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JACQUES DELORS INSTITUTE

MAKING THE ENERGY TRANSITION A EUROPEAN SUCCESS

TACKLING THE DEMOCRATIC, INNOVATION, FINANCING AND SOCIAL CHALLENGES OF THE ENERGY UNION

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Foreword by Jacques Delors and Enrico Letta

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1. Thomas Pellerin-Carlin and Jean-Arnold Vinois were the scientific coordinators for this Report. Eulalia Rubio and Sofia Fernandes respectively wrote the chapters on finance and the Social Pact.

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FOREWORD

by Jacques Delors and Enrico Letta

Since 2008, national and European leaders have been dealing with crisis management on a daily basis. Their efforts have resulted in the Eurozone and the Schengen area being saved and strengthened. Yet our Union must also continue with its long-term objectives and promote positive messages, opening up new frontiers for European integration. We must work towards building a desirable future for all Europeans. As we often say, while Europe needs firefighters, it also needs architects.

If there is one project today which carries a positive vision for Europe, it is definitely the energy transition. Energy is the foundation of our nations' power and is a key element in our daily lives: to transport people, to heat buildings, to power our televisions, phones and computers. By shaping our energy model, we are shaping the future of our societies. If Europe's architects are preparing a democratic, innovative, economically viable and socially fair Energy Union, it will contribute to a Europe that serves its citizens and paves the way for the rest of the world. If we fail in this project, the architects will have to give way to the firefighters, who will exhaust themselves putting out the fires caused by our past mistakes: climate refugees, dependence on Russia and Saudi Arabia, worsened energy poverty, the bankruptcy of energy suppliers who failed to adapt their strategy.

The Energy Union, which we have been championing since 2010[1] and which is currently fully supported by President Juncker, is an ambitious project which can already be bolstered by the successes achieved by the European Union. In

1. Delors Jacques, Buzek Jerzy, "Towards a new European Energy Community", Tribune, Jacques Delors Institute, 9 May 2010; Andoura Sami, Hancher Leigh, Van der Woude Marc, "Towards a European Energy Community: a policy proposal", Studies & Reports No.67, Jacques Delors Institute, March 2010; Andoura Sami, Vinois Jean-Arnold, "From the European Energy Community to the Energy Union", Studies & Reports No.107, Jacques Delors Institute, January 2015

2007, we set ourselves three target figures to be reached by 2020. Out of these three objectives, the reduction in greenhouse gas emissions and the improvement of energy efficiency have already been achieved, and the target of developing renewable energy sources is within reach.

More substantially, Europe's strength in the energy transition lies in the drive of millions of citizens, consumers, local elected representatives, researchers, innovators, entrepreneurs and workers, who make the energy transition a reality. Our mayors are also fully aware of the potential of this transition to reduce air pollution, traffic problems and to stamp out energy poverty. Our wind power and energy efficiency companies are already the world leaders. We are already designing and manufacturing the clean energy solutions of today and tomorrow.

Europe has all the assets to succeed in its energy transition. We are the first in the world to have launched it and have paved the way for other global powers, such as China, to commit through the Paris Agreement. The USA's withdrawal from this Agreement further strengthens European leadership and enables us to attract innovators and investors who understand the opportunity created by the energy transition.

We have made great strides forward but there is still a great amount of potential. We must now leverage, increase and achieve it, to serve a long-term positive vision. Such vision was clearly defined by the European Commission in its Communication dated 25 February 2015 and confirmed at the highest level, by the commitment of all EU member states to the Paris Agreement. This positive vision of our energy future has received widespread acclaim from citizens who support the fight against climate change by means of a European energy policy based on energy solidarity, energy efficiency, and renewables.

This report clearly sets out four objectives which could contribute to the success of the Energy Union, and in turn restore trust between Europe and Europeans. Firstly, democracy must be at the heart of the Energy Union's governance. This involves mechanisms for more direct participation of citizens, local elected representatives and civil society in the major choices which shape national and European energy strategies. Secondly, Europe must implement a genuine innovation-driven industrial policy to make our companies the world

leaders in clean energy. Thirdly, public and private investment arbitrations must fully integrate the energy transition's objectives. Fourthly, the Energy Union must serve a just and fair energy transition via a "Social Pact for the Energy Transition" which strives to create jobs for our young people and stamp out energy poverty.

The European Union is currently facing wide-ranging challenges: centrifugal forces, nationalism, dependence on foreign powers, high unemployment rates and Euroscepticism. In various areas (Eurozone, defence), a new drive will require heightened cooperation between a group of member states. Against this backdrop, the Union is in particular need of projects in which all 27 member states make progress together, on issues such as energy and climate. The Energy Union's success will thereby be a masterful demonstration of what a united Europe can do for Europeans.

We will be able to show that competition stimulates economic and social progress through an innovation-driven industrial policy. We will be able to show that European cooperation makes us stronger through a genuinely democratic Energy Union that provides real achievements. We will be able to show that European solidarity unifies through a "Social Pact for the Energy Transition".

The European Commission has done its part of the work by submitting ambitious proposals that must now be improved on. We would like our national and European leaders to be aware of the strategic importance of the Energy Union for our Europe, our nations and our way of life. We must take the decisions that render the common aspirations of European citizens tangible: a European energy policy for all 27 member states, based on energy efficiency and renewables, able to provide clean, secure and affordable energy to all Europeans. A lack of progress in achieving the Energy Union would cost citizens dearly and be detrimental to our ideal of a Europe which is democratic, prosperous, social and united in diversity.

Jacques Delors
Founding President of the Jacques Delors Institute

and Enrico Letta
President of the Jacques Delors Institute

EXECUTIVE SUMMARY: 10 FINDINGS, 20 RECOMMENDATIONS

In 2010, Jacques Delors and Jerzy Buzek proposed a "European Energy Community" to strengthen the political, economic, environmental and social sustainability of European integration. Under the name "Energy Union" this idea became the catalyst for the holistic approach to the energy transition we called for in our 2015 report "From the European Energy Community to the Energy Union".

Since then, the European Commission has done its part of the work by submitting ambitious proposals that must now be improved on. This report wishes to contribute to the current debate in institutions, Member states and civil society to strengthen these proposals and convert them into tangible realities for all Europeans. This executive summary highlights 10 findings and 20 recommendations from this report.

10 FINDINGS

1. The **energy transition has already started in Europe**: efficient technologies and behaviours drive energy consumption down for the first time in European history, while renewable energy production rises. The EU has already met two of its three energy-climate targets for 2020, while its third target is within reach.

2. The way we perform our energy transition is shaping our collective life as Europeans. Beyond the objective to provide clean, secure and affordable energy for all, **the energy transition is an opportunity to make Europe more democratic, more competitive, more just**. It must reinforce the environmental, political, economic and social sustainability of the European way of life.

3. **The EU has all the needed assets** (policy goals, innovation ecosystem, business leaders, skilled workers, financing instruments) **to lead the global clean energy race**. Donald Trump's announced **US withdrawal from the Paris Agreement grants a historic opportunity for Europe** to affirm global leadership on climate change. It is also the opportunity to drain talents to Europe, thus boosting European competitiveness.

4. The energy transition is not a costly endeavour. **Performing the energy transition does not require significantly different amounts of investment**, compared to those needed to maintain the current energy system based on mainly imported fossil fuels. It however requires significantly different types

of investment. **The key challenge is to re-allocate capital from high-carbon to low-carbon assets and infrastructures.**

5. **Carbon pricing (including through taxation) is essential but insufficient to promote the energy transition at an adequate pace.** It should be used in combination with other tools, such as regulation, public support to innovation and enabling projects. Many measures are in place at EU, national and local level to support low-carbon investment. They however tend to be designed and carried out in isolation, thus undermining their potential impact.

6. **The Energy Union needs a strong social dimension.** The immediate negative social impacts of the energy transition can be manipulated by lobbies to slow-down the transition. Its positive social impacts (new quality jobs, reduced air pollution, enhanced purchasing power, better housing conditions) are downplayed.

7. **The European energy transition creates jobs in new sectors, but it redefines and destroys jobs in others.** EU and national policy makers need to pay more attention to the necessity to actively accompany workers. They have to **ensure that this transition is not "just a transition", but a just transition.**

8. **Air pollution is a public health risk leading to 430,000 European premature deaths every year.** It also burdens public health spending. Performing the energy transition markedly reduces air pollution and saves lives.

9. **More than 50 million Europeans are at risk of energy poverty.** Member States have often chosen to finance public support to renewable energy by increasing electricity taxes for individual consumers, which may have worsened the situation of energy poverty. However, **the energy transition gives the opportunity to eradicate energy poverty in Europe** if ambitious measures to increase the energy efficiency of housing are put in place. This would bring multiple benefits such as better quality of life, job creation and social inclusion.

10. **The energy transition is swifter, cheaper and more democratic when it is powered by people**. People are increasingly becoming active consumers, prosumers, crowdsourcers and crowdfunders of the energy transition. We witness the shift from a situation where energy policy was driven by "decision by a few", to one where it is driven by "action by all".

20 RECOMMENDATIONS

1. **Enhance the political and social sustainability of the Energy Union** by making its governance more democratic, its financing more efficient and its aim more social. This is key to ensure the long-lasting legitimacy of the European energy transition in the eyes of member states, national parliaments, civil society and citizens.

2. **Democratise energy policy making** at EU and national level through the implementation of new ways to foster direct and indirect democratic legitimacy, through tools like deliberative polling, further use of European Citizen Initiatives as well as granting a "Green Card" to national parliaments.

3. **The EU and all member states should develop long-term energy plans to achieve carbon-neutrality**, as this objective is one of the key takeaways from the Paris Agreement. Such plans should be developed in the most inclusive manner. Medium-term plans should be developped in a way that is consistent with long-term carbon-neutrality.

4. **Sector-related and regional decarbonisation strategies should be elaborated** to identify the business and local opportunities. With a long-term objective in mind, they can help to anticipate future job gains and losses in order to ensure a smooth transition.

5. **Governing the Energy Union is also about delivering concrete and visible projects showing policy makers and citizens that the energy transition is happening**, is beneficial, and that the EU can play a positive enabling role in this endeavour. Such projects include the use of the Juncker Plan to roll-out charging points for electric vehicles and to help making European islands 100% renewable.

6. **The EU, starting with the European Commission, needs to adapt its institutional mechanic to better deliver on the Energy Union.** The creation in 2014 of a position of Vice President of the European Commission for the Energy Union was a step in the right direction. The EU now requires a European Energy Information Service that, within the European Environment Agency, will be able to provide independent, transparent, reliable, open-source and up-to-date information and modelling to decision makers and citizens.

7. **Empowering people is key to deliver the energy transition.** It entails adopting a series of measures encouraging consumers to become active, or to produce energy (directly or via local energy communities). It is enhanced

by societal appropriation of energy, crowdfunding, by providing more support to local authorities and by reinforcing the capacity of local commercial banks to finance clean energy projects.

8. Europe needs to ensure the sustainability of its financial system. The decarbonisation imperative should be better embedded in existing national and EU initiatives, including the Capital Market Union project. This would be helped by **setting effective carbon prices for all economic activities**, promoting the harmonisation of energy taxes (and eventually moving towards the establishment of a EU carbon tax to finance the EU budget) and by helping Member states to define a mid-term strategy to phase out subsidies to high-carbon production and energy consumption.

9. Further **climate mainstreaming is key to ensure that all public investment decisions are fully aligned with our common long-term decarbonisation strategies.** This should also include the development of climate mainstreaming of national promotional banks activities. Public actors should moreover make further use of green public procurement as to promote clean energy innovation.

10. **Develop a more coordinated approach to boost energy efficiency investment,** by streamlining the more than 200 energy efficiency financing schemes in operation across the EU and establishing "one-stop-shops" at EU, national and sub-national levels for energy efficiency project developers.

11. **Optimize public support for renewables** through more use of cooperation mechanisms between market-based schemes and by making sure that EU direct financial support to renewables (as grants and loans) is additional to national financial interventions.

12. **Unlock the potential of green bonds** by bringing smaller and risky projects to the green bond market (e.g. via public guarantees to green bond pooling projects) and lowering the cost of capital for green bonds financing projects clearly aligned with national long-term decarbonisation strategies.

13. European energy innovation can benefit from **interdisciplinary thinking that includes social sciences to better understand energy choices.** Existing tools such as H2020 calls, Erasmus exchanges or Marie Sklodowska Curie actions need to be adapted to foster interdisciplinarity. Innovative tools allowing citizens' direct contribution to energy innovation need to be tested and financially supported by the European Union.

14. **European businesses need to become the energy transition tigers Europe needs.** This requires to support innovative thinking within corporations, in cooperation with start-ups and public sector actors. Intrapreneurship can be a useful tool to foster innovations that can be swiftly rolled-out. Frugal innovation needs to play a bigger role to provide clean energy solutions to European and emerging economies.

15. The European Union, member states and regions need to join forces in **mapping the strengths and weaknesses of all European regions vis-à-vis the energy transition.** Such mapping should feed into their industrial strategies for the energy transition, as well as helping them to anticipate the expected job creation, destruction and redefinition due to the transition.

16. Europe needs a **"Social Pact for the Energy Transition"** to ensure that this transition leaves no one behind. It should become the 6th dimension of the Energy Union and include all social aspects, including quality job creation, vocational training, social protection, health and energy poverty.

17. **Maximising quality job creation** in energy transition sectors requires a holistic approach. It starts by building an EU industrial policy for the energy transition with innovation at its core. It is pursued by public-private cooperation at all levels of governance, notably to identify the new skills required for the new jobs. It is fostered by projects to attract more young people into such jobs, such as the launch of a **"Green Erasmus Pro" programme**.

18. The Energy Union requires **a European Energy Transition Adjustment Fund** to accompany the workers at risk of losing their jobs as a result of the energy transition. Having an *ad hoc* fund is politically necessary to signal Europe's will to ensure that no one is left behind.

19. **Making the fight against air pollution a high-level policy priority for the European Union and all member states.** A European Citizen Initiative on air pollution could play a positive role to raise awareness. Regulatory measures aiming at reducing air pollutants emitted by vehicles and power plants should be strengthened.

20. Drawing a **European action plan to eradicate energy poverty**. This should build on the findings of the announced European Energy Poverty Observatory. Public action on energy poverty should increasingly target its root causes, moving progressively from palliative to preventive measures, such as dwelling renovation and shaping new behaviours.

INTRODUCTION: THE EUROPEAN ENERGY TRANSITION HAS ALREADY STARTED

Energy has been at the heart of European integration from its beginning, with the 1951 European Coal and Steel Community and the 1957 Euratom Treaties, which provided for a common policy with specific energy tools based on supranational powers vested in a European authority. After this initial push, half a century was lost until 2007 when the European Heads of State and Government set three energy-climate targets to be reached by a European energy policy. Seeing the benefits of a successful European energy policy for all Europeans, Jacques Delors called for the establishment of a "**European Energy Community**". His idea was recycled under the name "Energy Union" in 2014 by the then Polish Prime Minister Donald Tusk, and by the then candidate for President of the European Commission, Jean-Claude Juncker. To contribute to the debate on the substance of this Energy Union, the Jacques Delors Institute published its report "From the European Energy Community to the Energy Union" that shaped the European Commission overarching Energy Union Strategy revealed in February 2015.

Since then, the European Commission has tabled most of its proposals to transform its project into legally binding decisions. Negotiations are ongoing to reach a "Clean Energy Union Deal" in the year 2018. Achieving such a far-reaching Clean Energy Union Deal is of great relevance for Europe's future. **Energy is indeed the cornerstone of any way of life.** We need energy every day to transport people, heat our homes, power our appliances. It directly impacts our collective and individual daily life. Politically, as several EU member states favour the use of enhanced cooperation to further European integration in key policy areas such as the Eurozone, Defence and Schengen Area, the EU needs more than ever an emblematic project where progress can be achieved at 27. The Energy Union is one such project which can even impact non-EU countries, such as Ukraine and other members of the Energy Community.

Today, 75% of the EU energy mix still relies on fossil fuels (oil, gas and coal) that ought to be phased out to reduce emissions and fight effectively climate change. Over the past decade, a European energy transition has started with European fossil fuel consumption structurally declining since 2006. Two complementary dynamics are at work. First, European energy demand has been decreasing since 2006 mostly as the result of the widening implementation of existing and new technologies, behaviours and processes that tend to be more energy-efficient. Second, renewable energy sources are booming, while their costs keep on falling. New behaviours, technological and social innovation, falling battery costs and smarter policies will further boost energy efficiency and renewables.

The European energy policy can take its share of credit for this success. In 2007, our Heads of State and Government set Europe three energy targets to be reached by 2020: reducing EU Greenhouse gas emissions by 20%, improving energy efficiency by 20%, increasing the share of energy coming from renewable sources up to 20%. The two first targets have already been reached while the third one is within grasp. In spite of the many hurdles, imperfections and structural flaws, the policy decisions taken at EU, national and local levels have helped the EU to deliver on its energy-climate targets.

This evolution of the EU energy system towards an efficient system based on renewable energy sources is often referred to as "Energy transition". In the past, human societies saw phenomena that resembled **energy *additions* rather than *transitions***: with growing energy demand, coal was added to bioenergy then followed by oil, nuclear and gas. As Europeans are decreasing their fossil fuel consumption thanks to energy efficiency and renewables, they are starting to perform the first-ever energy transition in human history.

Such European energy transition is necessary to fight climate change, in line with the Paris Agreement. It is of paramount importance to ensure Europe's energy security. It is also the opportunity to make our energy system more democratic, more supportive of economic prosperity, and more just. European Commission Vice President Maroš Šefčovič was therefore right to talk about the Energy Union as a project guided by "5Ds": Decarbonising our economies allows us to Democratise energy production and consumption; this is helped by Digit(al)isation, fosters the Diversification of our energy supplies and help our innovators to create and diffuse the innovations that progressively Disrupt traditional energy cycles.

With the Paris Agreement and the Energy Union, we now have a clear common vision. The time has come to deliver a fully-fledged energy transition that brings benefits to all Europeans. To do so, decision makers need to embrace the holistic approach to the energy transition where it is seen in its entirety, with its energy, mobility, climate, democratic, innovation, competitiveness, financial, social and foreign policy implications.

To contribute to such a holistic approach, without pretending at exhaustiveness, this study looks at the state of the energy transition in Europe throughout four cross-cutting and complementary perspectives:

- **Governance**: no energy transition may occur without a strong political will and the right governance tools to transform such will into reality.
- **Innovation:** the cornerstone of a renewed approach to Europe's competiveness. Innovation makes the energy transition simpler and cheaper. It opens opportunities for European industries to conquer the booming global clean energy markets. This means jobs, competitiveness and prosperity.
- **Financing**: a move towards a low-carbon economy will only be possible if there is a general re-allocation of capital from high-carbon to low-carbon assets and infrastructures and if the costs of transition are fairly distributed across different segments of the society
- **Social:** the Energy Union requires a "European Social Pact for the Energy Transition" to ensure its political sustainability, to deliver more quality jobs, to fight air pollution and to eradicate energy poverty.

Each one of these perspectives is subject of an in depth analysis in the following four chapters. Key findings and recommendations for actions are presented in the upcoming chapters as well as in the executive summary of this report.

1. The governance of the Energy Union: a new relationship between European citizens and decision makers

by Thomas Pellerin-Carlin and Jean-Arnold Vinois

Energy Union Governance: the comeback of energy as a driver of Europe's progress

Despite the 1951 Coal and Steel Treaty and the 1957 Euratom Treaty, it took half a century for Europe to agree on a comprehensive Energy Policy articulating all levels of governance to deliver sustainable, affordable and secure energy for all. The new momentum around the EU Energy Union concept proposed in 2015, one of the European Commission's top 10 priorities[2], allows academics and policy-makers[3] to think and reshape the governance of energy policies in Europe.

Our common long term objective of decarbonising our economies has been reaffirmed by the Paris Climate Agreement, in line with the energy-climate targets the EU and member states set themselves for 2020, 2030 and 2050 (see table 1).

At the international level, all EU member states have signed the Paris Agreement, which entered into force on 4 November 2016. Its article 4 sets the end-goal: global carbon neutrality in this century[4]. Few countries have already developed a national plan to make their country carbon-neutral, with the exception of Sweden[5] and Finland[6] which committed to become carbon-neutral as soon as 2045.

