A no-regrets strategy towards 2030 Smart Sector Integration

Dr. Nikolaos Vasilakos
Member of the Advisory Board
European Renewable Energies Federation (EREF)

Summary

The paper discusses key features of the energy transition process towards 2030, of which Smart Sector Integration (SSI) is an important element and analyses the main barriers to energy system integration that need to be addressed by priority. It focuses attention on the electricity-driven decarbonisation of other sectors, the role of renewable gases and hydrogen in the energy integration process, and the contribution of energy markets and infrastructure to a more integrated energy system. Based on the above analysis, the paper proposes a set of no-regrets strategies, policy actions and legislative measures, aimed at fostering an efficient and cost-effective drive for energy system integration towards 2030.

1. Introduction

A no-regrets strategy and measures in the energy transition process towards 2030, of which Smart Sector Integration (SSI) is an important element, will necessarily have to address and effectively support the following key features of the transition process:

i) The massive growth and integration of renewables, particularly intermittent (wind, solar), into Europe's electricity system, at an unprecedented scale and rate, in order to meet the EU 2030 targets, which will be increased in the context of the European Green Deal, and to facilitate reaching net zero emissions by 2050[1]. To this end, effective decarbonisation will require a very significant increase in the use of renewable electricity across sectors, particularly in the heating and cooling, industrial and transport sectors, which still rely, to a large extent, on fossil fuels and which need to be electrified much further.

ii) The urgent need for a substantial increase in the efficiency of both the functioning of the internal electricity market and the utilisation of the associated electricity infrastructure, in order to smoothly and effectively integrate, transport and use the huge amounts of generated RES electricity[2].

iii) The necessary phase out of fossil fuels in energy production, which needs to be driven by: i) a very substantial and rapid decrease in the share of coal-fired power capacity, and ii) the gradual but irreversible phase out of fossil gas-fired power capacity, a direction which is necessary to reach stringent 2030 and 2050 decarbonisation targets. This, in turn, necessitates the corresponding growth of green electricity storage capacity, especially large-scale projects for mid- and long-term storage, but also projects in demand side flexibility and other green storage options[1].

iv) In addition to strengthening the electricity storage capacity, in times of low demand and high RES generation through wind and solar, the integration of the gas and electricity sectors can turn the temporarily abundant renewable electricity into green hydrogen, that can be easily stored and reconverted back into electricity, in times of high demand. Investing in green power-to-gas technologies could, in the medium and long-term, contribute to increasing the RES share in the EU's energy mix and help decarbonise the gas sector.

Each of the above key features of the 2030 energy transition process can be promoted by a set of no-regrets strategies and measures, that can effectively support the transition process, generally at low cost and quick turn-around times, as well as with multiple economic, employment and social benefits.

2. Main barriers to energy system integration

From our perspective, the following main barriers need to be addressed by priority:

i) The persisting RES growth/integration problems related to space planning, tortuous administrative/licensing procedures, new technological and regulatory challenges associated with the development of RES projects in progressively more difficult and testing environments, etc. The Recast RES Directive 2018/2001 (RED II) is certainly a very substantial step forward in this direction, but more specific and targeted EU legislation and actions are needed to overcome the above mentioned problems[1].

ii) The need for minimising the fossil fuel-based overcapacity. The variability of energy output from intermittent renewables requires a flexible power system with flexible back-up power sources, a smart grid and adequate electricity storage capacity for short, medium and seasonal variations, in order to compensate for the variability of renewable energy supply and energy demand. Yet, overcapacity, particularly inflexible overcapacity, has negative impacts on all of the three basic objectives/pillars of the EU energy policy: affordability, security of supply and sustainability. First, overcapacity is clearly an economic problem, in terms of the efficiency of the resource allocation and competitiveness. Second, it may affect the security of supply, since flexible capacity, which is needed to back up intermittent renewables, may lose the incentive to supply electricity when needed. Third, overcapacity represents a barrier to an energy transition based on renewables deployment.

iii) The need to improve market integration and harmonise the Member States' capacity adequacy mechanisms, to ensure proper incentives for new green investment. In the energy only markets, low marginal cost and variable nature of RES generation lead to revenue reductions and, therefore, disincentivise investment. The fundamental problem is not mainly the low-cost levels and the intermittency of renewables. Most market imperfections and failures existed prior to significant renewables integration, but their effects were amplified, at the physical level, by: a) the introduction of variable RES generation in a system based on inflexible baseload power plants, and b) at the institutional level, by poor market integration and individual country definitions of capacity adequacy.

