot from that process, however, much remains to be developed.

Mandatory municipal and regional long-term and short term plans and programmes have been part of the Energy Efficiency Law since 2004. These programmes take into account national priorities as well as regional development plans and sustainable economic development prospects for the regions. Municipal and regional administrations have learned from implementing these obligations and have formulated local policies and measures to make the best use of local resources and encourage citizen's involvement. This included planning beyond energy efficiency or RES measures separately and viewing these within a larger context.

*Main obstacles for smart sector integration*
Main obstacles are insufficient information and understanding about a smart sector integration approach. Better awareness of the issues involved and benefits of smart sector integration are needed, for policy makers and also for the general public.

## 7.14 Country: Croatia

*Status of Smart Sector Integration*

In Croatia, both transmission and distribution system operators are dealing with smart energy transition (implementation of various cooperation smart energy projects, installation of smart energy meters is expected) while the consumer sector is mostly dealing with energy efficiency. At the moment, smart energy transition projects (for example engaging consumers) are primarily furthered by academia and industry through various cooperation and R&D projects. A high application of smart sector integration solutions is expected by 2030, according to the National Energy Strategy, to fulfil low carbon energy goals set at the EU level.

*Possibilities for smart sector integration*

The Croatian TSO invites proposals for balancing service agreements, to increase flexibility in the grid.

*Main obstacles for smart sector integration*

The main challenge is to provide a regulatory basis for a smooth cooperation between energy producers/active consumers and the distribution and transmission operators.

*Organisational aspects of promoting smart sector integration*

The energy agency is divided into various departments, for example for transmission and distribution, energy economics, energy efficiency and renewable energy. Cross-cutting themes such as smart integration and the development of national energy strategies require cooperation between these departments.

## 7.15 Country: Malta

*Status of Smart Sector Integration*

Malta has introduced some smart sector integration approaches, such as:

- Grants for battery storage to be added to PV systems
- A preferential night time tariff for electric vehicle charging
- The installation of smart meters at 99% of all households
- Improved digitalisation and operational analysis of the nationwide distribution network.

*Main obstacles for smart sector integration*

The main bottleneck is that in order to apply a smart integral approach on a wider scale one would need to encompass various sectors, which are not within the remit/control of one entity. Fragmentation may be solved through the setting up of a central governance body on smart integration.

*Instruments to be used to promote smart sector integration*

Stimulation of smart integration is driven mainly through national funds and a number of EU funded programmes, aimed at research and promotion of smart integration.

*Organisational aspects of promoting smart sector integration*

The agency primarily works on the energy-water nexus. The agency is split in an energy unit and water unit however, with common management and easy communication between staff and synergies can be easily identified and exploited. To move away from compartmentalising the development of energy policy in segments, the agency has chosen a sectoral approach. This ensures that energy policy is based on a combination of enabling tools and synergies can be better exploited.

## 7.16 Country: Poland (KAPE)

*Status of Smart Sector Integration*

Smart sector integration is relatively new in Poland. There are not yet many initiatives, even at Government level. The topic is being mentioned in longer-term outlooks, although typically after the energy efficiency first principle and after the longer-term goal of deep electrification.

*Possibilities for smart sector integration*
Smart sector integration topics that are gaining traction in Poland include decentralisation of energy generation (renewable energy and co-generation) and electromobility.

*Main obstacles for smart sector integration*
Electricity, heating energy and transport networks have developed independently, and a long-term strategy would be needed to start integrating these.

*Organisational aspects of promoting smart sector integration*
KAPE is a for-profit private organisation funded through contracts. It is largely devoted to implementing national and EU projects. KAPE focuses primarily on energy efficiency in commercial buildings.

*Lessons from implemented projects*
Project so far are limited to a project aiming to build the business case for large-scale PV systems. One lesson emerging from that is that the electricity grid is following fairly old designs and, in parts of the country with a large concentration of PV, there are power quality issues. DSOs are monitoring the quality of their grids and upgrade these when necessary, however, the issue continues in rural areas.