2. European Commission, *Energy Union Package Communication*, 25 February 2015
3. See for instance, European Commission, *Second State of the Energy Union*, 1 February 2017
4. i.e. reaching a situation where human greenhouse gas emissions do not exceed human sinks of greenhouse gas emissions (e.g. by planting trees)
5. "Sweden takes major step towards setting 2045 carbon neutral goal", *Business Green*, 3 February 2017
6. "Environment Minister: Finland carbon neutral by 2045", Yle Uutiset, 21 February 2017

TABLE 1 ► 2020, 2030 and 2050 targets for the EU, France and Germany

2020 TARGETS	EU	FRANCE	GERMANY
Greenhouse gas *	20%	20%	40%
Renewables *	20%	23%	18%
Energy efficiency *	20%	20%	20%
2030 TARGETS	**EU**	**FRANCE**	**GERMANY**
Greenhouse gas	40%	40%	55%
Renewables	27%	32%	30%
Energy efficiency	27%-30%	20%	/
2050 TARGETS	**EU**	**FRANCE**	**GERMANY**
Greenhouse gas	80%-95%**	75%	85%
Renewables	/	/	60%
Energy efficiency***	/	50%	50%

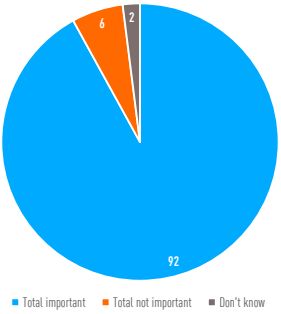
* 2020, 2030 and 2050 targets for "greenhouse gas emissions" aim at reducing greenhouse gas emissions by the given percentage, compared to 1990 emissions levels. 2020 and 2030 targets for "renewables" aim to increase the share of renewable energy sources in the final energy mix, up to the given percentage. 2020 and 2030 targets for "energy efficiency" aim at reducing (both primary and final) energy consumption by the given percentage, compared to a Business as Usual scenario
** This target has been endorsed by the European Commission, but not by the European Union as a whole.
*** Germany's target tackles primary energy consumption, while France's tackles final energy consumption.
Source: data from official EU, French, and German sources

Our common energy-climate objectives are not only promoted by political, technocratic and scientific elites, they are also overwhelmingly supported by citizens[7] (see figure 1). More than 90% of EU citizens consider climate change to be a serious problem. 80% believe that fighting climate change can boost the economy and jobs in Europe. There is moreover a consensus on the key ways to undertake the energy transition, with more than 90% of Europeans favouring public measures to boost energy efficiency and renewable energy production. 72% consider that there is a need for a common energy policy among EU member states. 79% favour European energy solidarity, considering desirable for their country to assist another EU country facing significant energy supply problems[8].

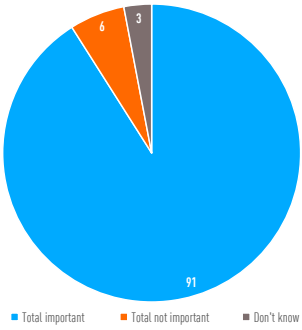
7. Eurobarometer, November 2015
8. Such solidarity does not exclude a financial compensation system as just agreed by the European legislator in the case of gas supply crisis. See "The Europeans and Energy", Parlemeter, January 2011

FIGURE 1 ► European citizens overwhelmingly support the means and objectives of the Energy Union

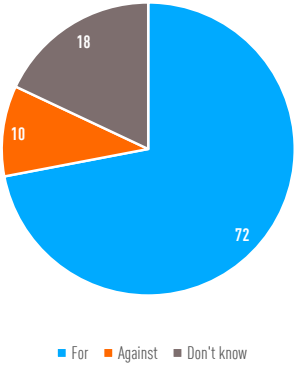
How important do you think it is that your government provides support for improving energy efficiency
(for example, by encouraging people to insulate their home or purchase low energy light bulbs) by 2030)?
(% - EU28)



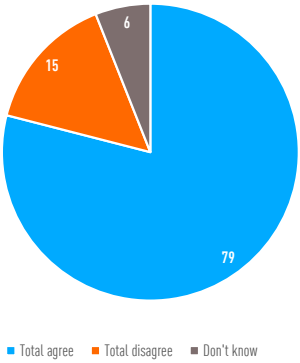
How important do you think it is that your government sets targets to increase the amount of renewable energy used such as wind or solar power, by 2030? (% - EU28)



What is your opinion on the following statement :
a common energy policy among EU member states (% - EU28)



Please tell me whether you totally agree, tend to agree, tend to disagree or totally disagree with the following statement:
It is desirable that your country provides assistance to another EU member state facing significant energy supply problems in the



Source: Eurobarometer

There is a vast consensus among Europeans for a common energy policy, based on renewables, energy efficiency and solidarity, aimed at fighting climate change and able to stimulate the economy.

There is political will from the grassroots level to the top levels of the European structure. It should be used to drive the energy transition throughout all levels of decision making, be they European, national, regional or local, coordinated to deliver the concrete decisions and actions needed to achieve our common objectives.

BOX 1 ► All levels of government have a role to play in the energy transition: each level has different competences which have to work in a complementary way to be effective

The European level has now become critical with the EU objectives to reduce EU greenhouse gas emissions (by 20% by 2020, and by 40% by 2030), increase the share of energy coming from renewable sources (to 20% by 2020 and to 27% by 2030) and improve energy efficiency (by 20% by 2020, by 27% or 30% by 2030). Moreover, the EU has strong powers related to critical elements of the energy transition such as energy performance of buildings and appliances, emissions standards for vehicles, electricity market design.

A macro-regional level has emerged as an intermediate step between the national and the European levels to go further in terms of cooperation in various areas such as market coupling, security of supply, or infrastructure development[9].

The national level remains critical. Member states can freely decide on energy mix and exploitation of natural resources. Energy taxation decisions can only be approved by a unanimous vote. Member states moreover keep a great freedom to translate into practice the details of the EU policy objectives, transposing directives and implementing EU law. Over the past decade, **the implementation of EU energy policy by member states, has been diverse and sometimes very disappointing, leading to incoherence** between various national policies and between national and EU energy policies.

The local level also rises in importance and can make energy policy more efficient and more democratic. Regions and cities in Europe often have power over critical energy areas, such as transport, energy efficiency of buildings or renewables development. They are closely linked with the European level through the Covenant of Mayors[10] signed by more than 7,300 entities, cities and regions of all sizes committing to implement the 2020 objectives in their jurisdictions.

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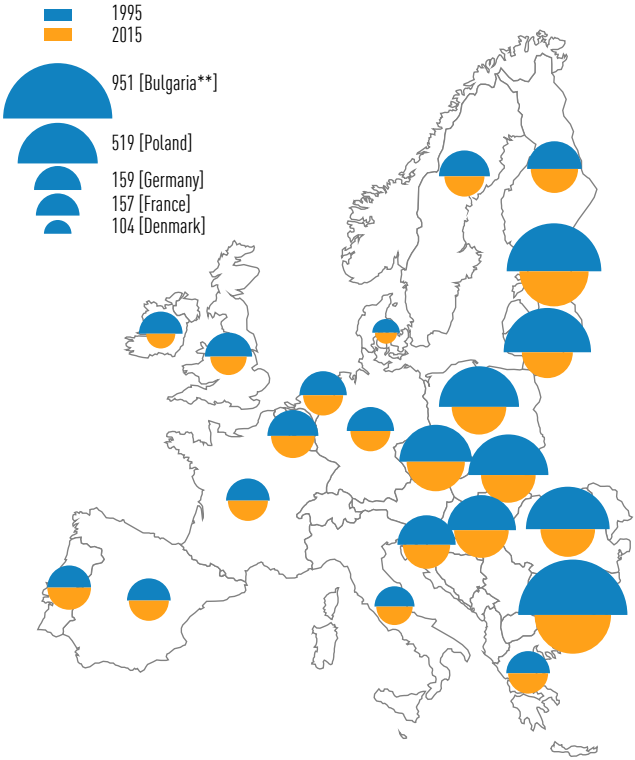
9. The need and the potential of regional cooperation between member states have been examined namely by J. de Jong and Ch. Egenhofer in a CEPS report of April 2014 and in the study published by the Jacques Delors Institute, prefaced by Jacques Delors and written by S. Andoura and J.A. Vinois, January 2015, pages 109-112. See also Thomas Pellerin-Carlin, Jacques de Jong et Jean-Arnold Vinois, "Governing the differences in the European Energy Union", Policy Paper No. 144, Jacques Delors Institute, October 2015
10. See the website of the Covenant of Mayors: www.covenantofmayors.eu

While there is agreement on the objectives for the future, there is a huge diversity in national energy systems, as illustrated by the figure below highlighting the diversity of national energy mixes and the energy efficiency of national economies.

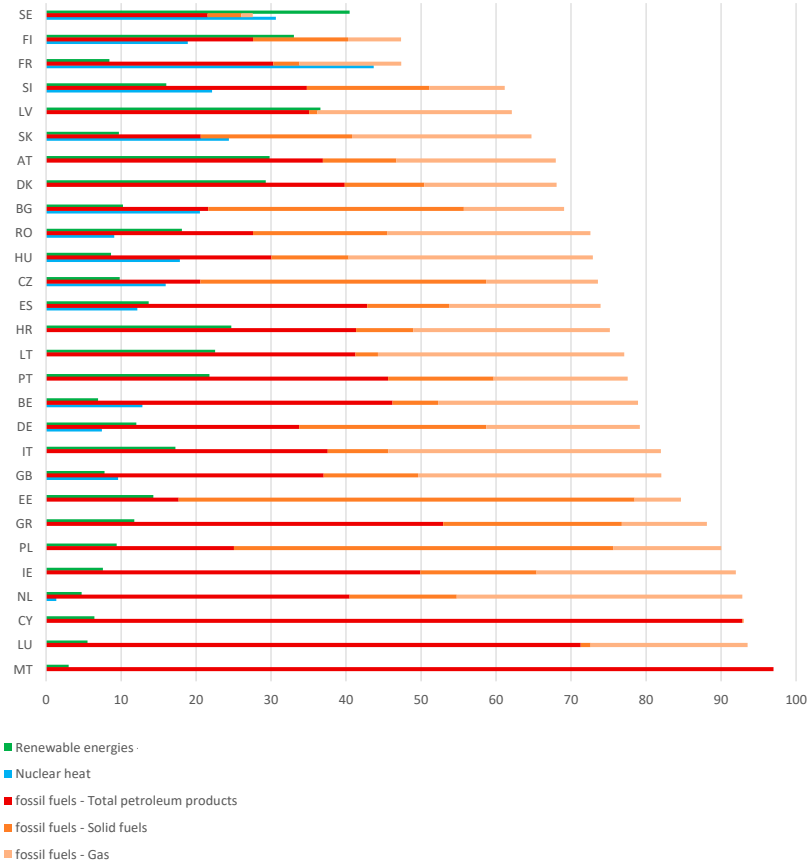
FIGURE 2 ► Energy intensity* of the economy of a selection of EU member states



*Energy intensity is a ratio. It is obtained by dividing the gross comsuption of energy of a given country (measured in kilogram of oil equivalent) by this country's grossdomestic product (measured in thousands of euros). The smaller the figure, the more energy efficient the economy is (as it needs less energy to produce 1 euro of GDP). Central-Eastern countries are the most energyintense, as they inherited Soviet-shaped energy systems. They also are the ones that improved their energy intensity at the fastest pace between 1995 and 2015.
** 1995 data for Bulgaria were not available. 1996 were used instead.

Source: Eurostat

FIGURE 3 ► Energy mix of EU member states (in % of energy source in primary European consumption



Source: Eurostat

National differences, such as the diversity of energy resources, can be both a threat and an opportunity for a coherent European energy policy. They are a real asset for Europe if their strengths can be combined in a coordinated and constructive manner. The example of the electricity market, where resources may be used to reinforce the level of security for all, is telling. However, they may be a liability if each country relies on itself or take measures which are undermining other countries policies, especially in our interconnected world[11].

Pre-2015 EU energy policy focused on mid-term targets for 2020 and 2030. In 2014, national governments, under the pressure of some lobbies including their own national champions (see box 3), decided that the 2030 renewable target should not be legally binding at the national level in contrast with the binding 2020 target. They also confirmed their refusal to make the energy efficiency target legally binding. European governments then took the paradoxical risk of slowing down the energy transition when the global energy transition era is starting. Clear signals for investment in low carbon technologies are suddenly removed (see chapter 3., box 10).

Europe cannot afford to miss the opportunity of the energy transition. To maximise its benefits, it needs an ambitious industrial innovation policy to help European workers and businesses to lead the global clean energy race (see chapter 2.), a framework to boost coherent and cost-effective clean energy investments (see chapter 3.) and a social dimension to maximise its social gains by eradicating energy poverty, slashing air pollution and maximising quality job creation while also addressing its negative impacts for some (see chapter 4.). To deliver on all fronts, Europe needs a strong Energy Union governance. This is the subject of this chapter.

So far, the only significant proposal put forward by the European Commission has been the proposal for an "Energy Union Governance" regulation of 30 November 2016[12], inspired by the 26 November 2015 Council conclusions on the governance system of the Energy Union[13] and the European Council conclusions of October 2014[14]. Those are attempts to deal with national governments' refusal of legally

11. One could give the example of the German nuclear phase out that was decided without coordinating with neighbours, or the national capacity remuneration mechanisms established by several countries.
12. Proposal for a regulation of the European Parliament and of the Council on the Governance of the Energy Union, COM(2016) 759 final, 30 November 2016
13. Council conclusions on the governance system of the Energy Union, 26 November 2015
14. Conclusions of the European Council of the 23 and 24 October 2014

binding national targets for renewables and energy efficiency, forcefully required by the European Parliament. The European Commission proposal is extremely disappointing[15] as it focuses on administrative monitoring, reporting and verification. It misses the point of governance: organising the best system to take tangible decisions based on the inputs of local, national and EU civil society[16].

This chapter analyses the state of energy governance in the EU and suggests changes to ensure that sound Energy Union Governance can be a tangible driver of a democratic, holistic and fair energy transition.

1.1. Four guiding principles to articulate and cross-fertilise the several levels of energy governance

1.1.1. Democracy and sovereignty: the citizen at the centre of the energy transition

In recent years, millions of Europeans made clear that they wanted to (re)gain control over their individual and collective lives. When designing a genuine Energy Union governance, the notion of democracy must thus be at its core[17]. The Energy Union which is putting the citizen at the centre of its preoccupations needs to demonstrate that it is governed in the most democratic way.

The European Commission vision is indeed "most importantly [one] of an Energy Union with citizens at its core, where citizens take ownership of the energy transition"[18]. It tries to put citizens closer to the centre by proposing tools to empower people[19]. Yet, there is a need to go much further, to make citizens not only closer to the centre, but fully at the centre of the energy system and energy policy-making.

One of the EU's biggest democratic shortcoming comes from national governments blaming the EU for "imposing" something they themselves supported in

15. The European Commission itself recognises the shortcoming of its proposal as the explanatory memorandum attached to its regulation proposal states that it only "set[s] out the necessary legislative foundation for this process in view of delivering the Energy Union, which will have to be complemented by non-legislative measures and action for the Governance to succeed."
16. This definition draws from the European Commission Translation Office definition published in a note by Manuel de Oliveira Barata. See Olivier Paye, « La Gouvernance : d'une notion polysémique à un concept politologique », *Études internationales*, Québec, 2005. .
17. Democracy is usually understood as a system where decisions are taken for the people, by the people. The first historical occurrence of this definition can be traced back to the funeral oration allegedly given by Périclès in 431BC. See Thucydides, *The Peloponnesian War*, Book II.
18. European Commission, *Energy Union Framework Strategy*, 25 February 2015, p.2
19. For instance with better information on their bills, the recognition of local energy communities, the right to directly contract with aggregators without their supplier's permission so consumers can economically benefit from their contribution to the stability of the electricity grid.

Brussels[20]. With some exceptions like Denmark, most governments effectively ignore their parliaments and citizens when making decisions in Brussels[21], which creates a problem for democracy but also for the perception of sovereignty.

Sovereignty is the ability to adopt decisions that are enforced in a given territory[22]. But who does exercise sovereignty? Who does decide and how? National technocrats, governmental politicians, national MPs, and/or citizens? Currently, in EU energy policy making, the argument of "preserving national sovereignty" is too often used to mean "preserving the capacity of a handful of unelected national technocrats to rule with no democratic oversight". **We argue for a democratic understanding of sovereignty: genuine sovereignty as the capacity of citizens to individually and collectively impact the world they live in**. This requires to ensure democratic control over decisions, whether taken at the local, regional, national or EU level. In other words, what matters is for citizens to drive the energy transition, be it at the local level, national level (where it is relevant) or at the EU level (when sovereignty truly lies at the EU level). The latter option may raise the question of subsidiarity: in a given policy area, is the national interest best preserved if it is exercised at national or at EU level? (see 1.1.2.)

1.1.2. Subsidiarity: deciding at the relevant level of governance

Subsidiarity entails that decisions should be taken at a level of decision as close as possible to citizens. More central levels of governance (regions, states, macro-regions, European Union) should act only if and in so far as the objectives of the proposed action cannot be sufficiently achieved by less central levels of governance. This is therefore a two-way street: the EU should not act where states, regions or cities can deliver, but the EU should step in where national actions are not sufficient and the EU could do better.

For instance, subsidiarity means that the EU should not impose a plan for child education to energy conservation behaviours when member states, regions and/or cities deliver. It however also means to act where European action can best promote citizens' interests. For instance, European interest in world affairs is

20. « Commerce "Les États de l'UE critiquent les négociations qu'ils ont eux-mêmes lancées" », interview of Cecilia Malmström, *Libération*, 3 January 2017
21. Andreas Follesdal et Simon Hix, "Why There is a Democratic Deficit in the EU: A Response to Majone and Moravcsik" JCMS 2006 Volume 44,. Number 3,. pp. 533–62
22. National sovereignty can thus be exercised at the national level with, for instance, a national parliament adopting rules that are enforced on the national soil. National sovereignty can thus also be exercised at the EU level, with national and EU actors adopting decisions that are enforced on national soil.

more likely to be effectively promoted by a united Europe conveying a single message than by the unarticulated aggregate of national external energy policies. In this area, the Paris Climate Agreement may be seen as an immense success for the EU, while we are still witnessing utter failures, such as the cacophony around Nordstream2 (see box 2).[23]

One obstacle to EU action is the impression of "Brussels overreach". This perception undermines the European energy transition, for instance by making politically difficult for the European Commission to propose more ambitious energy efficiency regulations[24]. To overcome such situations, proposals should come from more grassroots organisations. In this respect, the Energy Union Governance could look at two ways forward:

- A European Citizen Initiative (ECI) could be launched by civil society organisations to impact EU policy making. Consumer associations could ask the EU to extend its energy-labelling standards to other products as to give consumers basic and user-friendly information about the operating costs of the appliances they buy (e.g. hair dryers, toasters, kettles etc.). Another example would be for healthcare/patient associations to mobilise against air pollution as it is a key factor of respiratory and heart diseases (see chapter 4., 4.2.1.1.). Their ECI could ask the European Commission to propose tougher air pollution standards for cars[25].
- Giving a "green card" to national parliaments. EU treaties give national parliaments the right to voice their concerns about the EU overreaching by giving a "yellow card" or an "orange card" to the European Commission. This procedure is useful to ensure that the EU acts only where necessary. It should

23. For a broader—and humoristic—perspective on the need for a well-coordinated EU foreign policy see Sven Biscop, *Europe and the world – or Snow White and the Seven Fallacies*, Egmont Paper, 2013.
24. The EU already sets energy efficiency standards and energy labelling for everyday appliances to level the playing field for appliance producers, and thus boosts economies of scale that benefit producers and consumers. The question there is the extent of the EU action, often being accused of over-regulating peoples' lives. A recent example is the 2016 discussion that gained the journalistic name "Toaster-gate", i.e. whether EU legislation on eco-labelling that already applies to many domestic appliances (such as white goods), should be extended to other smaller appliances such as toasters or coffee machines etc. In the end, the European Commission decided not to propose such extension, fearing of being accused of overreaching, even if this proposal would have helped reducing European energy consumption, people's electricity bills, while creating jobs and economic activity in Europe as European appliances tend to be more energy efficient than, say, Chinese designed appliances.
25. In 2016, the European Commission proposed new air pollution standards. In the end looser standards were adopted by national governments, with little democratic accountability as many national governments, most notably the French one, ended up voting in favour of an amendment that they officially –and vocally- opposed; as this was revealed by the European Parliament's investigation. See Quentin Ariès, "Brussels wants ministers to shoulder policy responsibility", *Politico*, 14 February 2017.

be completed with a positive procedure, a "green card" where national parliaments would also be allowed to step up to ask the EU to act[26].