iv) The lack of storage/flexibility options for accommodating the rapid increase of RES in Europe's energy systems. We note that the growth of variable renewable energy resources, i.e. wind and solar power, has added a third stochastic process to power systems, in addition to load and failures of components, with much more dynamics than the two other processes. In addition, mid- and long-term storage is also needed to ensure security of supply and reduce the cost of overcapacity associated with renewable sources. Most of the short, mid- and long-term benefits of storage are not sufficiently (if at all) remunerated in today's market environment. Moreover, they are not even appropriately quantified[1].

v) The need for coordinated infrastructure planning across networks, which is particularly important to optimise flexible power demand and generation, as well as its transmission and distribution to consumers. For instance, in certain EU countries, wind and solar power are curtailed due to real or alleged grid constraints, or lack of implementation of priority grid access for renewable energy. Electricity distribution networks, via local flexibility markets, or gas networks, via production and injection of green gases like green hydrogen, biomethane, biogas or synthetic fuels, could significantly help reduce these constraints and/or be used to soak up the temporarily abundant wind or solar power. Hence, a holistic system approach to local and national infrastructure planning needs to be undertaken, as efficiency and decarbonisation will also depend on it. In order to maximise benefits at the national, regional and local level, the implications of coordinated infrastructure planning need to be considered across the system and, first and foremost, address the need to reduce inflexible fossil and nuclear capacity, in order to facilitate significantly higher RES deployment and system integration, and resulting in a truly green system change, with variable renewables at the centre of Europe's energy mix and energy networks.

3. The electricity-driven decarbonisation of other sectors

The integrated energy system in Europe and elsewhere will be much more electrified than today's energy system. Major parts of heating and cooling demand will be met by a mix of significantly increased building efficiency and by electric heat pumps driven by renewable power. Individual and public transport will largely be based on -increasingly green- electricity. Some industrial processes and relevant parts of air and maritime transport will probably not be based directly on electricity, but will need to be operated through indirect electrification, e.g. by green hydrogen, synthetic fuels and biogas/methane produced with renewable energy. Estimates about direct and indirect electrification shares in the future energy system reach up to 70%. And nearly all models and studies agree that electricity will play a significantly bigger role than it does today. Furthermore, the ongoing digitalisation, which will be needed for smart sector integration, will be a strong driver for higher electricity shares in the energy mix and for higher electricity demand, not all of which can be compensated through innovative efficiency solutions.

4. The role of renewable gases and hydrogen in the integrated energy system

All gases used in the future energy system should be renewable gases: green hydrogen, sustainable biofuels and synthetic fuels. They should be used when and where direct electrification is not (yet) possible or available. Conversion losses in both directions of (green) gas production and use should be thoroughly considered and calculated. Incentives should be provided only for green gases. Decarbonised gases from fossil fuels using CCS, CCU, etc. can only be accepted -but should not be supported financially- for processes where direct electrification or green gases are not (yet) available. Finally, green hydrogen should be used for processes which cannot be directly electrified, as well as as a storage option for various end-uses, from electricity via heating and cooling and for some transport applications.

5. The contribution of energy markets and infrastructure to a more integrated energy system

Market design must favour flexibility and clean (renewable) energy, and disadvantage carbon-emitting and inflexible energy sources. This can be achieved by meaningful carbon pricing and by incentivising combined renewable energy power/energy production, for example through virtual power plants. The accompanying higher degree of electrification can be addressed by shifting power markets closer to intraday and (close to) real time trading, which again requires a high level of digitalisation and smart systems that result in a more distributed and decentralised energy system.

Inflexibility should be penalised and flexible supply and demand should be rewarded. We need to move to real time markets and facilitate decentralised energy production and consumption via prosumers. This will reduce the required grid capacity, due to behind-the-meter supply and demand, and it will leave capacity for integrating larger scale storage and cross-regional and cross-border energy flows.

6. Required policy actions and legislative measures to foster an efficient drive towards energy system integration

We recommend pursuing the following objectives and measures, by priority:

i) Stop designing and favouring one-sided and narrow-minded evaluation criteria for renewable energy support mechanisms. Technology neutral auctioning for renewable electricity projects is a barrier to a holistic citizen and industry engaged transformation of the whole energy sector, and it violates the rights and duties of the Member States to be responsible for their integrated and sustainable energy mix and system transformation.

ii) Facilitate and accelerate the deployment of renewable energy in all end-use sectors, which is the key to Europe's smart energy future. This applies to the increasing electricity demand due to digitalisation and to higher degrees of electrification of all end-uses, but it also includes, increasingly, direct renewable energy applications for heating and cooling, for industrial processes and for various transport options. Therefore, market design needs to incentivise sector coupling and sector integration and support coordination at the EU, regional, national and sub-national levels, for power and gas grids and their system operators. Virtual power plants, as well as integrated renewable energy systems for power, heat and transport, would be helpful to facilitate this process. Customer tariffs for households and industrial customers need to foster flexibility and demand response, as well as energy savings. Power and heat storage capacities at all levels -from small to large, from minute reserves to seasonal storage- need to be promoted and their system services need to be rewarded, in contrast to inflexible load and production. Grid fees and prices need to be adjusted accordingly.