# 8 Annex: List of contributing experts

| Name | Organisation | Country | Involvement | | |
|---|---|---|---|---|---|
| Kerstin Schilcher | AEA | Austria | | | TGM |
| Leonardo Barreto-Gomez | AEA | Austria | Interview | | TGM |
| Lovorko Maric | EIHP | Croatia | | | TGM |
| Pia Dorfinger | DENA | Germany | Interview | Task force | TGM |
| Irmeli Mikkonen | Motiva | Finland | Interview | Task force | TGM |
| Päivi Laitila | Motiva | Finland | Interview | Task force | |
| Anna Sahiluoma | Motiva | Finland | Interview | | |
| Irina Dupouey | ADEME | France | | Task force | TGM |
| Didier Bossebouef | ADEME | France | | Task force | TGM |
| Philippe Masset | ADEME | France | | Task force | TGM |
| David Marchal | ADEME | France | Interview | | |
| Vasilis Kilias | CRES | Greece | Interview | | TGM |
| Charalampos Malamatenios | CRES | Greece | | | TGM |
| Minas Iatridis | CRES | Greece | Interview | | |
| Argiro Giakoumi | CRES | Greece | Interview | | |
| Helen Williams | SEAI | Ireland | | | TGM |
| Roberta Boniotti | ENEA | Italy | | Task force | TGM |
| Alessandro Federici | ENEA | Italy | | | TGM |
| Enrico Biele | ENEA | Italy | | Task force | TGM |
| Maria Valenti | ENEA | Italy | Interview | | |
| Charles Buttigieg | EWA | Malta | | | TGM |
| Manuel Sapiano | EWA | Malta | | | TGM |
| Rebecca Jones | RVO | Netherlands | | Task force | TGM |
| Wiesje van Nunen | RVO | Netherlands | | Task force | TGM |
| Marian Poolen | RVO | Netherlands | | Task force | TGM |
| Barto Piersma | RVO | Netherlands | | Task force | TGM |
| Jacques Kimman | RVO | Netherlands | Interview | Task force | TGM |
| Bert Stuij | RVO | Netherlands | | | TGM |
| Marion Bakker | RVO | Netherlands | Interview | | TGM |
| Petter Hersleth | Enova | Norway | Interview | | |
| Ryszard Wnuk | KAPE | Poland | Interview | | TGM |
| Piotr Nowakowski | KAPE | Poland | Interview | Task force | TGM |
| Luis Silva | Adene | Portugal | | | TGM |
| Neuza Rosa | Adene | Portugal | | | TGM |
| Rui Fragoso | Adene | Portugal | | Task force | TGM |
| Stanislav Laktis | SIEA | Slovakia | | | TGM |
| Virginia Vivanco | IDAE | Spain | Interview | Task force | TGM |
| Marisa Olano | IDAE | Spain | | | TGM |
| Miguel Rodrigo | IDAE | Spain | Interview | | TGM |
| Josephine Bahr | STEM | Sweden | | | TGM |
| Anders Pousette | STEM | Sweden | Interview | | |
| Paule Anderegg | SwissEnergy | Switzerland | Interview | | |
| Anil Hanim | DEEE | Turkey | | | TGM |
| Bilal Behadia | DEEE | Turkey | | | TGM |
| Emilie Carmichael | EST | UK | | Task force | TGM |
| Philip Sellwood | EST | UK | | Task force | TGM |
| Colin Smith | EST | UK | Interview | Task force | TGM |
| Graham Ayling | EST | UK | Interview | | |
| Katie Hoy | EST | UK | | Task force | TGM |
| Katie Searle | EST | UK | | Task force | TGM |

*Task force: EnR taskforce Smart sector integration; TGM: EnR Thinking Group Meeting on smart sector integration*