As the EU is undergoing a severe political and confidence crisis, the European Commission published on 1 March 2017, a White Paper on the future of Europe[27]. It identifies five scenarios for Europe, where the third scenario proposing "those who want more do more" may be of particular relevance to allow a group of forward-looking countries to cooperate in specific policy areas where national sovereignty is best served when it is exercised at a supra-national level. This would be useful to ensure cooperation on energy-related domains where more common actions would yield better results, such as research. The latter is now a fully Europeanised area and it is now recognised that it makes sense to ensure that each euro invested in research goes to the best researcher in his/her field regardless of nationality or geographical location—provided that it remains on EU soil[28].

1.1.3. A more holistic approach to the energy transition

Past European energy policy choices tended to be taken in silos, leading to incoherent policy making (for an illustration, see box 2). Significant progress has been made[29] in recent years thanks to the new European Commission structure with the creation of the position of European Commission Vice-President for the Energy Union (see 1.2.4.2.). It rightly ensured the linking of all its energy proposals as to counter the usual silo mentality, thus opening the door to what Europe needs: a holistic Clean Energy Union Deal (see 1.2.3.).

26. For instance, witnessing the impact of air pollution on their constituents and public health spending, national MPs may act together to ask the European Commission to propose tougher air pollution standards.
27. White Paper available at : https://ec.europa.eu/commission/sites/beta-political/files/white_paper_on_the_future_of_europe_en.pdf
28. This entails to change the legal status of research policy from a de facto parallel competence to a genuine EU exclusive competence. With the rise of the debate on adopting a budget for the Eurozone that could be used to finance strategic long-term investments, it may be sensible to kick-start an enhanced cooperation in the area of research –including energy-related research- to ensure that it is managed at a more adequate level of governance (e.g. at the Eurozone level for a start), with the aim of extending this cooperation to all other EU countries.
29. One illustration of the increased coherence of European Commission proposal can be found in its proposal for a new electricity market design. Several member states have adopted capacity mechanisms that can be used to subsidise unprofitable power plants if they are necessary to ensure security of electricity supply. The European Commission agrees that such schemes can be necessary, and suggests measures to ensure coherence with EU and national climate policies, for instance by proposing to ban coal power plants from benefitting from such public support schemes. The detailed proposal is thus to ensure that such public support schemes will not benefit any power plant emitting more than 550gCO2/kWh, having regard to what is already common practice within the European Investment Bank.

BOX 2 ► A holistic approach to the Energy Union entails to re-shape the Nordstream 2 project[30]

NordStream 2 is the project to build two new pipelines to ship 55 billions cubic meters (bcm) of gas (or more than 10% of the present EU consumption) from Russia to Germany via the Baltic Sea. While it has an economic interest for Russian gas supplier Gazprom to create such a physical link, it is incoherent from a holistic approach to EU interests.

First, the EU energy policy of decarbonising the economy and boosting energy efficiency both reduce European energy consumption (including gas). This has been successful, with EU gas demand declining by 100 bcm since 2010. Nordstream2 can only be an economic success if the EU fails on its decarbonisation and energy efficiency agendas.

Second, Nordstream 2 would deprive the Ukrainian government of an important annual income (between 1 and 2 billions € of gas transit fees) as Nordstream 2 is meant to replace the Ukranian transit pipelines to transport Russian gas to the EU. This would weaken Ukraine at a moment when the EU actively supports the reforms of this country and particularly in the field of energy. In the end, less revenues for Ukraine will likely increase the amounts of Ukrainian debt towards EU states—a debt that may never be fully repaid.

Third, the east-west divide between European States has been exacerbated over the past years, notably during the "refugee crisis". It is incoherent for a western member like Germany to ask an eastern member like Poland to show solidarity on the refugee crisis, while Germany is refusing to show solidarity on energy by supporting Nordstream 2—and vice-versa.

In the end, Nordstream 2 whose President is the former German Chancellor, Gerhard Schroeder, is currently going forward under the intense lobby exerted by Gazprom and its western partners on EU leaders, most notably the German Foreign Minister Sigmar Gabriel, but also on other countries such as Austria (through its champion OMV), Netherlands (Shell) and France (Engie) but also Italy (SAIPEM/ENI). As an illustration of how politically charged this issue can be, current Nordstream CEO Matthias Warnig was working for the Stasi at the time when Vladimir Putin was a KGB agent in East-Germany.[31] Nordstream 2 is therefore much more than a pure commercial project.

A step in the right direction has recently been taken by the European Commission in March 2017 as it proposes that EU member states give the European Commission a mandate to negotiate an EU-Russia agreement on Nordstream 2[32].

There is a need to overcome the silo mentality and adopt a longer-term perspective. It is a matter of efficiency to ensure both horizontal coherence (e.g. coherence

30. This box builds on Jean-Arnold Vinois and Thomas Pellerin-Carlin, "Nord Stream-2 : A decisive test for EU energy diplomacy", Natural Gas Europe, 16 December 2015.
31. For further information on Nordstream 2, including from an economic and legal perspective, see: "Energy Post debate: Nord Stream 2 and the future of the European gas market", video of the conference of 8 March 2017 organised by Energy Post.
32. "EU offers to negotiate Nord Stream 2 on behalf of members", *Euractiv*, 30 March 2017

between electricity, industry, trade, development, cohesion, social, transportation, taxation policies etc.) as well as vertical coherence (e.g. coherence between EU, national and local levels). One illustration of the holistic approach to the energy transition is to ensure that current decisions are climate-consistent by avoiding lock-ins (see chapter 3.), such as the German public bank support to a Greek coal power plant[33] meant to run from 2020 to around 2070—i.e. at a time where Europe's electricity mix is supposed to be fully decarbonised. Another illustration would be for Europe to debate and agree on a Social Pact for the Energy Transition, that could be based on the proposals detailed in the chapter 4.

Adopting a holistic approach to the energy transition is moreover paramount to allow a more democratic decision making. A silo-system enhances the power of lobbies (see box 3) to block specific elements of legislation they don't like. A specific lobby tends to be effective in its own silo, but less so when policy issues are approached through a cross-cutting perspective.

BOX 3 ► European Energy Lobbies

Companies and civil society organisations try to influence policy makers in order to induce them to adopt decision that fit their interests. This lobbying affects many policy areas, including energy. Energy lobbies have no problem defending their interests, even when such interests are narrow, selfish and clash with citizen interests or commonly agreed goals (e.g. fighting climate change, as agreed in the Paris Agreement).

A schematic classification could identify three kinds of energy lobbies: those of the old world, those transitioning from the old to the new world, and those of the new world.

Lobbies of the old word mostly gather public and private companies. This category includes oil and gas suppliers (IOGP, Eurogas), coal suppliers (Euracoal) as well as the power generating facilities usually called utilities (Eurelectric). It may include non-EU companies, such as the global number one oil and gas giant ExxonMobil (whose CEO became Donald Trump's Secretary of State), or Russian gas company Gazprom owned by the Russian State. Electricity suppliers, gathered in Eurelectric or in the more confidential Magritte Group and the nuclear lobby (Foratom) have been instrumental in watering down the 2030 objectives, for instance by ensuring that Europe's 2030 targets for energy efficiency and renewables would not be legally binding at the national level. In several instances, national governments (who also often are their shareholders)[34] act as megaphones of company interests, thus defining their "national interest" as the interest of national companies rather than national citizens. Most car manufacturing companies could also be included in this category as they consistently lobby against air pollution and emissions standards

33. "Poland, Greece reject Eurelectric's no new coal plant after 2020 plan", *Platts*, 5 avril 2017
34. For instance, the support the French and Austrian governments give Nordstream 2 is best understood by successful lobbying from Engie and OMV on their respective governments.

in order to delay their eventual shift towards electric vehicles. But the dieselgate and the digital companies seem to have changed the position of some major manufacturers like VW and Toyota.
Fortunately, several lobbies are transitioning from a dirty past towards a clean future. Among them, there are unbundled electricity networks operators, gathered as independent infrastructure managers within ENTSO-E, moving towards a more decentralised and demand-driven electricity market, accommodating more and more renewables sources of energy. Some utilities are now faced with the so called Kodak dilemma that is defending the past paradigm of electricity centrally produced, transported and distributed to a passive abonnee (like the argentic photo era) and the new world resulting from a more decentralised power generation with renewables and an active consumer managing cleverly its consumption (the digital camera). Another significant group is made of companies stuck between their clean commitments and their dirty assets, like EON/UNIPER, RWE/INNOGY, ENEL, ENGIE and others. Total is in a similar situation as it remains a leading oil and gas producer while having acquired solar and batteries assets. The European chemical industry lobby CEFIC also has split interests: rising energy prices may endanger its cost-competitiveness but the energy transition creates new markets for its products. The electro-intensive industry (IFIEC) has not yet adopted a constructive approach towards the new future. In terms of lobbying, all those companies face a challenge of time consistency. For instance, when lobbying for the post-2020 electricity market design, some lobbyists may lobby in favour of their company's old business model, rather than focusing on what would be positive for the post-2020 business model. When speaking about the most effective way to reduce emissions through the ban of coal in power generation, most of these lobbies are in a schizophrenic position and are usually prevented to express a meaningful position.
Finally, there is a rising number of lobbies of the new world, still in their infancy and still much less powerful than their counterparts. These lobbies are representing energy regulators (CEER), consumers (BEUC), promoting renewable energy (WindEurope, Solar Power Europe), energy efficiency (EuroAce, European Coalition for Energy Savings), demand-side management (Smart Energy Demand Coalition), or they are pro-environment civil society organisations (European Climate Foundation, E3G, WWF).

1.1.4. From decision by a few to action by all

With the rise of nationalists like Wilders in the Netherlands, Petry in Germany or Le Pen in France, it is critical for the EU to demonstrate that the European Project, including its Energy Union, is not meant to be an elitist project where key decisions are taken by a few. It has to have a grassroots component, and ensure that the Energy Union is effectively made by and for the people. In other words, to move from a situation of "decision by a few" to a situation of "action by all".

This is critical to uphold the principle of democracy (see 1.1.1.). It is also a matter of efficiency as the more democratic and grassroots our energy decisions are made, the more people will not oppose them and become actors of the change.

Moving away from a situation where few people take decisions, to a situation of actions by all entails empowering people as citizens, consumers, savers and workers. Several of the European Commission proposals go in the right direction[35]. Yet, there is a need to go much further. Strong democratic consensus will create the certainty that favours more optimal investment choices, thus economically benefitting investors, workers and taxpayers who may otherwise end up bearing the burden of unfortunate private or public investment choices.

Based on those four principles, the following sections further analyse the state of Energy Union Governance and suggest policy recommendations to transform those guiding principles into tangible actions impacting the Energy Union Governance regulatory framework (1.2.) and delivering concrete projects (1.3.) that can show right now that the EU is suiting its actions to its words, thus building the political consensus to drive the energy transition.

1.2. Building trust and consensus on a best way to achieve the energy transition

In November 2016, the European Commission published its regulation proposal for an Energy Union Governance[36]. Its core element is for member states to send by 1 January 2018 a draft "integrated national energy and climate plan" that should reflect the national energy strategy for the decade 2020-2030. The European Commission would make country-specific recommendations on this draft, the member states "shall take utmost account of any recommendations from the Commission when finalising their plan," to be submitted by January 1st 2019. A similar process is planned for national plans looking at a 2070 horizon.

This proposal has no chance to deliver tangible governance. It is a toothless administrative reporting, not the enabling political process required to deliver what 72% of EU citizens want: a common energy policy for all EU member

35. e.g. greater emphasis on the role of cities in the energy transition, smart meter roll-out, clearer electricity bill, capacity to sign a contract with an aggregator without needing supplier's consent etc.
36. Proposal for a regulation of the European Parliament and of the Council on the Governance of the Energy Union, COM(2016) 759 final, 30 November 2016

states. It moreover fails to capture the novelty of the Paris Agreement that sets for the first time a clear long-term end-goal: carbon neutrality[37].

This section thus seeks to analyse and recommend steps to ensure effective governance for (1) mid-term plans (horizon 2030), (2) long-term plans (horizon carbon-neutrality), in order to lead to (3) concrete political decision on a Clean Energy Union Deal that can be (4) effectively implemented as to impact real life.

1.2.1. Planning for the medium term - horizon 2030

1.2.1.1. Ensuring that mid-term plans can be democratically adopted

The current European Commission proposal is hindering democratic accountability of energy decisions. Symbolically, in its 89-pages proposal, the words "citizen" and "civil society" never appear while "democracy" appears only once and only to refer to the European Parliament's 15 December 2015 resolution. More substantially, three key critics are to be mentioned:

1. European and national parliaments have virtually no role in the envisaged governance framework. A behind closed door dialogue between the European Commission and national governments is unlikely to be democratic.

2. Unless it has already worked on a plan before like some member states, the proposed timing *de facto* prevents any member state to propose something more than a document drafted by a few national technocrats. Even if the European Commission were to achieve its unrealistic objective of reaching an agreement on this proposal by the end of 2017, this would leave a ludicrous few days/weeks for member states to submit their draft plans on 1 January 2018.

3. The European Commission proposal has no teeth to pressure a national government to adapt a flawed plan, and no teeth to ensure that plans are actually implemented. The European Commission may issue recommendations but has little legal and political tools to ensure that those recommendations impact and alter national plans. Here it is useful to draw lessons

37. Paris Agreement, Article 4

from the European Semester[38] where similar recommendations are given on economic and social policies. Among the country-specific recommendations issued by the European Commission under the European Semester, only 2% are fully addressed by member states[39].

Against this background, the EU should give a toolbox to those national decision makers who believe that energy policy is a too sensitive policy area to be left to governmental technocrats alone. It is thus suggested to (A) elaborate a list of best practices for national energy plans, (B) include a list of tools member states are invited to use, and (C) build a review mechanism ensuring that national energy plans are soundly and democratically debated at EU level.

1.2.1.1. Identify all the best practices to elaborate national plans that are sound, trustworthy, and endorsed by a vast majority of national stakeholders

Ahead of its Energy Union Governance regulatory proposal, the European Commission created the valuable "Technical Working Group on National Energy and Climate Plans" which gathers European Commission and national governments officials. This allows the European Commission to proactively engage national governments ahead of the drafting of national energy-climate plans.

Research institutions such as Ecologic[40] and IDDRI[41] have already started to identify several best practices in national decision making processes to elaborate a national energy-climate policy. Further research need to be made and fed into the work of the "Technical Working Group on National Energy and Climate Plans". Member states should be encouraged to experiment new processes that, if useful, could be adopted by other member states. Among already existing best practices, two could be mentioned:

38. The European Semester is a sort of governance process for the Economic and Monetary Union, which notably aims at ensuring more coordination of Eurozone members' national budgetary policies.
39. Jacques Delors Institute – Berlin, EU Economy Brief n°12/2017, 24 March 2017
40. Katharina Umpfenbach, Streamlining planning and reporting requirements in the EU Energy Union Framework, Ecologic Institute, September 2015
41. Oliver Sartor, Michel Colombier, Thomas Spencer, "Designing planning and reporting for good governance of the EU's post-2020 climate and energy goals", IDDRI, October 2015. Oliver Sartor et al., "Developing 2050 decarbonization strategies in the EU: insights on good practice from national experiences", IDDRI, January 2017.

1. As part of a "National debate" process, it is useful to form a group of independent experts working with stakeholders to identify and propose several long-term decarbonisation scenarios from which to choose the mid-term objective. Such a group exists in the UK with the UK Climate Change Committee (CCC), or in France as part of the 2015 energy transition law. The UK CCC moreover provides annual progress report to the Parliament, enhancing the democratic accountability of the British energy transition.

2. Ensuring an open discussion that allows to overcome taboos (e.g. nuclear in France, coal phase-out in Germany). In Germany, this led to the creation of a Commission for industrial transition that will notably deal with transition options for the country's coal regions.

Best practices alone are no silver bullet. It is however useful to show that countries like the UK, France, Germany, the Netherlands, Sweden, Finland or Czech Republic have already found ways to efficiently tackle the issue of energy plans. This is likely to alleviate the fears some national governments may have.

1.2.1.2. Include in the regulation a list of tools that member states are invited to use

Europeanisation does not always require legal constraints. Member states are not monoliths. Within member states, many would welcome a more holistic and forward-looking decision making for national energy policy. To that end, the Energy Union Governance regulation should empower those national actors who can support the national decisions needed in the framework of the Energy Union.

In concrete terms, the regulation could include a list of suggestions. For instance, an article saying "Where relevant, member states are invited to consult their national and regional consumer associations, cities, local governments, business and SMEs associations, relevant NGOs and other relevant civil society organisations", would signal national Civil Society Organisations (CSOs) that they can voice their opinion in their national arena when the government drafts the plan. Forward looking CSO officials may even decide to kick-off the drafting of national energy plans themselves by organising conferences and working groups where the national decisions makers of those plans would be invited and may therefore be influenced by some ideas presented by trade-unionists, clean energy business

leaders and NGOs. A similar provision could be made to include the work already done by many European cities (e.g. through the Covenant of Mayors) and regions.

1.2.1.3. Build a review mechanism involving a large range of stakeholders

Contrary to what is currently proposed, governance should not be limited to bilateral reporting between the European Commission and each national government. This is by far not the optimal solution, not least because it limits the capacity to enable or pressure a Government to adopt changes in its energy plan.

To answer those concerns, at least four steps need to be taken:

1. 2017 sees the Vice-President Šefčovič's making its second "Energy Union Tour" where he visits each EU country to discuss energy with key national decision makers and stakeholders. During this Tour, he presents the European Commission SWOT assessment[42] of the national energy situation. A version of it should be widely and timely published online in the national language in order to allow for assessment by all stakeholders and to enhance the robustness of the proposals to be made by the national decision makers to the Vice-President.

2. The regulation should ensure that national draft energy plans benefit from a peer review between member states. Lessons could be learnt from other EU policy domains (e.g. the Economic and Monetary Union's "European Semester"[43]) and the country energy policy review process conducted by the International Energy Agency. This would help to create mutual trust and common understanding, as well as highlight best practices. To ensure a more democratic review, representatives of the European Parliament and of national parliaments could be invited to comment on draft national plans. Specific organisations, such as national Economic and Social Committees, academic organisations and think tanks might also be invited as some of their members may have valuable input on specific elements.

42. A SWOT assessement assesses the Strengths, Weaknesses, Opportunities and Threats of a given topic, in this case, the energy situation of an EU member state.
43. Jacques Delors et al., "Le semestre européen : un essai à transformer", Bref, Jacques Delors Institute, February 2011

3. These peer-review mechanisms should also offer the forum to discuss elements where EU energy policy decisions are difficult to achieve because unanimous vote is required, such as in the case of energy taxation. Forward-looking member states should consider engaging into an enhanced cooperation ensuring some basic harmonisation of the composition of energy prices[44].

4. Democratic accountability is only possible where there is transparency. As it is already the case for the Technical Working Group on National Energy and Climate Plans, the public session of the proposed peer review mechanism should be broadcasted online as to, for instance, allow national journalists to follow the debate and inform national citizens of the plan their national minister will present and defend in Brussels.

1.2.2. Planning for the long term - horizon carbon neutrality

1.2.2.1. Clarifying what is Europe's desired end-state: carbon-neutrality under the Paris Agreement

The Paris Agreement sets, for the first time, the end-state target for the energy transition: carbon-neutrality (i.e. net-zero emissions: manmade greenhouse gas emissions should not exceed manmade capture of greenhouse gases, for instance thanks to reforestation). If Europe is serious about the Paris Agreement, it requires its cities, regions, member states and the European Union to prepare long-term plans to reach carbon-neutrality. This needs to start now, with the adoption of an adequate Energy Union Governance Regulation.

In the European Commission's regulatory proposal[45], only one article is dedicated to long-term plans, with no reference to the Paris Agreement objective of carbon-neutrality. It defines "long-term" as 2070, a period that is so far away that IDDRI advocates for those plans to aim at 2050[46]. Both approaches may be missing the point of carbon-neutrality set-out by the Paris Agreement. To avoid that, long-term should strive for a simple target: carbon-neutrality, with a target year that might differ from country to country taking into account national diversity.