iii) Improve the functional efficiency of the European energy markets. European markets require clear, non-discriminatory rules and a stable regulatory framework that will give consistent signals both to investors of energy assets (generation facilities, grids), as well as to their users. In that respect, the effective and rapid implementation of the network codes and guidelines adopted in the Third Energy Package, as well as in the Clean Energy Package, is considered a top priority[2].

iv) Use the existing interconnectors efficiently. The efficiency of the use of interconnectors, as expressed by the ratio of net transfer capacity to nominal capacity, should be raised significantly. This means that congestion management should be non-discriminatory and should maximise the European socio-economic welfare. The introduction of an operational target aiming at maximising the efficiency of the existing infrastructure, whilst keeping network security limits under control, is a potential measure in the right direction[2,3].

v) Actively pursue political coordination at local, national, regional and European level. Support and coordination between different political levels are crucial to sending the message on the added value of key RES and storage projects for ensuring a long-term social and economic welfare of European citizens. Stronger presence and involvement of representatives of the EU institutions could build bridges between Member States' various decision-making levels[2,4,5].

vi) Promote the deployment of storage/flexibility options that will support the RES growth. In this direction:

- <u>Develop EU Guidelines for establishing a proper, dedicated and effective operational and tariffication framework for electricity and gas, as well as heat and cold storage, in Europe and the Member States,</u> that will allow storage to become viable and competitive, on the road to Europe's Clean Energy Transition. This framework should postulate that storage should not only be allowed to participate fully in the energy market, on equal footing with the other service providers, but also to be fairly and equitably rewarded for the multiplicity of crucial services it can offer to the energy system (flexibility, balancing, congestion management, voltage and frequency stabilisation, increased renewables integration, security of energy supply, decarbonisation of other economic sectors, such as transport and chemical industry etc.)[1].
- <u>Actively promote the prompt and effective application/specialisation of the above Guidelines to each Member State or Regional Market, in order to develop their own optimised regulatory/legislative/tarification framework for storage.</u> Since the design and operation of storage systems is strongly dependent on (and adapted to) the particularities of each Member State's energy system, it is obvious that there is no single, "one size fits all", framework that can promote the optimal use of such systems and maximise their benefits for the national and regional energy systems.
- <u>Design and execute an EU Storage Pilot Programme.</u> Undertake a program of pilot projects, including projects in electricity, gas and liquid applications in different constellations, including projects encompassing more than one end-use and/or

offering integrated energy supply, to identify technologies and Member States suited to develop storage systems that are appropriate to offer storage capacity to a wide range of EU markets. The project selection criteria should include, in addition to cost, the commitments and capacity to offer long-term and short-term storage to other EU markets, and the availability of infrastructures for so doing.

- Perform a detailed analysis, both at the EU and the Member State levels, to quantify directly or indirectly all the above benefits. The objective will be to determine a total value of the benefits that storage units offer to the European and national energy systems and compare it with their investment costs. A favourable comparison will provide a compelling evidence that these assets should be remunerated properly and the investments should proceed for the benefit of the said energy systems.

References

1. Nikolaos Vasilakos, "Energy transition challenges and development priorities for the Greek energy sector in the coming decade", Renewable Energy Law & Policy Review 9 (3), 32-38 (2019).

2. Christophe Gence-Creux, Sebastien Lepy, Nikolaos Vasilakos, Yannick Phulpin, et. al., "Towards a sustainable and integrated Europe - Report of the Commission Expert Group on electricity interconnection targets, European Commission, November 2017.

3. Paulina Beato Blanco and Nikolaos Vasilakos "Identifying and Promoting Missing EU Power Interconnectors", European Energy Journal 7 (4), 30-37 (2018).

4. Nikolaos Vasilakos and Catharina Sikow-Magny "Enhancing the public acceptance of crossborder electricity interconnection projects: a crucial step in the EU energy transition process", Renewable Energy Law & Policy Review 9 (2), 7-13 (2019).

5. Robert Schroeder, Apostolos Gkizas, Anne Boorsma, Nikolaos Vasilakos, et. al., "Public engagement and acceptance in the planning and implementation of European electricity interconnectors - Third report of the Commission Expert Group on electricity interconnection targets, European Commission, June 2019.