44. One illustration would be harmonising taxation on gasoline for trucks that may sometimes travel with two tanks as to buy gasoline in low-tax countries (e.g. Luxembourg), thus harming the effectiveness of EU and national policies as well as undermining the revenues of those member states that opted for stronger environmental taxation
45. European Commission, Proposal for a Regulation of the European Parliament and of the Council, 30 November 2016
46. Oliver Sartor et al., "Developing 2050 decarbonization strategies in the EU: insights on good practice from national experiences", IDDRI, January 2017

1.2.2.2. Structuring long-term plans through sectorial approaches to carbon-neutrality

Looking at a long-term horizon with a specific net-zero emissions objective tends to reduce the importance of short-term vested interests in the debate[47]. It therefore also allows for a more science-based approach to decarbonisation, relying on relevant scenarios to be established and discussed.

A traditional approach to such long-term planning would look at each already existing production process (e.g. steel production) to see how it could become low/zero/negative carbon. A more holistic approach would look at the services delivered to people and see how to make such services zero-carbon. To illustrate the latter, producing zero-carbon housing may entail a change in the use of housing materials, for instance by reducing/eliminating the use of steel in housing as steel is carbon-intensive, and substituting steel by less CO_2 intensive materials or even negative emissions material such as wood—as wood production stores amounts of CO_2 that remain stocked within the wood used for housing.

Once the sectors are identified, it is worth looking at (A) sectors where getting to zero seems unlikely for technical (e.g. aluminium production[48]) and/or political reasons (e.g. military activities[49]), (B) sectors that can easily become zero-carbon (e.g. electricity generation) and (C) activities that enhance carbon sinks (e.g. reforestation, agriculture, use of wood in the construction sector, heat/power generation with biomass combined with carbon capture etc.). Given uncertainties about technologies and human behaviour in 30-70 years, the outcome of this exercise would be a set of scenarios that should be constantly updated to take into account real-life evolutions and changing expectations. In other words, the process of creating such plans is as important as the content of the plans themselves[50].

47. Oliver Sartor et al., op. cit.
48. Aluminium production involves an electrolysis that transforms alumina into aluminium and CO2. It moreover produces other GHG, especially CF4(g) and C2F6(g) that are potent GHG (respectively 6,500 and 9,200 times more potent than CO2). For more information on aluminium production, see International Aluminium Institute.
49. The military sector is often neglected in energy-climate debates. It is a very particular sector for both political and technical reasons. Politically, it is the realm of exceptions from classic legislations. Technically, for civilians, a vehicle's capacity to accelerate is an element of social status while, for the military, the capacity of a vehicle (e.g. a battle tank) to accelerate is a matter of survival in combat.
50. Oliver Sartor et al., ibid.

1.2.2.3. Improving citizens involvement in energy policy-making

To put into practice the idea of energy democracy, the EU and member states should test new ways to interact democratically with citizens on key topics hardly ever discussed during elections—such as long-term plans for carbon neutrality.

One way forward can be deliberative polling[51]. This approach considers democratic legitimacy to be based on informed opinion, open deliberation and equal participation of citizens. This translates in creating a pool of randomly chosen citizens that are representative (e.g. in terms of age, gender, social origin, level of income, education etc.), to gather them, to inform them substantially, to give them time to debate, and finally to vote a resolution. This has already been done more than 20 times, including once at the EU level in 2007.[52] The European Parliament could again apply this method to allow EU citizens to come to the European Parliament in order to debate Europe's energy future. The European Parliament could commit to endorse the key elements of the outcome of this deliberative poll within a European Parliament Resolution. A similar method could be done at the national level by national parliaments.

A complementary way forward can be to extend the pool and diversity of people involved in the decision-making process, not only to make it more democratic, but also more efficient[53]. An "Energy Transition Assembly" may include people representing the various relevant segments of society, such as MPs, mayors,

51. The official definition of deliberative poll is : "A Deliberative Poll (DP) surveys a scientific, random sample before and after it has deliberated one or more policy issues or electoral choices. The deliberative treatment includes exposure to balanced briefing materials laying out the arguments for and against given policy proposals, small group discussions led by trained moderators, and plenary sessions in which competing experts and politicians answer questions formed in the small groups. The post-deliberation measurement affords a picture of what the public would think if it thought and knew much more about the issues and had talked much more about them with a much wider variety of their fellow citizens, and the contrast with the pre-deliberation measurement shows how these more considered opinions would differ from those the public currently holds". See Laurie Boussaguet, "Listening to Europe's citizens. An assessment of the first experiments in participation organised at EU level", Policy Paper No.44, Notre Europe – Jacques Delors Institute, 2011.
52. 362 citizens from the then 27 member states were selected for such deliberative polling that occur inside the European Parliament and during two days. For more information on deliberative polls, see in particular: Pierre Martin, "Réconcilier délibération et égalité politique : Fishkin et le sondage délibératif", Revue Française de Science Politique, 1998. See E. Olsen and H.J. Trenz: "From Citizens' Deliberation to Popular Will-Formation? Generating Democratic Legitimacy in Transnational Deliberative Polling". Conference Paper prepared for ESA Conference, Milan Nov. 30/Dec. 1st, 2012. Boussaguet L. and R. Dehousse (2007) « L'Europe des profanes: l'expérience des premières conférences citoyennes », in Costa and Magnette (eds. 2007), *Une Europe des élites ? Réflexions sur la fracture démocratique de l'Union européenne*.
53. Open approaches to decision making indeed increase the quality of the top ideas even if they may decrease the average quality of proposed ideas. See Andrew King and Karim R. Lakhani, "Using Open Innovation to Identify the Best Ideas", MIT Sloan Management Review, fall 2013, pp.41-48

representatives of the scientific community, farmers, businesses, energy operators, trade unions, NGOs, as well as citizens randomly chosen—in a way similar to the way most EU countries pick citizens for jury duty[54].

Beyond the need to have more visible democratic debate on energy issues, testing such methods would also positively impact the image of European Union as a body that is conscious of the criticisms made against its so-called lack of democratic accountability. Moreover, if the vast European consensus over the necessity to fight climate change through energy efficiency and renewable is confirmed, this could help counterbalance the influence some lobbies of the "old world" (see box 3) may have on policy makers.

1.2.3. Adopting a "Clean Energy Union Deal"

International, EU and national energy objectives are clear (see introduction). To deliver them, EU decision makers need to agree on new rules for the European energy sector. The European Commission proposals are now on the table, especially since 30 November 2016[55]. It is now time for the member states and the European Parliament to deliver a "Clean Energy Union Deal".

1.2.3.1. European Council Impetus is required

Heads of State and Government can deliver the needed impetus. As national leaders, their duty is to articulate all policies, including the numerous ones driving the energy transition: energy, transport, climate, research, innovation, vocational training, social affairs, taxation, etc. Their action is thus of paramount importance to overcome the hurdles of usual technocratic reluctance, and to ensure both horizontal and vertical coherence of EU and national energy decisions (see 1.1.3. on holistic approach).

These leaders already signed and ratified the Paris Agreement. The Clean Energy Union Deal is "only" one element to allow all European states to achieve the collectively agreed objectives of reaching global carbon neutrality in this century. Yet,

54. Other options could be further studied, such as applying to energy-climate issue the G1,000 initiative initiated by David Van Reybrouck. See http://www.g1000.org/en/manifesto.php
55. European Commission, *Clean Energy Package for All European*, 30 November 2016

without a push at the highest level, lobbies and governmental technocracies are likely to significantly undermine the ambition of the Energy Union.

1.2.3.2. A "Clean Energy Union Deal", not a "winter package" nor a "fourth energy package"

The Brussels' bubble has a seemingly limitless capacity to create useless jargon ensuring that what is discussed in Brussels never reaches national debating arenas. The latest example is the November 2016 European Commission proposals officially named "Clean Energy For All Europeans", but that Brussels insiders disturbed by these ambitious words quickly renamed "Winter Package". Aside from the fact that the winter season is rarely associated to anything fully positive, this term is confusing as this November 2016 "Winter Package" may be confused with the other November 2016 "Winter Package" dealing with defence policy[56], the February 2016 "Winter Package" on security of gas supply[57], the February 2017 European Semester "Winter Package".[58] Others, such as the French Parliament[59], have called this the "fourth energy package", locking those proposals in the paths of the first (1996), second (2003) and third (2009) energy packages, associated to a sometimes unwelcomed liberalisation process. Both denominations are wrong as they fail to capture the novelty of the Energy Union.

The Energy Union project is a new impetus given to the European Energy Policy, a qualitative jump to go beyond the narrow-minded regulatory framework, to break energy silos (see 1.1.3. on holistic approach) and to ensure that Europeans have a common energy policy that can work to their greatest benefits. It now also relies on a new target, the Paris Agreement's carbon-neutrality objective. It brings a new mind-set: putting consumers and citizens—and not the incumbent energy suppliers—at the centre of policy decision. It also occurs at a moment where energy is among the few areas where the EU can be proactive and deliver concrete and tangible benefits to the citizens of the 27 member states (see foreword). Finally, it happens at a time when Europe is, for the first time in recent history, unsure of US support, and directly surrounded by two powers, Russia and Turkey, that are actively seeking to divide and rule Europeans to enhance their powers. There may

56. European Parliament, Directorate General for Internal Policies, *The 2016 "Winter Package" on European Security and Defence: Constitutional, Legal and Institutional implications - In-depth analysis*, December 2016
57. European Commission, *Proposal for a regulation of the European Parliament and of the Council concerning measures to safeguard the security of gas supply and repealing Regulation*, COM(2016) 52 final, February 2016
58. European Commission, "European Semester Winter Package: review of member states' progress towards economic and social priorities", Press release, 22 February 2017
59. French National Assembly, Le Feuilleton n°665, 22 February 2017, p.13

even be possibly a third power fostering European division: Britain for the same power game reasons during the Brexit negotiations.

As this time is different, a new name is required. Naming it "A Clean Energy Union Deal" should help bringing about a change in mind sets to get an ambitious deal and avoid having an agreement on the lowest common denominator within each policy area.

In terms of content, this Deal can only deliver if it is maintaining the holistic approach adopted by the Commission in its Energy Union project. The negotiations already started but are unlikely to end before the second half of 2018, after elections in Germany, Italy and others. British exit from the European Union also impacts the decision that will be made (see box 4). It appears already that the European Parliament has much bigger ambitions than the appetite shown by the member states for several elements of the package proposed by the Commission. A compromise will have to be reached and it has to keep the level of ambition high to remain significant and in line with the objectives set by the Paris Agreement and the targets set for 2030. While the rationale is for member states to secure their major interest while being flexible on their secondary interests[60], Heads of State and Government may have a major role to play to go beyond.

60. To take a schematic example, Poland's main interest may be to secure an EU united front on energy to ensure energy security as well as a common EU energy diplomacy avoiding the shortcomings of the current situation where Vladimir Putin can divide and rule in Europe on several key issues (e.g. Nordstream 2, see box 2). To secure this interest, Poland should be flexible on secondary interests where it can accept some losses (e.g. on phasing out coal in the long run) or still secure wins (e.g. boosting electric vehicles). France's main interest may be to save EDF from a bankruptcy that would cost the French State tens of billions. To do so, it needs to find ways to boost nuclear's competitiveness, e.g. via a higher ETS price and developing electricity vehicles as to secure a higher overall electricity price. In exchange, France would show more flexibility on other elements, such as its reluctance to develop renewables or achieve a genuine EU energy diplomacy. Germany's primary interest may be to secure EU-wide integration of renewables able to reduce the cost of Energiewende on German households (see chapter 3.). It should then show flexibility on other elements, such as its strong opposition to an EU energy diplomacy. A similar approach should be taken to ensure that a broad Clean Energy Union Deal can secure the largest coalition of member states as well as MEPs.

BOX 4 ► Brexit and its impact on European energy policy[61]

The June 2016 vote for British exit from the EU (Brexit) was not driven by energy issues but it will impact them. As Britain is no longer a coalition maker or a motivated ally in the Council anymore, the Brexit vote weakens the coalitions in which Britain was a key member if not the leader. As a result, EU energy policy may:

- Shift the balance from the overarching objective of reducing greenhouse gas emissions to more effective targets for renewables and energy efficiency;
- Focus less on energy security;
- Put a greater emphasis on stronger governance as David Cameron's government was reluctant for any real governance improvements ahead of his June 2016 Brexit referendum;
- See a weakened position of UK traditional allies, such as Poland, Ireland or the Netherlands;
- See a weakening of the coalition in favour of an ETS reform to boost the carbon price (see chapter 3 for a discussion on carbon pricing);
- See a weakening of the pro-nuclear coalition, as the UK is the only European state where a significant plan to develop nuclear exists, as symbolised by the Hinkley Point C project.

Energy will also be part of the negotiations defining post-Brexit relations between the UK and the EU. Linked to the Single Market negotiations are the energy efficiency standards that the EU has adopted. Trading gas and electricity between Britain and the continent is also important to ensure security of supply at the lowest possible cost. Participation of the UK to the ETS remains an open question. Finally, nuclear safety in Europe is currently ensured by Euratom and even though no Brit voted for British exit from Euratom (Brexatom), current government policy is to consider that Brexit also means Brexatom, thus needing to find a new way to ensure the safety of British nuclear power plants, as well as the security of supply in uranium.

1.2.4. Preparing for implementation

Laws are, by themselves, only ink on paper. For a law to impact people's life, it needs to be implemented and enforced. Implementation thus critically matters for European people.

1.2.4.1. Key principles: Rule of law and trust between Europeans. Decisions that are taken should be fully enforced.

Implementation must be grounded in key principles. In coherence with those mentioned in section 1.1., the principle of the rule of law is fundamental: it means that the law is the same for everyone, and everyone needs to abide by it.

61. This box derives from Jean-Arnold Vinois' intervention at the Florence School of Regulation: http://fsr.eui.eu/brexit-impact-energy-jean-arnold-vinois/

This principle of the rule of law is too often poorly applied in EU decision making, as if indeed some were more equal than others. This became quite visible in the Economic and Monetary Union budgetary governance when the rule of law was not applied in 2003 when France and Germany were not sanctioned for breaking the 3% public deficit rule. To avoid a similar fate for the Energy Union Governance, we now turn to new ways to ensure that Energy Union decisions are efficiently and effectively implemented in Europe.

1.2.4.2. A stronger role for the European Commission after 2019

"Nothing is possible without men,
nothing is sustainable without institutions …
When well built, those institutions can accumulate
and pass wisdom to future generations".
Jean Monnet's Mémoires, 1976.

Once elected by the European Parliament in 2014, Jean-Claude Juncker restructured the European Commission's internal organisation by creating Vice-Presidents positions and asking them to steer the work of "Project Teams" gathering all commissioners relevant on a given policy area. Energy policy now has its dedicated Vice-President: Maroš Šefčovič, a career-diplomat who already served as EU commissioner for transport (2009-2014). His role is to ensure that the European Commission overcomes the silo mentality when it comes to the Energy Union. He works hand-in-hand with commissioners that are key for the Energy Union[62]. This is very welcomed as those project teams are more likely to ensure an effective holistic approach articulating all EU tools towards a common objective.

This new structure added to already existing tensions. Media attention was paid to tensions between Maroš Šefčovič and Miguel Arias Cañete. Yet, such tensions do not necessarily have to be negative. They can "bring about a competition of ideas, which in case of thorny issues, allows the [European Commission] President to hear both sides of the argument and to take an informed decision if no compromise"[63] is to be found. It makes the Commission more political and less technocratic if it debates real political choices.

62. Miguel Arias Cañete, Commissioner for Energy-Climate, Violeta Bulc, Commissioner for Transport, Carlos Moedas, Commissioner for Research and Innovation etc.
63. Marine Borchardt, "A political European Commission through a new organisation - 'This time it's different'. Really?", Policy paper No.180, Jacques Delors Institute, December 2016

TABLE 2 ► Project team « Energy Union »

COMMISSIONER	POLICY PORTFOLIO
Full members	
Miguel Arias Cañete	Climate action and Energy
Karmenu Vella	Environment, Maritime Affairs and Fisheries
Phil Hogan	Agriculture and Rural Development
Violeta Bulc	Transport
Elżbieta Bieńkowska	Internal Market, Industry, Entrepreneurship and SMEs
Corina Crețu	Regional Policy
Carlos Moedas	Research, Science and Innovation
Associate members	
Günther H. Oettinger	Budget
Cecilia Malmström	Trade
Marianne Thyssen	Employment, Social Affairs, Skills and Labour Mobility
Pierre Moscovici	Economic and Financial Affairs, Taxation and Customs
Věra Jourová	Justice, Consumers and Gender Equality
Margrethe Vestager	Competition

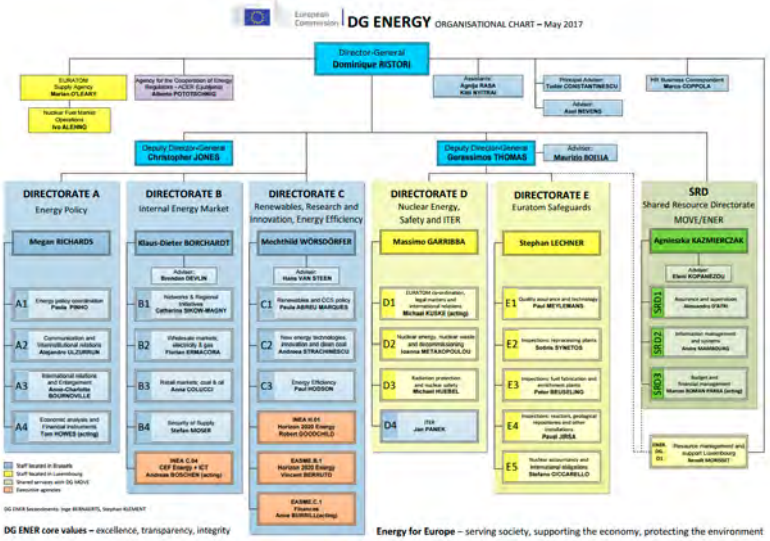
This new Vice-Presidency structure is a success that needs to be continued after 2019. It has indeed been effective in ensuring a holistic approach to the legislative proposals the European Commission has put forward from 2015 to 2017.

Need to restructure the Commission services into a "climate and clean energy department" aiming at framing clean energy services (one for H&C, one for electricity, one for mobility).

The creation of the Vice-Presidency has also shown the difficulty for the various DG's concerned, and responding to different management structures, to deliver the proposals in the most coherent and coordinated way. The time has come to restructure the administrative organisation of the European Commission in line with the holistic approach required by the Energy Union, to offer greater added value of the European Commission's work in respect of national energy administrations, and more independence *vis-à-vis* lobbies.

The European Commission's DG Energy is still organised along energy supply sources (see figure 4) rather than on energy services to the consumers[64]. While such an approach may fit the interests of those energy suppliers that are still structured in an energy-source way[65], it fails to capture what energy end-users (i.e. businesses and citizens) actually need. Energy consumers do not need oil, gas or renewables *per se*; they want energy services: heating, cooling, mobility and electricity.

FIGURE 4 ► Organisational Chart of the DG Energy



As a result, a genuinely consumer-centric European Commission requires a DG Energy structured around those three key energy services: heating & cooling, mobility, and electricity. This would also help make the European Commission more independent from vested interests as this transformation would oblige lobbies to drastically rethink their lobbying strategy to adapt it to the renewed structure of DG Energy. The same applies to DG Move dealing with transport. And it may also involve DG Climate and DG Environment.

64. This is similar for DG Move that is stil organised on transport modes, while virutally all transportation is multi modal (e.g. someone walking to take a bus to get to a railway station/airport).
65. Example of the change in Engie, that is now structured in B2B, B2C and B2T.

Last and not least, this would increase the capacity of the European Commission to deliver an added value to the work already done by national administrations. The Commission's new structure would refocus its work on energy services, while national administrations will presumably continue to be structured on an energy source basis.

Such a deep restructuring of the European Commission should happen only after the decisions on the "Clean Energy Union Deal" have been adopted, hence more likely in the 2nd semester of 2018 or 1st semester of 2019. This should be the task of the new Commission that will be elected during the 2nd semester of 2019 as it also implies a different distribution of the portfolios of the Commissioners to come.

Such restructuring should also go hand-in-hand with the creation of a European Energy Information Service within the European Environment agency (see box 5) to provide European and national decision-makers, as well as citizens, with independent, reliable and up-to-date information.

BOX 5 ► A European Energy Information Service to save Europe the money wasted by ill informed decisions[66]

Science-based policy decisions require good analysis. The Energy Union thus needs up-to-date data, robust analysis, and scenarios for the future which are produced by open models relying on transparent assumptions. Currently, the European Union tends to sub-contract analysis to external consultants. This system has reached it limits.[67] To illustrate, the projections used by the European Commission to estimate future gas demand suggested that gas demand would skyrocket. In truth, actual demand decreased[68]. Such flawed projections favoured unnecessary gas infrastructure investment in Europe. These mistakes reached the point where the European Court of Auditors considers that the European Commission "needs to restore credibility of the [gas demand] forecast it uses"[69].

To deal with those problems, Europe needs its own, fully independent and open-source provider of both reliable energy statistics and scenarios. It needs to be accessible by all EU and national decisions makers, business leaders and citizens. Such "European Energy Information Service" (EEIS) should work hand-in-hand with Eurostat. It should ensure the quality of the data provided by member states, develop one entry point for all the datasets needed to assess the progress of the Energy Union, develop with stakeholders the assumptions for different scenarios, provide open source models to allow for testing different assumptions and to check consistency between different projections.

66. The authors would like to thank Yamina Saheb for her contribution to this box.
67. It also leads to inconsistencies between models used for different European Commission proposals. See Yamina Saheb, *Clean Energy for All Europeans Package - Do the Commission Impact Assessments Assign the Right Role for Energy Efficiency?* OpenExp, 2017
68. Dave Jones, Manon Dufour, Jonathan Gaventa, *Europe's declining gas demand*, E3G Report, June 2015
69. European Court of Auditors, « Des efforts supplémentaires sont nécessaires pour améliorer la sécurité de l'approvisionnement énergétique en développant le marché intérieur de l'énergie », Special Report No.16, December 2015, p. 37

As to avoid the hurdles of creating a new European agency, this service should be created by extending the capabilities and mission of the European Environment Agency (EEA). Having an ad hoc service, rather than external consultants, is key to ensure continuity and institutional memory. It is also important to ensure that the EEIS is independent from all decision-makers (including the European Commission). As Article 35 of the proposed Energy Union Governance regulation deals with the role of the EEA in the governance of the Energy Union, it can be the legal vehicle to create a properly staffed EEIS within the EEA.

Restructuring existing energy fora

The restructuration of the European Commission should be the opportunity to adapt the competences of the existing Energy fora in order to steer European wide debates with all stakeholders, including the member states and the national regulatory authorities. Existing Fora are mostly[70] centred on a supply-side perspective, with the ones of Madrid on gas[71], Florence on electricity[72], Berlin on fuel mix[73], or Prague/Bratislava for nuclear energy[74], while the more recently created London Forum deals with the citizens' issues and the Copenhagen Forum with infrastructures. Whether these fora should all be maintained or should be consolidated is a valid question if the Energy Union is about eliminating the silos. An alternative could be to organise fora to discuss how energy should best serve customers while being climate friendly: we could imagine a forum on transport and mobility, another one on heating and cooling and a last one on electricity. The optimal fuel mix and infrastructure aspects should be integrated in each one of these three fora. Another option could be a single plenary Energy Forum working with subgroups on the various energy services and reporting to the plenary. And these new fora should also make a significant room to representatives from civil society such as NGOs dealing with climate action, consumers interests and other aspects directly linked to the public acceptance of energy actions.

1.2.4.3. Working with grassroots national organisations to implement EU law

The European Commission should have the highest authority in ensuring by all legal means the full implementation by member states and stakeholders of the applicable law designed to guarantee a level playing field for all throughout the EU. Yet, the current situation knows three key limits:

70. A notable exception is the London forum on citizens and consumers : https://ec.europa.eu/energy/en/events/citizens-energy-forum-london
71. See https://ec.europa.eu/energy/en/events/madrid-forum
72. See https://ec.europa.eu/energy/en/events/meeting-european-electricity-regulatory-forum-florence
73. See https://ec.europa.eu/energy/en/events/berlin-energy-forum-february-2014
74. See https://ec.europa.eu/energy/en/events/european-nuclear-energy-forum-enef-plenary-meeting

- First, in some cases, the European Commission may prefer not to enforce legislation to keep good relations with a specific national government or to avoid interference with elections.
- Second, the process is lengthy. The European Commission waits for member states to notify the legislation adopted to transpose EU directive. In most cases, several fail to transpose EU directives in a timely and appropriate manner. In such instances, the Commission starts a dialogue with the member state—a time during which EU legislation is *de facto* not applied. Only when a member state proved to be reluctant does the European Commission start bringing the case in front of the European Court of Justice. This ping pong game between the Commission and the national government may take several years before it lands for the Court of Justice where it takes another one or two years to get a judgment. In some cases, a second judgment is needed. The possible imposition of financial penalties to the member state in breach of fulfilment of its obligations has improved a bit the situation. However, it is clear that the best way to avoid such huge delays is to proceed with regulations directly applicable to all parties and avoid as much as possible to legislate with directives whose transposition into national law is too often the occasion for the member states to buy time or to create new loopholes.
- Third, the process can be unpopular. When the Commission brings a case to the European Court of Justice, national media may qualify the situation in terms of "Brussels' interference" in national decision making.

Strengthening the EU level of enforcement of the law remains critical. Yet, the EU should add another tool in its EU law enforcement toolbox. This new tool should aim at Europeanising the national level of enforcement of the law—including national enforcement of EU law.

In our era shaped by citizen engagement, rising role of civil society organisations and digital communication, the European Commission should aim at working with national actors with a vested interest in ensuring the respect of EU law in a specific area. Those organisations can indeed bring cases in front of national judges who may directly apply EU law when it is clear and put questions to the Court of Justice when it is less clear. Relying on national courts is likely to make the process swifter in most EU member states[75]. As the case is brought in front of

75. Such approach may however not work in some countries where, such as in Greece and others, the national judicial system is too slow to deliver timely decisions.

national judges by national actors there is a smaller chance to see the EU opinion image harmed in the process.

1.3. Delivering concrete and visible projects

The European Commission now embraces the holistic approach[76] (see 1.1.3.) to the energy transition. It proposes concrete legislative proposals for a "Clean Energy Union Deal" that should create a robust regulatory framework able to deliver clean energy for all Europeans (see 1.2.4.). Reaching such deal requires complementary efforts. In its role of facilitator, the European Commission should encourage public and private players to promote concrete projects that visibly benefit citizens while showcasing the benefits of concrete energy transition decisions. We suggest five concrete projects aiming at:

- Delivering concrete benefits to EU citizens, hence promoting the idea that the EU can be a tangibly useful project for its citizens;
- Showing the direct benefits the energy transition can bring in people's life, in order to foster support for clean energy at all levels of governance,
- Unlocking some key bottlenecks that are slowing down the energy transition;
- Building a network of a variety of actors who can act as national enablers of clean energy decisions, including by acting as EU energy law enforcers (see 1.2.4.3.).

We further propose a method to enable EU actors to identify other projects that those proposed here.

1.3.1. Rolling-out charging points for electric vehicles with the Juncker Plan[77]

Electric vehicles are one of the most promising components of the future of mobility. Developing electric vehicles is of strategic importance for Europe to make European carmakers the world leaders in electric vehicles (see chapter 2.), thus avoiding that international competition harms job prospects in Europe. It also fights air pollution as oil-based transport is a key contributor to air pollution killing 430,000 Europeans every year (see chapter 4.). It helps fighting

76. See Andoura Sami, Vinois Jean-Arnold, "From the European Energy Community to the Energy Union", Studies & Reports No.107, Jacques Delors Institute, January 2015
77. The authors would like to thank Michel Derdevet, Marjorie Jouen, Patrick Jochem and Abrial Gilbert d'Halluin for their valuable comments on this section.

climate change, provided that electric vehicles run on clean electricity[78]. Last and not least, it makes Europe less dependent on fossil fuels imports and it keeps the money of these imports for more domestic economic developments.

Many initiatives are already under way[79] (e.g. Juncker Plan support to the Swedish GigaFactory, see chapter 2.), and classic regulatory tools should be effectively used with an European Commission regulatory proposal coming up in the second half of 2017. To pave the way for electric vehicles, the European Commission should act as a regulator, but also as an enabler.

One major roadblock for the deployment of electric vehicles is people's perception of a lack of charging points. No one wants to buy an electric vehicle if he/she is not certain that it can easily be charged. The charging point must moreover be reliable, i.e. to provide security of electricity supply to all users, as well as an easy, secure and affordable mean of payment. To fight both the perception and reality of the risk of "running out of battery", the European Commission should join forces with like-minded public and private actors[80] to equip all European highways and cities with charging points for electric vehicles by 2020[81]. Such a project should benefit from the financial support of the Juncker Plan[82]. In exchange for this financial public support, the EU should ensure that:

- The roll-out of this project enables the emergence of a single European norm for charging points, thus ensuring that any electric vehicle sold in Europe can be plugged on those EU-supported charging points;
- The roll-out should not be limited to the most densely populated areas (e.g. European metropolis) but also concern peri-urban and rural areas as to ensure territorial cohesion as well as access to EV by all Europeans.

78. Hence the necessity of a holistic approach encompassing electric vehicles, electricity market design and renewables deployment. For a study of rising CO2 emissions because of rising electricity consumption due to passenger cars, see Jochem, P., Babrowski, S., Fichtner, W. (2015), *Assessing CO2 emissions of electric vehicles in Germany in 2030*, Transportation Research.
79. European Commission, *A European Strategy for Low-Emission Mobility*, July 2016. See also Michel Derdevet, *Énergie, l'Europe en réseaux*, La Documentation Française, February 2015
80. Example of those actors are Nations and cities already pushing in favour of electric vehicles (e.g. the Netherlands, Denmark, Poland, France). Companies would also be involved, such as electricity distribution system operators who would like to avoid that a disorganised roll-out of charging points disturbs the stability of local electricity grids. Companies like Total may also be involved, both because they are in the electric battery business, and because they need to ensure the future of the refilling stations they own.
81. For an in-depth study on the optimal allocation of a specific kind of EV charging points, see. Jochem, P.; Brendel, C.; Reuter, M.; Fichtner, W.; Nickel, S. (2016), "Optimizing the allocation of fast charging infrastructure for electric vehicles along the German Autobahn", *Journal of Business Economics* 86(5), 513-535
82. Eulalia Rubio, David Rinaldi and Thomas Pellerin-Carlin, "Investment in Europe – Making the best of the Juncker Plan", Jacques Delors Institute, Study, March 2016

EU support should be clearly visible as to show citizens that their taxpayer money is put to good use by the EU[83].

1.3.2. A Green Erasmus Pro Programme

The energy transition creates new jobs. In a Europe with millions of young unemployed and the difficulty for clean energy businesses to sometimes find workers with the right skills at the right place at the right time, the energy transition is a critical opportunity to fight youth unemployment by boosting green jobs creation (see chapter 4.).

One way forward is for the EU to channel some of its EU budget money for a green Erasmus pro programme aimed at allowing young apprentices to learn the "green skills" that will increase their chances to find a quality job, while making them agents of the energy transition. This proposal is further detailed in chapter 4., section 4.1.4.3.

1.3.3. Making European islands the figureheads of the energy transition[84]

The European Union has more than 2,500 islands where millions of Europeans live. Those islands should become the test bed and showrooms of transition paths to self-sufficiency thanks to a 100% renewable energy mix.

There is a clear economic case. These islands tend to almost entirely rely on oil for their transport, heating and electricity (see figure 2), while renewable electricity generation is now cheaper than oil-based electricity generation. Islands' energy bills are very high, and often heavily subsidised. As an illustration, mainland French consumers pay a special tax on their electricity bills to subsidise French islanders so they can benefit from a cost of electricity lower than the actual production cost of electricity on their islands. This represented €1,8 billion in 2014[85] for France alone.

It is in Europe's interests to work with European islanders to develop European islands paths to the energy transition. It will also help to establish many examples of best practices that can later benefit mainland Europe and any isolated

83. One simple way to ensure this point is to have an EU flag on all the charging points built with EU support.
84. Enrico Letta, Bertrand Piccard, Herman Van Rompuy, "Why and how Europe should become the world leader of renewable energy?", Tribune, Jacques Delors Institute, 7 February 2017
85. Commission de Régulation de l'Énergie, Historique des charges de service public de l'électricité et de la contribution unitaire.

areas on any continent[86]. Political momentum is gathering as illustrated by the 18 May 2017 Valletta declaration on clean energy for EU islands, signed by the European Commission and 14 EU countries[87].

1.3.4. Develop an EU-Africa clean energy partnership

Africa is one of Europe's greatest challenge and opportunity in the 21st century. With a projected population of 2 billion in 2050, a sound and clean development of African countries is crucial and it should offer great opportunities for European businesses and workers to contribute to this development. Any setback in Africa may directly impact Europe, notably through forced migration.

The energy transition is a critical enabler for the economic development of Africa. 600 million Africans currently have no access to electricity, hence little to no prospects of economic development. Ensuring access to electricity is thus critical. This electricity will be clean, because renewables (especially solar) is often the cheapest way to generate electricity in Africa today, but also because many African countries are on the frontline of climate change.

Developing an EU-Africa energy transition partnership[88] embedding public authorities and civil society is thus a strategic endeavour for both continents. The challenge is to structure and scale-up all existing initiatives[89] to ensure that millions of micro-projects contribute to the overarching endeavour[90]. November 2017 will see the holding of a EU-Africa summit which could decide to accelerate this transition.

It is a concrete way for Europe to show its commitment and interest in becoming the global provider of clean energy solutions (see chapter 2.). It is also a concrete step to deliver on the Paris Agreement as well as the UN Development Goal of

86. This external dimension offers another opportunity to the European competences to bring benefits to the more than 1,2 billion people having no access to electricity today. See Thomas Pellerin-Carlin and Pierre Serkine, "From distraction to action – for a bold European Energy Union innovation strategy", Jacques Delors Institute, Policy Paper, June 2016.
87. Those signatories are the European Commission, Croatia, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Malta, Portugal, Spain, and Sweden. The text of the declaration is available here.
88. Enrico Letta, Bertrand Piccard, Herman Van Rompuy, "Why and how Europe should become the world leader of renewable energy?", Tribune, Jacques Delors Institute, 7 February 2017
89. Such as the programme of the Vlerick Business School or other business or engineering schools. In such programmes, MBA students, as part of their cursus, may be sent to African countries to perform a market study among small enterprises to assess the potential for self-sufficient power solutions, through better efficiency and use of renewable sources. Such consultancy work could be organised by all business and engineering schools of Europe with an appropriate funding, for instance by the European Development Fund.
90. See Simone Tagliapietra, "Electrifying Africa : how to make Europe's contribution count", Bruegel Policy Contribution, June 2017

"ensuring access to affordable, reliable, sustainable and modern energy for all"[91]. And it is the way to achieve the EU goal to be the world leader in renewables.

1.3.5. Protecting Europeans from unwelcomed foreign interference

Europe needs to show it is not the fall guy of globalisation. It has sometimes acted like this in the past. For instance, some member states impeached the European Commission to adopt anti-dumping measures that would have saved thousands of European jobs in the nascent solar industry, while strengthening Europe's solar industrial base to pave the way for the next generation of solar panels. Consumers may have benefited from initially cheaper Chinese solar panels but thousands of workers lost their jobs. There is no black and white situation and that is why any "protectionist" intervention should be carefully assessed in order to ensure the best welfare for the society.

Today, countries like China or Russia, that have put in place very strong measures to protect a long list of strategic sectors, are buying critical elements of the EU economy, including in strategic sectors like the media or energy. A striking move was recently State Grid of China[92], the largest transmission and distribution system operator and the largest manufacturer of all equipment needed such as cables etc… It purchased European electricity transport system operators (TSOs), starting in Portugal and Italy. This is a worrying move because TSOs are a critical element of the electricity supply value chain and European companies are also their suppliers of equipment, up to now. In a spirit of effective reciprocity, the EU must use its trade, security and competition tools to effectively protect European interests, in this case ensuring that those purchases will not be detrimental to European companies that provide equipment to European TSOs, while being excluded from the Chinese market.

Mapping foreign investments into strategic sectors (e.g. energy, digital, media) is a necessary first step. It should be embedded in a broader agenda attempting to ensure a common European response to what is sometimes called "economic warfare" or "hybrid threats". One element could for instance be that any non-EU entity acquiring more than 10% of a strategic company, should first be authorised by a kind of Committee of Foreign Investments as it exists in the US. As Estonia is very much aware of those risks, the European Commission could work with the Estonian Presidency of the EU (July-December 2017) to identify ways forward.

91. United Nations, Sustainable Development Goal n°7: Ensure access to affordable, reliable, sustainable and modern energy for all
92. State Grid of China is the biggest transport and distribution system operator of electricity, as well as the biggest manufacturer of related equipment, such as cables etc.

1.3.6. Identifying more concrete projects

The five above-mentioned concrete projects are not silver bullets. They however are useful elements that can start to deliver by 2018, while having a strategic impact, as well as a political one of showcasing to Europeans that the energy transition is not only feasible and desirable, but that it is already underway, and that the EU is at the forefront of this endeavour that makes European lives better.

Yet, there is a need to identify more concrete projects that could have similar benefits. To do so, the European Commission should launch three initiatives.

First, the European Commission should map the strengths and weaknesses of all European regions *vis-à-vis* the energy transition as to see their opportunities and threats. It should help identifying champions and showing how countries are already benefitting or can benefit. Such assessment can be done by the European Commission's DG GROW (in charge of the panorama of EU competences) in collaboration with national and regional administrations as well as private actors. This mapping is moreover of political importance as it may help national politicians reassessing where their national interest truly lies. For instance, it could inform them that, while energy efficiency may lead to less coal consumption and thus less coal jobs, it might also lead to households buying insulation solutions which happens to create much more local jobs.

Second, the European Commission should federate forward-looking European companies into a coalition for the transition. There is a need for a paradigm shift in the way public and private sectors interact in Brussels—as well as in most EU countries. Currently, private sector officials, led by lobbyists, visit public decision makers to influence them on legislative details usually with the aim to reduce the level of ambition of the proposals to be made or tabled by the Commission. While it may be useful to avoid situations where policy decisions may poorly take into account the situation "on the ground", it has a severe political downside as it creates suspicions that EU bodies are following what some powerful private companies are telling them to do.

The energy sector is obviously subject to intense lobbying, with national governments often being the best lobbyists for their national corporations[93] (see box 3). Sometimes prominent political leaders are leading the way as exemplified by former German Chancellor Gerhard Schröder's position of President

93. As recently emphasised by national governments to raise car emissions limits to protect their national car manufacturers after the DieselGate.

of NordStream[94] (see box 2). At the EU level, 2016 saw José Manuel Barroso, former European Commission President (2004-2014) joining the US Bank Goldman Sachs, an entity best known as the bank that helped former Greek governments to falsify data in order to get into the Eurozone.

Public-private cooperation is useful when it promotes the public interest. Beyond ensuring genuine transparency[95], it is important to shift the focus of such cooperation towards concrete projects. In other words, the discussion should focus on how public tools (e.g. Juncker Plan) and private initiative (e.g. development of electric cars) can work together on concrete win-win projects (e.g. the large-scale roll out of charging points for electric vehicles advocated in section 1.3.1.).

The interest of private businesses there is to ensure that policy makers will create the right and stable framework to make possible useful projects. The interest of EU public actors is to show that they are not only here to regulate—a critical mission that needs to continue—, but also to enable private initiative aimed at promoting elements of public interest, such as breakthrough innovation, job creation, and the shift to clean energy.

Good news is that the EU has already created several fora that can be used for that purpose. One is currently under construction by the European Commission: the "Clean Energy Industrial Competitiveness Forum"[96]. This forum may become the European Union's arm to drive a European industrial policy for the energy transition based on innovation, public-private cooperation, entrepreneurship, transparency and democratic accountability.

Third, the European Commission should work with mayors of cities and regional decision makers that experience the holistic nature of energy challenges, encompassing mobility, heat and power. The top down approach of the EU and States should be able to join forces with the bottom up initiatives of local authorities and civil society, in a spirit of cooperation to reach the objectives of the Energy Union. The Covenant of Mayors[97] (see box 8) offers a unique platform to that effect and it can be developed further, both inside and outside the EU.

94. "Gerhard Schroeder's Sellout", *Washington Post*, 13 December 2015
95. Steps in the right direction have been taken over past years, with for instance the Transparency Register. Yet, there is immense room for improvement.
96. European Commission, Second Report on the Energy Union, February 2017
97. See the website of the Covenant of Mayors: www.covenantofmayors.eu

CONCLUSION: CONCRETE PROJECTS AND LONG-TERM GOVERNANCE WORK HAND-IN-HAND

The energy transition is one of Europe's defining endeavour in the 21st century. The way we perform our energy transition is already shaping collective life, creating jobs while destroying others, redefining the relationship between the EU, member states, regions and cities, as well as relationships both within and between public sector and private sector organisations.

Embracing the holistic nature of the energy transition is crucial also as it allows to link the more abstract—and yet critical—elements of the energy transition with the most concrete and specific projects that can be done today. It is both about democratically building long term carbon-neutrality plans (see 1.2.2.2.), and about delivering concrete projects today, such as using the Juncker Plan to roll-out charging points for electric vehicles (see 1.3.1.).

Both elements are intertwined and cross-fertilizing. The more we implement concrete plans, the more the energy transition is seen by everyone for what it is: a desirable change that is already happening. The clearer and best designed our long-term plans are, the more we can foster certainty on what needs to be done now, while also highlighting the remaining obstacles where more technological and/or social innovation needs to occur.

In the end, governance in the energy transition must not be limited to the administrative process of monitoring, reporting and verifying information the European Commission proposes. It has to happen as good information is key to govern. But governance in the energy transition is much more than that. It is about our ability as Europeans to deliver a better life for ourselves. More democracy is now needed to answer popular concerns and avoid having Europe following once again the authoritarian path proposed by some.

Beyond that, governing the energy transition is the enabler for Europe's industrial renaissance based on Europe becoming the global provider of clean energy solutions, as we develop in chapter 2. This requires an enabling investment framework analysed in chapter 3. Finally, it requires a Social Pact as described in chapter 4. arguing to make the energy transition a just transition able to deliver quality jobs, empower consumers and eradicate energy poverty.

2. Innovating to drive an energy transition for all Europeans

by Thomas Pellerin-Carlin

The energy transition is introducing new technologies, processes, services, techniques and behaviours in human organisations; it is a process of innovation on a massive scale.

Research and innovation (R&I) are key enablers for a swifter, cheaper and fairer energy transition. Well-crafted energy R&I policies and actions, supported by appropriate market design and enabling policies, can moreover foster a renewed European approach to competitiveness, industrial policy and citizen involvement in 21st century Europe.

This chapter[98] looks at R&I in the context of the energy transition[99]. It begins by highlighting the critical role of R&I, not only as the 5th dimension of the Energy Union, but as an enabling area where public support is critical to reap the economic benefits of the energy transition. It then provides an analysis of the current strengths of Europe in the global clean energy race, notably its academia and businesses. It describes the many relevant EU policy tools and highlights areas that need to be improved. Finally, it provides policy recommendations to foster an adequate transformation of EU energy policy as well as the renaissance of energy incumbents into the energy transition tigers, which Europe needs them to become.

98. Several sections of this chapter build on previous publications of the Jacques Delors Institute, in particular: Thomas Pellerin-Carlin and Pierre Serkine, "From Distraction to Action – towards a bold Energy Union Innovation Strategy", Policy Paper No. 167, Jacques Delors Institute, June 2016 ; Thomas Pellerin-Carlin and Pierre Serkine, "Europe needs crowd-based innovation for a competitive energy transition", Tribune, Jacques Delors Institute, September 2016.
99. For a definition of the energy transition, see the introduction.

2.1. Public sector support is key to drive a swift and competitive energy transition

In its February 2015 communication, the European Commission highlighted five dimensions of the Energy Union. Its fifth dimension is "research, innovation and competitiveness" (see box 1 for the definition of those three notions).

The European energy transition has already started and disrupted traditional energy sector business models (section 2.1.1.), driven by new policies, technologies but also enabled by digitalisation—among other megatrends shaping the energy system[100]. Businesses thus need to become the leaders in the booming global markets of renewables and energy efficiency (section 2.1.2.), to make Europe a leader in driving a global energy transition (section 2.1.3.). To do that, private sector initiatives must be complemented by (and work closely and collaboratively with) the public sector. Public R&I support is critical for the energy revolution, much like it has been for the digital revolution (section 2.1.4.).

BOX 1 ► Defining research, innovation and competitiveness[101]

Research is the process of *creating* ideas, processes, technologies, services or techniques that are *new to the world*. In terms of input, available statistics often refer to Research & Development (R&D) spending.
Innovation is here defined as introducing something *new to a given organisation*—but not necessarily *new to the world*. For innovation to be beneficial, it must be useful and valuable, and can often be monetised.
Competitiveness is a too-often ill-defined[102] buzzword excessively used as a synonym for cost-competitiveness[103] (i.e. cost-minimisation: "doing what everyone does, but cheaper"), a definition that Paul Krugman assesses to be "not only wrong but dangerous"[104]. A more holistic approach to competitiveness is useful to

100. See Annex 1
101. Those definitions synthesis the more complete definitions given in Thomas Pellerin-Carlin and Pierre Serkine, "From Distraction to Action – towards a bold Energy Union Innovation Strategy", Policy Paper No. 167, Jacques Delors Institute, June 2016.
102. The concept of "competitiveness" is criticised by academics. For instance, Robert Reich considers competitiveness as one of those "few terms in public discourse [to] have gone so directly from obscurity to meaninglessness without any intervening period of coherence". Robert Reich, *American Competitiveness and the President's new relationship with American Business*, 21 January 2011. For a deeper critical discussion on the definitions of competitiveness, see Karl Aiginger, Susanne Bärenthaler-Sieber, Johanna Vogel, "Competitiveness of EU versus USA", WWWforEurope Policy Paper, No.29, November 2015.
103. European Commission, *Energy Union Framework Strategy*, 25 February 2015, p. 10
104. Paul Krugman, *Competitiveness: A dangerous Obsession*, Foreign Affairs, March/April 1994

embrace what makes competitiveness for the European economy in 21st century globalisation: the capacity to "do what no one else can do[105]", something that is first and foremost characterized by one's capacity to innovate[106].

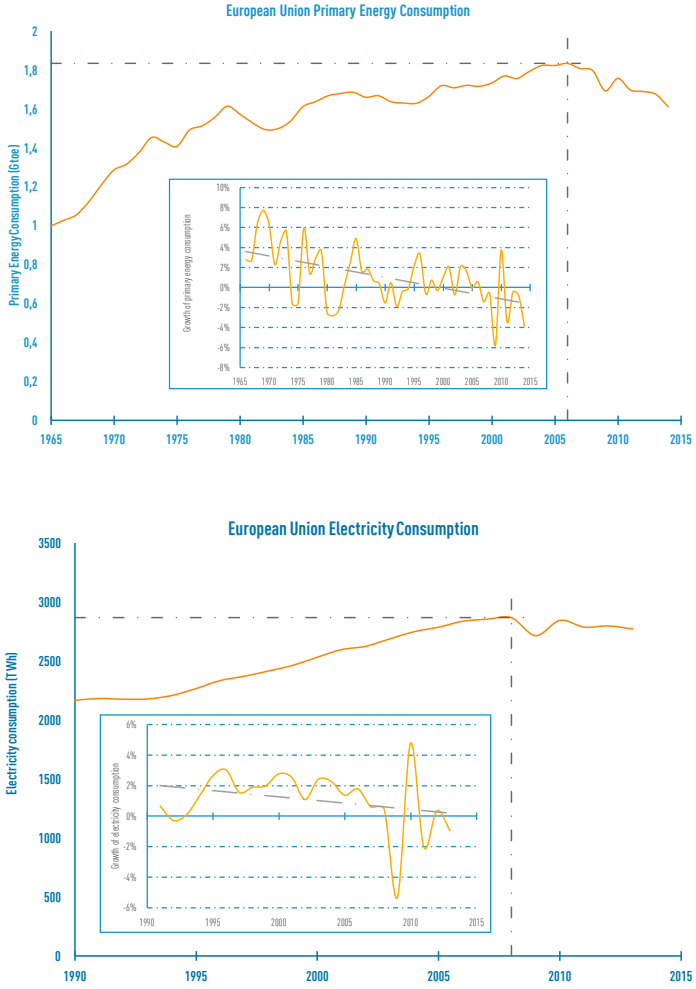
2.1.1. Businesses must innovate to survive the energy transition

"We have to move away from an economy driven by fossil fuels, an economy where energy is based on a centralised, supply-side approach and which relies on old technologies and outdated business models."
European Commission, Energy Union Framework Strategy, 25 February 2015

The traditional business model of energy incumbents was based on selling the greatest amount of energy at the highest possible price. This is no longer possible with the decline of EU energy consumption that started in 2006, and the decline in EU electricity consumption that started in 2008[107] (see figure 1). As the European Commission rightly argued in its 2015 Energy Union Strategy, "we have to move away from … [those] outdated business models". The question is now straightforward: which companies will successfully change to reap the benefits of the energy transition? How can policy makers help companies transition ?

105. Andrea Ovans, *What is Strategy Again?*, Harvard Business Review, May 2015
106. Other definitions exist, among which the World Economic Forum defines "competitiveness as the set of institutions, policies and factors that determine the level of productivity of an economy", hence using competitiveness as a synonym for "elements improving productivity". See Klaus Schwab, *The global competitiveness report 2015-2016*, World Economic Forum, 2015.
107. Some services of the European Commission however seem to assume that electricity demand will increase in the future. A possibility still not backed by certainty. While electrification of transport and heating indeed pushes electricity consumption upwards, energy efficiency pushes electricity consumption downwards, and it is unclear how speedy and important both elements will be. See European Commission Impact assessment, COM(2016) 861 final: p.24: "Moreover, electricity demand will progressively reflect the increasing electrification of transport and heating. "; p.39: Table indicating increase from 3090 TWh in 2015 to 3397 TWh in 2030

FIGURE 1 ► Evolution of EU Primary Energy Consumption and of its growth rate between 1965 and 2014 (top) and evolution of EU Electricity Consumption and of its growth rate between 1990 and 2013 (bottom)



Source: T. Pellerin-Carlin and P. Serkine, Jacques Delors Institute, data from *BP Statistical Review 2015* (graph on the left) and from *Eurostat* (graph on the right)

It is still time for European energy companies to shift, and some already started their own transition. German energy company E.ON. for instance created two distinct entities to keep its "forward looking" activities related to networks, renewables and customer solutions in the entity E.ON., while putting "traditional" activities (coal power generation, energy trading, and exploration and production) within a new entity named Uniper. Similarly, GDF-Suez radically changed its organisational layout, with a name-switch to Engie and the restructuration of its activities.[108] Beyond E.ON. and Engie, companies like Centrica, ENEL, and EDP have also taken significant steps to try to build a business model that can work in the energy transition.

Other companies (e.g. EDF, RWE) are testing new business models via their subsidiaries, but their board remain split and have taken too few ambitious and forward-looking decisions.

Policy makers have an important role to play in stimulating incumbents to become the energy transition tigers Europe needs. This choice for the transformation—rather than extinction—of incumbents is driven by three main reasons:

- Incumbents already have the manpower, financial capacity and customer relationship to foster mass-scale engagement in the energy transition through more massive adoption of innovations. They can thus be efficient tools to foster the energy transition in Europe and allow Europeans to lead the global clean energy race (see 2.1.2.).
- Many incumbents, such as RWE or EDF, are largely owned by public entities. Their shutdown would thus become a massive burden on public debts, at a time when the Eurozone is not prepared enough to face the next economic crisis[109].
- Incumbents failures would lead to the loss of hundreds of thousands of quality jobs. Besides the impact a job loss may have on one's personal and

108. "Faced with an evolving energy market, this transformation is intended to serve the development of our group and our position as the global leader of the energy transition. It will allow us to take on the many challenges of the energy market: decarbonisation of the energy mix, digitalisation of activities, decentralisation of energy production and development of energy efficiency." Gérard Mestrallet, then CEO of Engie, 4 January 2016. In a more concrete way, while Engie keeps its two traditional lines of work: gas chain, and centralised production of electricity, it completes it wish three lines of works that are consumer-centric: B2T (i.e. providing solutions for "territories" understood as cities and other local entities), B2B (i.e. providing solution to businesses), and B2C (i.e. providing solution to residential consumers).

109. Henrik Enderlein, Enrico Letta et al. (2016). *Repair and Prepare: Growth and the Euro after Brexit*, Gütersloh, Berlin, Paris: Bertelsmann Stiftung, Jacques Delors Institut – Berlin and Jacques Delors Institute in Paris

family life, many may be too old to find another job, others may need to be retrained through publically funded vocational training. This human and economic costs for individuals and society can be avoided if incumbents transform themselves: the transition for a worker would be smoother as he/she can stay within the same company, without losing his/her job nor sense of belonging to a specific working group, while potential vocational training could be done in house, thus at a much lesser cost for public budgets. In other words, a transition based on the transformation of incumbents is likely to be a fairer transition for European workers.

Innovation, including business model innovation, is therefore a key element to mitigate the negative impacts of the energy transition. It is an element of the Social Pact for the energy transition that this study advocates in chapter 4.

2.1.2. Making Europe the global provider of clean energy solutions to boost its economy

"We need to strengthen the share of renewable energies on our continent.
This is not only a matter of a responsible climate change policy.
It is, at the same time, an industrial policy imperative
if we still want to have affordable energy at our disposal in the medium term.
I strongly believe in the potential of green growth.
I therefore want Europe's Energy Union to become
the world number one in renewable energies. I would also like
to significantly enhance energy efficiency beyond the 2020 objective."
Jean-Claude Juncker, Strasbourg, 15 July 2014.

The energy transition rests on two main pillars: renewables and energy efficiency[110]. Those two elements are booming global markets.

The figure below from the International Energy Agency (IEA) highlights three scenarios:

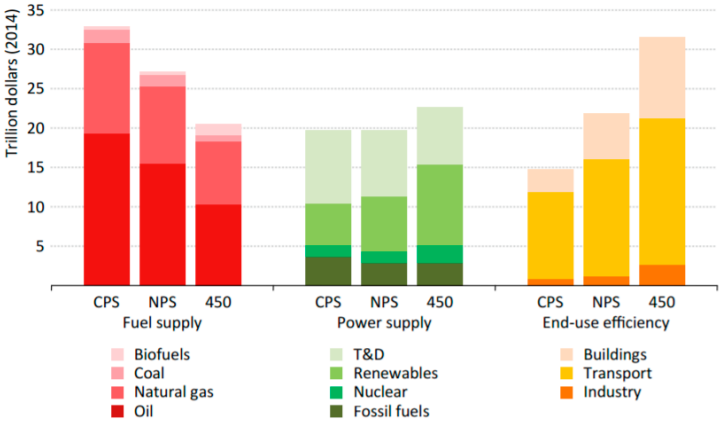
- "CPS" is a business as usual scenario.

110. There are other dimensions to the energy transition, such as ensuring flexible supply and demand of electricity, energy storage, and systems integration.

- "NPS" is a scenario where policy makers barely implement the decisions they announced before the Paris Agreement. In this scenario, investments in fossil fuels are smaller than investments in renewables and efficiency combined (see scenario "NPS" in figure 2).

- In the "450" scenario where decisions would be taken to limit the increase in the global average temperature to 2°C above pre-industrial levels, renewables and efficiency investments combined would represent around 35 trillion USD over the 2015-2040 period, compared to 25 for fossil fuels . In the scenario, the yearly investment in renewables and energy efficiency represents a amount similar to the GDP of a country like Russia[111].

FIGURE 2 ► Cumulative world energy sector investment by sector and scenario, 2015-2040



Note: CPS = Current Policies Scenario; NPS = New Policies Scenario; 450 = 450 Scenario; T&D = transmission and distribution.

Source: International Energy Agency, World Energy Outlook 2015, p. 60

111. This calculation is not meant to be entirely precise but to provide the reader with a general order of magnitude of the renewables and energy efficiency markets in the world. This comparaison is based on the IEA estimated in both NPS and 450 scenarios, divided by 25 as if those investments would be equally spread over the 25 years of the IEA 2015-2040 scenario. This gives an average number similar to Russia's 2015 GDP that, according to World Bank Data, is estimated at a level of 1.331BnUSD.

Well-crafted energy R&I policy and actions are crucial to help European companies to be well positioned on those booming markets (see 2.1.4.). This would increase Europe's prosperity and would also:

- Create quality jobs. As European businesses' competitiveness will be based on innovation, it is more likely to ensure that it leads to the creation of well-paid quality jobs for European workers (see chapter 4.).

- Diversify our export sectors to protect Europeans from violent external economic shocks. This is of particular importance for countries whose exports heavily rely on few economic sectors. To illustrate, if China were to become a potent car exporter like it became a potent exporter of other goods, the German economy would be "under massive [economic] pressure"[112]. It is thus important for EU and national economies to ensure Europe's capacity to diversify its exports to increase the protection of European workers and taxpayers from external economic shocks.

- Ensure that Europeans act concretely to make the European energy transition a global energy transition (see 2.1.3.).

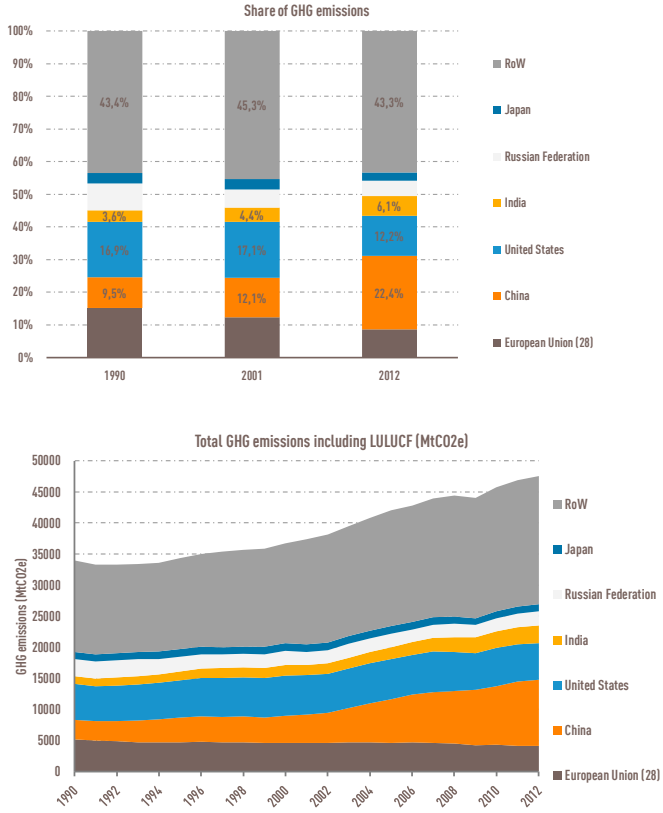
2.1.3. Research and innovation is Europe's best tool to trigger a global energy transition to fight climate change

"We have the [Paris Climate] deal. Now we need to make it real."
European Commissioner for Climate Action Miguel Arias Cañete [113]

Current EU and national policies tend to focus on the greenhouse gas emissions happening on their territory. Yet, climate change is fed by global greenhouse gas emissions, of which the EU represents only 8.7%[114]. This share is moreover steadily declining as EU emissions decline while others' increase (see figure 3).

112. Georg Zachmann, "An approach to identify the sources of low-carbon growth for Europe", Bruegel, 2016.
113. Miguel Arias Cañete, Speech in Brussels, 02 March 2016.
114. CAIT Climate Data Explorer. 2015. Washington, DC: World Resources Institute. Available online.

FIGURE 3 ► Share of total GHG emissions in 1990, 2001 and 2012 (top), and corresponding evolution of GHG emissions from 1990 to 2012 (bottom)



Source: T. Pellerin-Carlin and P. Serkine, Jacques Delors Institute, data from the World Resources Institute

By contrast, the EU is the world's biggest economy with 23.7% of global GDP[115]. Europe should further use its economic and innovative strengths to impact 100% of global emissions—rather than the EU's 8,7%. In this regard, energy R&I is of critical

115. Data from the World Bank

importance as many EU innovations can be exported or be inspirations for innovations in the rest of the world. Using its R&I, trade and development aid tools, the EU should aim at co-developing the goods and services helping developing countries to **leapfrog**: i.e. to go from poverty to low-carbon prosperity, without going through a phase of high-carbon economic development. Leapfrogging already occurred in other economics sectors, such as in telecommunications as poor countries went from no-phones to masse-scale diffusion of mobile phones—without going through a landline phone phase. In this endeavour, Europe's biggest challenge is fostering access to (renewable) electricity for all Africans (see chapter 1., section 1.3.).

2.1.4. Public support for research and innovation fosters private sector competitiveness

"In terms of policies, this cartoon image has fed into very concrete ways in which we think about innovation. Basically we see this roaring lion in a cage, business, with different types of impediments which prevent it from innovating. Government's role is to take away these impediments through R&D tax credits, getting rid of red tape and through different ways of incentivising innovation. If we look at many of the current innovation policies, they are actually driven by this image, which . . . is the wrong one because what we often have in the private sector is the nonwillingness to roar. Keynes outlined this idea to Roosevelt in 1936, he stated that we actually do not have these lions and wolves and tigers in the business community, we have a bunch of domesticated animals—gerbils, hamsters and pussycats. The role of policy therefore is to make them grow up and want to be lions."[116]
Marianna Mazzucato, 2014

Marianna Mazzucato highlights the misleading representation of innovation as stemming only from a business community made of roaring lions. In this narrative, the public sector resembles a clumsy elephant unable to "pick the winners"[117] and that should be limited to "technology-neutral"[118] and market-

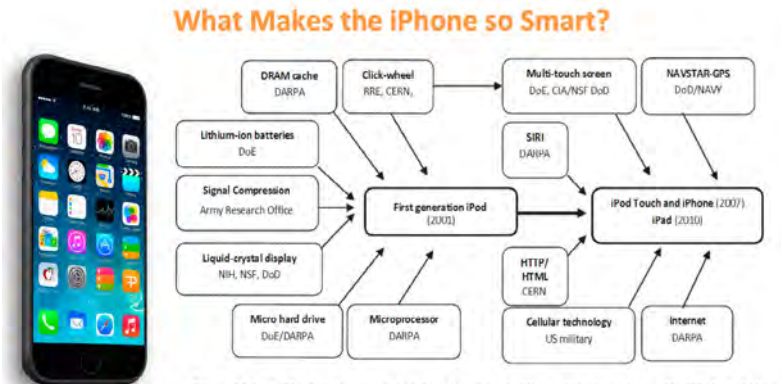
116. Marianna Mazzucato, Speech at the OECD, 28 May 2014
117. For instance, according to then European Commissioner for Competition Policy Neelie Kroes: "Let's be under no illusion: it is markets and not politicians that pick the winners". Neelie Kroes, Speech to the Villa d'Este Forum, 2 September 2006.
118. European Commission, *Energy Union Framework Strategy*, 25 February 2015, p. 14.

based approaches that are only legitimate when addressing "market failures"[119] for instance by creating a CO_2 emissions market such as the EU-ETS[120].

This still dominant narrative is wrong[121]. The reality indeed sees the public sector at the forefront of technological revolutions[122], such as the digital revolution. In this context, innovation policy is here to transform fearful businesses into the energy transition tigers Europe needs.

Looking at the digital revolution, we see that it stems from public sector research and innovation later diffused thanks to public and private sector innovations. Apple's iPhone is illustrative in this regards as it entirely relies on publically-developed technologies (see figure 4).

FIGURE 4 ► Debunking public vs. private sector myths: the example of the iPhone



Source: Mariana Mazzucato[123]

The digital revolution is not the result of a private sector spontaneous generation. It has been consistently pushed by a mix of public sector initiative, public

119. David Edgerton, *The shock of the old – technology and global history since 1900*, Profile Books, 2008, p. 107.
120. For an example of a paper where the EU-ETS is thought as a means to boost innovation, cf. Georg Zachmann, *Making low-carbon technology support smarter*, Bruegel Policy Brief, 2015.
121. Mariana Mazzucato, *The entrepreneurial state: Debunking public vs. private sector myths*, Anthem Press, 2015.
122. Carlota Perez, "Technological revolutions and techno-economic paradigms", *Cambridge Journal of Economics*, 2009
123. Mariana Mazzucato, *The entrepreneurial state: Debunking public vs. private sector myths*, Anthem Press, 2015. p.116

sector decisions constraining businesses[124], and private initiative. The lesson is thus clear for the energy revolution: the public sector entirely legitimate to intervene to promote energy R&I, and the more efficient public sector support to energy R&I is, the more energy companies will be able to benefit and develop innovations ensuring their viability in the energy transition.

2.2. Europe has the assets to lead the global clean energy race

Section 2.1. underlined the importance of R&I in making the European energy transition swifter, more beneficial for the European economy and enabling the forthcoming global energy transition. Let us now turn to Europe's energy R&I assets. Europe has tremendous capacity to lead the global clean energy race (2.2.1.), as well as several adequate—though not perfect—tools to help European researchers and innovators (2.2.2.) in order to enhance European competitiveness, especially *vis-à-vis* Trump's USA (2.2.3.).

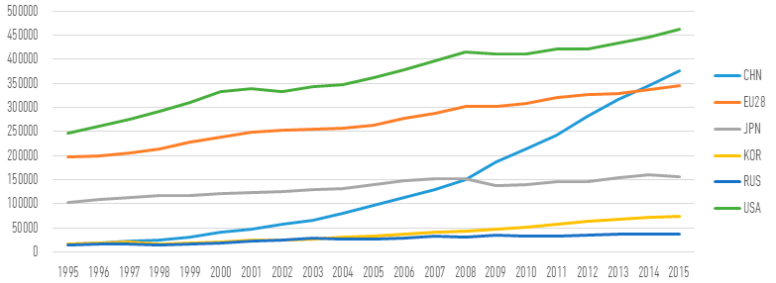
2.2.1. Europe has the academia and businesses ecosystem to lead the global clean energy race

European academia and businesses have been the centre of the first three industrial revolutions. Even though the two world wars destroyed part of Europe's innovative capital and allowed the US to become the epicentre of global R&I, Europe remains a key global player for R&I, especially in the energy sector.

R&D expenditure in Europe is significant (above 2% of EU GDP[125]) and has risen over the past decade (see figures 5 and 6), even if remains below the 3% target endorsed by the Lisbon Strategy. Europe remains, together with the USA and China, in the Top 3 of global R&D expenditure (see figure 5). European businesses also invest a lot in R&D as their investments represent two thirds of EU investment (see figure 6).

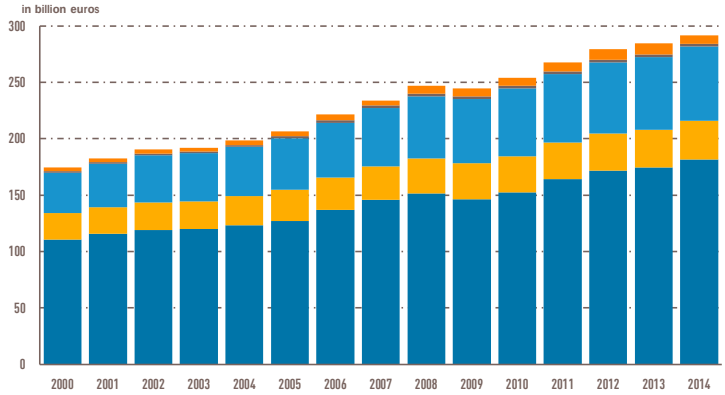
124. For instance, the US governement constrained the US private company AT&T to invest important amounts of money in basic and applied research. AT&T thus created the Bell Labs that invented key technologies for the digital revolution (including the transistor) and for the energy transition (with the first use of solar energy to generate a significant level of electricity, in 1954).
125. Source: OECD data on gross domestic spending on R&D. Several significant member states have R&D spending significantly below the EU average (2%). This is in particular the case for countries such as Italy (1,3%), Spain (1,2%), Poland (1%), Greece (1%) and Romania (0,5%).

FIGURE 5 ► R&D spending in selected countries (Millions of USD)



Source: OCDE

FIGURE 6 ► Evolution of the R&D spending in the EU by source of funds between 2000 andf 2014[126]



Source: T. Pellerin-Carlin et P. Serkine, Jacques Delors Institute, data from the European Commission and Eurostat

This being said, money invested in R&D is only one input of the R&I process. When looking at proxis for the quality of EU R&I, it appears that EU is amongst the leaders of academic and business R&I, especially in sectors relevant for the energy transition.

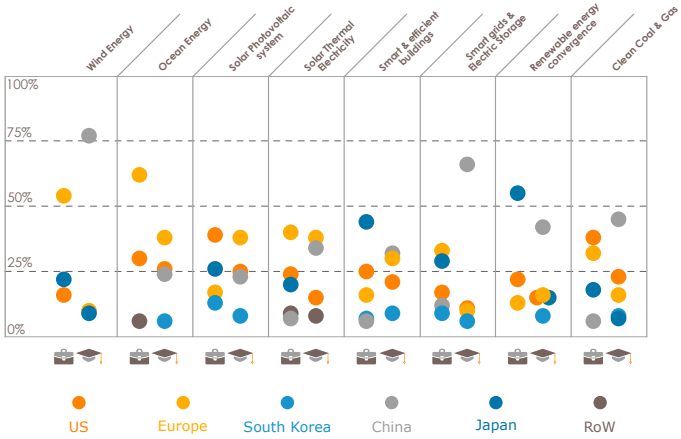
Europe also has an outstanding academic ecosystem for talents to flourish and thrive. To illustrate, according to Reuters, the two most innovative

126. The definitions for the first four sources of funds come from Manual Frascati, *Proposed standard practice for surveys on research and experimental development*, OECD, 2002. "EU (CSF-RI)" corresponds to the sum of H2020 and Euratom.

research institutions in the world are Europeans: the French CEA and German *Fraunhofer*[127] and both are extremely active in the energy sector[128].

The Top 10 report[129] provides a picture of the leading position of Europe academic and industrial players in key energy technologies (see figure 7 that displays the share of each world region in the total appearance of industrial and academic players in the 8 energy thematic fields identified).

FIGURE 7 ► Overview of the results of the Top 10 Energy Innovators in the 8 distinct thematic fields, for industrial and academic players[130]

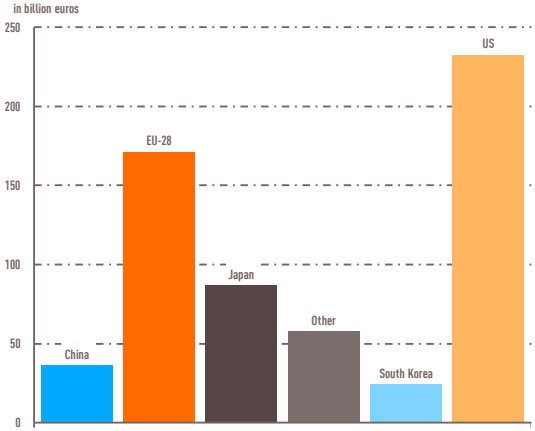


Source: T. Pellerin-Carlin and P. Serkine, Jacques Delors Institute, data from KIC InnoEnergy

Focusing on European businesses, cross-sector EU business R&D expenditure are the 2nd highest in the world, yet significantly lower than in the USA (figure 8).

127. David Ewalt, *The world's most innovative research institutions*, Reuters, 08 March 2016.
128. Another illustration could be that 25 of the 56 Fields medals (the Nobel Price equivalent for Mathematics) are EU citizens, the US comes n°2 with 14.
129. KIC InnoEnergy & Questel Consulting, *Top 10 Energy Innovators in 100 Energy Priorities: A unique report mapping industrial and academic players in global competition*, January 2015. The report is based on a methodology involving several key dimensions of R&I, such as patents, scientific publications, R&D collaborations and R&D commercialisation (spin-offs, start-ups, acquisitions, licenced technologies for instance), using quantitative and qualitative measures. The report analyses 100 energy technologies, spread among 8 thematic fields. For each of the 100 energy technologies, the report provides the top 10 reference companies and the top 10 reference research institutions, with a scoring based on a methodology developed specifically for this occasion. It is available upon request, contacting Pierre Serkine by mail (pierre.serkine@innoenergy.com).
130. Figures below 5% are not shown in the graph.

FIGURE 8 ► R&D expenditure in the world from the top 2,500 companies in 2014



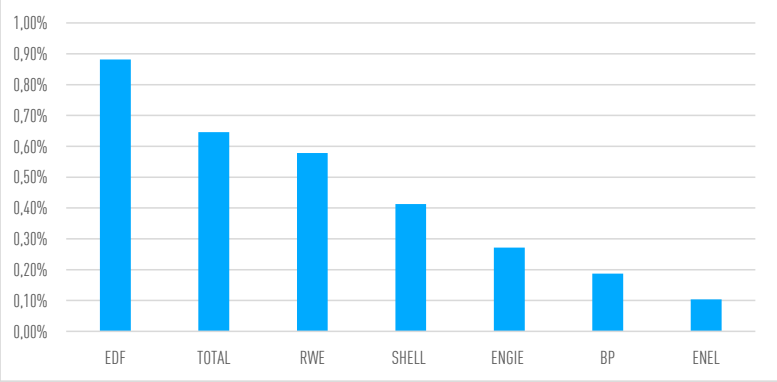
Source: T. Pellerin-Carlin and P. Serkine, Jacques Delors Institute, data from European Commission

It is however difficult to know in which sector private R&D expenditure is invested as available statistics are insufficiently detailed. A more detailed analysis could be done by the European Energy Information Service we argued in favour in chapter 1., section 1.2..[131]

While the overall picture of European energy R&I is positive, when one looks at Europe's energy utilities, the situation is more problematic. One may even argue that if European energy incumbents are undergoing significant troubles it is because they have been consistently under-investing in R&I over the past years. Figure 9 below shows the official amount of money invested by a selected number of European energy incumbents in R&I, expressed in percentage of their annual turnover. We here see that according to their own official statistics, all those companies are investing less than 1% of their annual turnover in R&I. In other words, energy innovation in Europe does not seem to be coming from European energy utilities, but from other EU companies.

131. Jacques de Jong, Thomas Pellerin-Carlin, Jean-Arnold Vinois," *Governing the differences in the European Energy Union: EU, regional and national energy policies*", Jacques Delors Institute, Policy Paper No. 144, October 2015

FIGURE 9 ► Official amount of money invested in R&I by a selected number of European energy incumbents (% of their annual turnover)



Source: Official documents of the said companies

This is corroborated by another study led by i24c and CapGemini Consulting[132]. The EU indeed appears to have key assets in the energy transition when we look at existing EU businesses and their ability to innovate.

This is in particular true for wind turbines, a booming sector where EU businesses are the world leaders (see table 1), symbolised by the success of Vestas (DK), as well as Siemens (DE), Gamesa (ES) and Enercon (DE).

TABLE 1 ► Top 10 wind turbine manufacturers (ranked by Global Market Share)

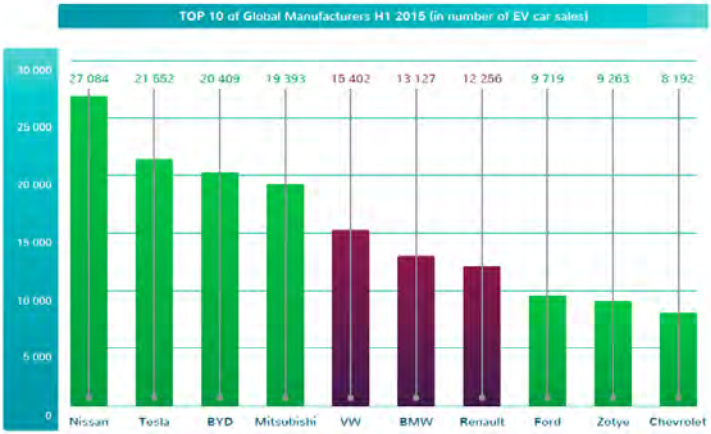
TOP 10 Wind Turbine Manufacturers (Ranked by Global Market Share)			
2008		2015	
1.Vestas	6.Sulzon	1.Goldwind	6.Enercon
2.GE	7.Sinovel	2.Vestas	7.Guodian
3.Gamesa	8.Goldwin	3.GE	8.Ming Yang
4.Enercon	9.Dongfang	4.Siemens	9.Envision
5.Siemens	10.Nordex	5.Gamesa	10.CSIC

Source: i24c, *Scaling up innovation in the Energy Union to meet new climate, competitiveness and societal goals*, May 2016

132. i24c, *Scaling up innovation in the Energy Union to meet new climate, competitiveness and societal goals*, May 2016

Electric vehicles are another booming market that constitutes the current best alternative to oil-based vehicles, at least for small vehicles such as cars. European car manufacturers are well positioned on this market as three of them are in the global top 10. Moreover, the current global leader is Nissan, a company that is closely associated to French car manufacturer Renault.

FIGURE 10 ► Top 10 global manufacturers, H1 2015 (in number of EV car sales)



Source: i24c, *Scaling up innovation in the Energy Union to meet new climate, competitiveness and societal goals*, May 2016

Global n°2, Tesla could be challenged in the future, as alternative European industrial solutions are appearing. That is the case for instance with the project of a battery gigafactory that Northvolt (led by Peter Carlsson, a former Tesla executive[133]), aims at launching in the coming years in Europe. This project could moreover benefit from the Juncker Plan (see box 1).

BOX 1 ► Northvolt: the potential for EU industrial leadership on electric vehicles[134]

Electric vehicles are one of the most promising component of the future of mobility (see chapter 1., section 1.3.1.). Developing electric vehicles is of strategic importance for Europe to make European carmakers the world leaders in electric vehicles.

133. http://www.breakit.se/artikel/6773/finansprofilen-harald-mix-backar-tesla-svenskens-nya-batterifabrik
134. The author would like to thank Guillaume Gillet for her contribution to this box.

One key component of the electric vehicle value chain is the battery. It is also one key reason for which electric vehicles remain more expensive than others. In order to reduce battery costs and conquer this booming market in Europe, the company Northvolt aims at building a gigafactory for batteries in Sweden, where it can locally access raw materials as well as cheap and low-carbon energy. Production is set to start in 2020 and eventually reach a level of sales of more than 3Bn€.
Northvolt's 4Bn€ project is still at an early stage. If fundraising appears to be difficult, the EU should envisage to grant its financial support through non-subsidy forms, for instance via the Juncker Plan.
As the number of constructions of electric vehicles increases, the demand for batteries rises. Other gigafactories will likely be needed, thus making Northvolt's Swedish gigafactory the first of several European battery factories.

Solar is a renewable technology where Europe lost ground especially as a result of a lack of EU industrial policy for its solar PV industry in the face of Chinese dumping (see chapter 1., section 1.3.). This played a key role in the destruction of 300,000 solar jobs in the EU from 2011 to 2014[135] (see chapter 4.) and the sector is now dominated by Chinese companies (in the global top 5 of solar panel manufacturers, four companies are Chinese while the n°3 is Canadian Solar)[136]. The Chinese industrial policy was successful and trumped the EU's lack of industrial policy for this sector. In the face of Chinese dumping on solar panels, the European Commission acted to implement anti-dumping measures to protect European businesses and workers from Chinese unfair competition. Yet, those measures were opposed by several member states who vetoed European Commission measures[137] that would have likely saved thousands of European solar industry jobs.

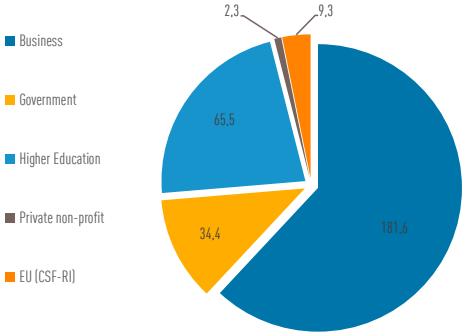
The dice have been cast for Europe's position on this generation of solar PV cells. There is however still hope for Europe to become a global solar leader if it manages to lead the next generation of solar PV cells. This may be feasible as leading academic players in the field of Solar photovoltaic system are EU organisations. Among the 10 organisations with the greatest number of solar PV patents, none are Chinese, and two are European (CEA is n°2, and Saint Gobain is n°8[138]).

135. Eurobserv'ER data
136. IHS Research (2015) Top Solar Power Industry Trends for 2015
137. Some member states vetoed this proposal because they do not have a solar industry on their national soil and thus prefer to benefit from cheaper Chinese solar panel even at the expense of an european solar industry located in other EU Member states. Other member states feared Chinese retaliation on other products, such as machine tools.
138. Insight-E (2015) Exploring the strengths and weaknesses of European innovation capacity within the Strategic Energy Technologies (SET) Plan

2.2.2. Existing EU R&I instruments for energy are relevant but need to be optimised

The EU has many relevant tools to foster clean energy innovation. More than two thirds of European R&D expenditures are done by businesses (see figure 11) and less than 10% are coming from the EU Budget. The challenge for the EU is thus to use EU money in a way that fosters quality national public and private investment in R&I.[139] In other words, **the *raison d'être* of EU R&I policy is not primarily to fund energy R&I, but to steer it.**

FIGURE 11 ► R&D expenditure in the EU by source of funds in 2014 (in bn €)



Source: T. Pellerin-Carlin and P. Serkine, Jacques Delors Institute, data from the European Commission and from Eurostat

The EU R&I policy has positively evolved over past decades. It moved from a project-driven approach (1983-2002) which helped developing transnational cooperation, to a more programmatic approach (2003-2013), and now closer to a policy approach[140] with Horizon 2020 (running from 2014 to 2020, see box 2) and its partial focus on societal challenges, including the energy transition[141 142].

139. Not specific to R&I. See chapter 3.
140. Research, Innovation and Science Policy Experts High Level Group, set up by the European Commission in June 2014
141. Among those seven societal challenges three are directly related to energy, (Energy, Climate Change and Transport) while two have strong links with energy (food-agriculture, inclusive societies).
142. Vincent Reillon, *Horizon 2020 budget and implementation – a guide to the structure of the programme*, European Parliamentary Research Service, November 2015

BOX 2 ► H2020: the EU's key instrument for R&I support

H2020 is structured in three pillars: excellent science, industrial leadership and societal challenges.

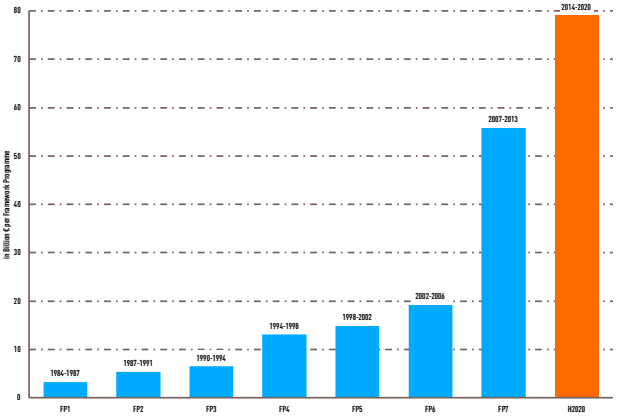
H2020's first pillar is dedicated to research and knowledge building activities. One of its key tools is the European Research Council (ERC) that funds research led by teams fully created and organized by a single researcher. Its budget quickly rose to significant levels (1,6 bn €/y). ERC schemes are not on specific calls, the researchers themselves propose the topic on a bottom-up basis to finance basic research, applied research, and some limited funding for elements that are at the frontier between applied research and innovation: the Proof of concept grants[143]. ERC support for energy-related projects has brought successes, such as a new way to produce solar cells.[144]

H2020's second pillar aims to speed up the development of technologies and innovations for European businesses. This pillar targets three specific objectives: developing Key Enabling Technologies (KETs)[145], providing financing tools for R&D activities in the private sector (loan guarantees, venture capital, direct corporate lending), and supporting specifically innovative SMEs.

H2020 brought a much welcomed evolution with **a third pillar** meant to address societal challenges (see figure 13) aligned with the Europe 2020 strategy, thus starting to bring policy orientations into the EU's innovation policy.

Some other activities lay outside H2020 three pillars, with a notable one for clean energy innovation being InnoEnergy (see box 3) that has an annual budget of 70-80M€.

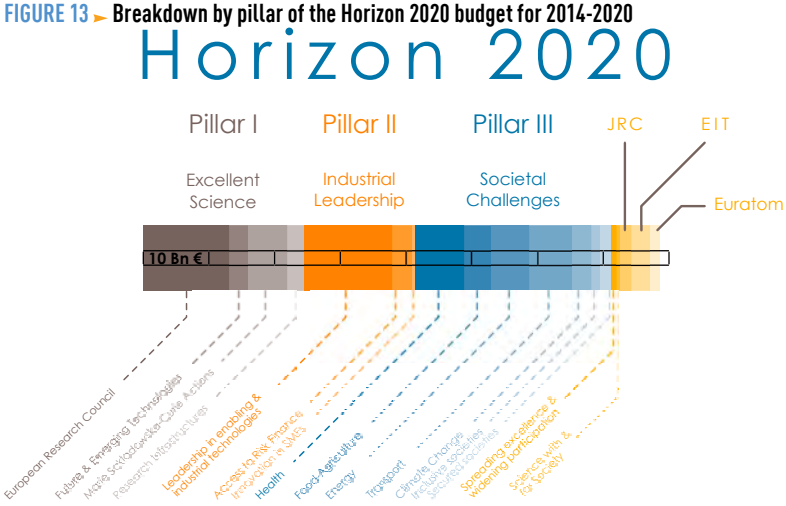
FIGURE 12 ► Evolution of the Framework Programmes' budget between 1984 and 2020[146]



Source: T. Pellerin-Carlin and P. Serkine, Jacques Delors Institute, data from the European Commission

143. For a longer description of the organisation of the ERC, cf. Vincent Reillon, *Horizon 2020 budget and implementation – a guide to the structure of the programme*, European Parliamentary Research Service, November 2015, p.20-21
144. Yella et al., *Porphyrin-sensitized solar cells with cobalt (II/III)-based redox electrolyte exceed 12 percent efficiency*, Science, November 2011.
145. For a study on the KETs, cf. European Parliament DG for internal policies, *Horizon 2020: key enabling technologies, booster for European leadership in the manufacturing sector*, European Parliament 2014.
146. Accessible for the first seven FPs, and for the H2020 programme.

FIGURE 13 ► Breakdown by pillar of the Horizon 2020 budget for 2014-2020



Source: T. Pellerin-Carlin and P. Serkine, Jacques Delors Institute, data from the European Commission

When looking at near-market innovation, the EU has created InnoEnergy that is a successful tool to ensure interaction between public bodies, academia, businesses and start-up (see box 3).

BOX 3 ► InnoEnergy: a successful EU public-private partnership for energy innovation

The creation of the European Institute of Innovation and Technology (EIT)[147] in 2008 goes into the direction of a mission-based approach of the R&I policy, as the Knowledge and Innovation Communities (KICs), integrate the knowledge triangle at their core (see figure 12), are structured towards markets, and dedicated to societal challenges, such as energy or climate change. KICs are furthermore operating according to an impact-oriented approach using Key Performance Indicators (KPIs) to assess their action and **embracing the entrepreneurship culture.**

The official mission of the EIT is to boost the innovation process from idea to product, from lab to market, and from student to entrepreneur.[148]

In the field of the energy transition, two KICs are important (Climate and Digital) while a third one is central as it is dedicated to energy. InnoEnergy (former KIC InnoEnergy) is therefore a European PPP, initiated in 2010

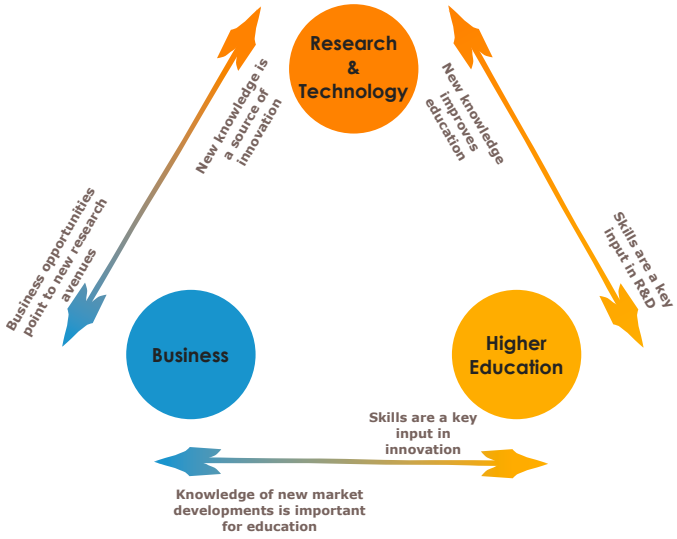
147. For a critical assessment of the EIT, see: European Court of Auditors, *The European Institute of Innovation and Technology must modify its delivery mechanisms and elements of its design to achieve the expected impact*, Special Report n°4/2016, April 2016.
148. EIT, *The EIT at a Glance*, November 2012.

by the EIT with universities and energy corporates, now InnoEnergy's shareholders. InnoEnergy is a for-profit but not for-dividend European company. It aims at reducing time-to-market for innovations that can reduce energy cost, decarbonise the energy system or increase energy efficiency. It has three core activities:

- **Innovative energy products** developed with InnoEnergy and partners, later sold by corporate, with a financial gain for InnoEnergy. 88 products have been created so far with forecasted sales of 3B€. 1.3B€ have been raised by the projects. InnoEnergy has invested 157 M€.
- **Fostering the creation of new start-ups**. 95 new start-ups have been created since 2009 with a current valuation of 100M€, and 171 early start-ups have been created. InnoEnergy owns shares of those start-ups.
- **Training future energy decisions makers** in a multidisciplinary way. 573 completed their training. They then enter energy companies and would ideally become top decision-makers of those companies, and incarnating the "game changers" of the very fast evolving energy landscape.

InnoEnergy is moreover embracing a more end-user centric approach to innovation as it has a dedicated work targeting end-user, with innovative approaches to foster societal appropriation of energy (see 2.3.1.).

FIGURE 14 ► The Knowledge Triangle[149]



Source: T. Pellerin-Carlin and P. Serkine, Jacques Delors Institute, adapted from EIT (2012)

149. Adapted from European Institute of Innovation and Technology, *Catalysing innovation in the knowledge triangle. Practices from the EIT knowledge and innovation communities*, 2012

2.2.3. Europe should create its own energy innovation path to outperform the US

Many European decisions makers admire the US innovation ecosystem. While there are many legitimate praises to be made towards the US system for innovation, it is the wrong model for energy innovation (see 2.2.3.1.). China and India moreover appear as increasingly important players in energy innovation and thus as rising competitors to Europe's clean energy leaders. In this context, the EU should set its own path to outperform its competitors in the global clean energy race.

2.2.3.1. The US "start-ups only" model has shortcomings and should not be mimicked by the EU

The US model for business innovation relies on start-ups[150] and a lot of attention is dedicated to the creation of unicorns[151]. Yet, at least for the energy sector, start-ups are no panacea. Two thirds of the job created by early-stage companies, such as start-ups, are destroyed in the first five years[152]. Such job destruction has a human and social costs, and it is also a waste of time, human and economic resources.

Davila et al. identify eight different possible explanations for this destruction. Three of them would most likely be at a much lower level if the underlying innovations were developed inside or under the responsibility of a well-established company rather than within a start-up:

- start-ups that open new markets, in which **established players** subsequently enter and **aggressively compete with deeper pockets**, even acquiring some of these start-ups to catch up the pace.
- some start-ups can grow rapidly on **non-profitable long-term business models**, which corresponds to a temporary revenue transfer from the incumbents to the newcomer, until the latter stops being supported by investors.
- **litigation risks** can compromise fundraising by reducing the interest of potential investors.

150. Start-ups in general and unicorns in particular are considered to be the engine of the new economy. Yet, recent evolutions suggest that this may constitute a bubble about to burst. Cf. Thomas Pellerin-Carlin and Pierre Serkine, *op.cit.* p. 5-6.
151. A unicorn is a young company owned by venture capital firms and valued over 1 billion dollars. When a unicorn makes an Initial Public Offering (IPO), it stops being owned by venture capital firms only, thus exiting the category. Unicorns can thus be seen as a bet venture capital firms make on the future, even on companies that are not profitable but are expected to grow and become profitable later on, when they would monetize their activity.
152. Their paper is an analysis about the job creation and destruction phenomenon in over 158,000 early stage companies from the UK, France, Italy, Spain, Belgium, Sweden, Norway, Finland, Japan and South Korea. See Antonio Davila, George Foster, Xiaobin He, and Carlos Shimizu, *The rise and fall of startups: Creation and destruction of revenue and jobs by young companies*. Australian Journal of Management, Vol 40 (1), 2015 pp.6-35.

A shortcoming of the US model is due to sometimes the very high Return-On-Investment (ROI) requirements set out by Venture Capital (VC) firms, which start-ups directly depend on. VC firms want to exit their investment typically in a 3 to 5 years' time span while sustainable company growth in the energy sector typically requires to think in decades rather than in years. VC can thus push early-stage companies to grow as quickly as possible, sometimes at the expense of business rationality. This leads to suboptimal development of the companies that would otherwise be able to take decision more oriented toward the mid-to-long-term.

Lonely start-ups typically cannot rely on the financial, legal and commercial backing of a big company. In most cases, they need to build everything from scratch, which limits their capacity to quickly roll-out their innovations, while energy incumbents have the financial and human capital, as well as the pre-existing customer relationship, to allow for such swift roll-out of energy innovations—provided that the company overcomes the hurdles of bureaucracies.

To finance start-ups, the current US model of venture capital (VC) has proved to be well fit to finance digital innovations, but constitutes the "wrong model for clean energy innovation"[153]. Its results are gloomy as half of the 25BnUSD invested by US VC between 2006 and 2011 has been lost[154] and this sector has not recovered from this. The US VC model Achilles heel for clean innovation is the reluctance from large energy corporations to acquire start-ups that have already passed important milestones but yet require years of further funding and development.

Aware of the limits of its model for energy innovation, the Obama administration created ARPA-E[155], the energy equivalent of the DARPA programme that finances US military R&I. It is yet unclear whether ARPA-E will survive the Trump administration.

The EU may learn from the US as start-ups and VC are one element of the innovation ecosystem. Yet, to boost energy innovation in Europe, the EU should set its own path, one that includes **patient public capital and intrapreneurship**[156] (see 2.3.).

153. Gaddy Benjamin, Sivaram Varun, O'Sullivan Francis, "Venture Capital and Cleantech: the wrong model for clean energy innovation", July 2016
154. B. Gaddy, V. Sivaram and F. O'Sullivan, *ibid.*
155. For a recent analysis of ARPA-E, see Brendan Haley, *Designing the public sector to promote sustainability transitions : institutional principles and a case study of ARPA-E*, Environmental Innovation and Societal Transitions, January 2017.
156. Intrapreneurship is the fact of acting as an entrepreneur while being employed in an existing company.

2.2.3.2. The Trump administration is an opportunity for Europe to outperform the US in clean energy innovation

The Trump administration and the Republicans majority in both Congress and Senate represent a threat to the world, but an opportunity for Europe's energy sector.

While Washington anti-energy transition lobbies (e.g. Peabody energy) were powerful before Trump, the new element now is an US Federal Government actively slowing down the energy transition—as symbolised by Donald Trump's decision to withdraw from the Paris Agreement. Yet, two elements need to be kept in mind to moderate one's perception of the impact of a Trump administration on energy:

- The US Federal State is not almighty when it comes to energy policy. US States have their own energy policies that remain largely uncoordinated and inconsistent—arguable even more inconsistent than European States' energy policies. While some US states (e.g. North Dakota, Kentucky) continued to attempt to ensure the continuity of a dirty past under Obama, others (e.g. California) are pursuing their choice for the energy transition and will continue to do so under Trump.
- The US Congress will face re-election in 2018 and Trump in 2020. It is thus unclear if Trump and Republicans will have the time to derail the energy transition, or will only fight a rear-guard action.

For European policy makers and businesses, the election of Donald Trump is an opportunity. As Donald Trump and Republicans focus public support on the outdated economic models of the fossil fuel industry, European clean energy companies have an opportunity to eliminate some of their US competitors, for instance by buying them out, repatriating US technologies into Europe and attracting US-based talents who may leave Trump's USA for a continent that puts a stronger emphasis on the necessity to develop R&I to allow a speedy and fair global energy transition. The US innovation system is moreover reliant on non-US innovators settling in the US, a situation endangered by Trump bans on immigration. In this context, Europeans can brain-drain talents, thus boosting European companies competitiveness.[157]

157. Jack J. Phillips and Lisa Edwards, Managing talent retention: An ROI approach, John Wiley & Sons, 2008. p.1

2.2.3.3. The external dimension of EU R&I policy needs to be further strengthened

As section 2.3. argued, energy innovation is not meant only to reduce European greenhouse gas emissions, but also impact global ones. This requires a strong external dimension to the EU innovation policy (including with a focus on innovation with emerging countries see section 2.3.2.2. on frugal innovation), as recognised by ACEI.

2017 is the key opportunity for Europe to take the lead in clean energy innovation. After a pro-active Obama administration, Donald Trump's USA is stepping down on clean energy. In the meantime, the EU is co-chairing the global initiative Mission Innovation launched in 2015[158]. The EU has a unique opportunity to building synergies with the Breakthrough Energy Coalition, a private initiative launched by Bill Gates, along with other investors and financial sector seeking to make long-term private investment in breakthrough clean energy innovations[159]. This role is key to provide the patient capital that mainstream private investor tend to be reluctant to provide.

2.3. Innovation to drive the clean energy transition

Section 2.1. showed the critical importance of public sector support to R&I for a swift, competitive and fair energy transition. Section 2.2. highlighted that Europe has all the assets needed to lead the clean energy race. Section 2.3. thus turns to policy recommendations aimed at fostering clean energy innovations[160]. It (1) highlights three shortcomings the EU should fix faster, (2) argues for an end-user centric approach to energy innovation, (3) suggest a concrete way to use digital tools to test a more efficient and democratic way to allocate EU funding for innovative energy projects, and (4) develop tools to help energy incumbents in their transformation into energy transition tigers.

2.3.1. Three shortcomings that need to be fixed faster

The EU has very good and generally well-funded tools to support R&I across the whole R&I value chain, from fundamental research (through the ERC) to bringing innovations to market (through InnoEnergy or others KICs). Among

158. Mission Innovation is an endeavor seeing the EU and 22 countries (including the US, China, Japan, Saudi Arabia, India, Brazil) committing to doubling their clean energy R&D investment in five years. Today, those countries represent over 80% of global clean energy R&D investment. Cf. https://www.iea.org/media/workshops/2016/egrdspacecooling/19.BobMarlay.pdf
159. https://www.technologyreview.com/s/603111/bill-gatess-1-billion-fund-will-back-radical-clean-energy-ideas/
160. This section focuses on innovation, rather than research for which the situation is by and large positive (cf. Section 2) and proposals related to research have already been made in Chapter Governance as well as in a previous publication, especially Thomas Pellerin-Carlin and Pierre Serkine, "From Distraction to Action – towards a bold Energy Union Innovation Strategy", Policy Paper No. 167, Jacques Delors Institute, June 2016.

the improvements needed for EU energy R&I to better enable the energy transition, there have been very positive evolutions, for instance with the creation of InnoEnergy (see box 3) and the European Commission November 2016 communication on "Accelerating Clean Energy Innovation" (ACEI)[161]. Through those positive developments, the EU energy R&I policy is attempting to fix three key[162] problems:

1. A **persistent over-focus on technologies**[163] illustrated by the Strategic Energy Technology Plan (SET Plan)[164]. While it provides an excellent state-of-art of technologies and very good insights in terms of cost and performance of the corresponding technologies[165], it is insufficient as technology alone is never the solution (see 2.3.2 on appropriation of energy & social sciences).

2. **Lack of prioritisation** as a result of the fact that "hardly any de-prioritisation has been done"[166]. Lobbies[167] were indeed successful in ensuring that their partial interests would not be deprioritised by decision makers[168]. While this wastes public money on doubtful projects, it did not severely constrain EU support to promising technologies as it happened at a moment when EU support to R&I was increasing (cf. figure 12), a situation that is changed as EU public money is made scarce and some may be tempted to deal with Brexit impacts on the EU budget by cutting EU policies spending, including R&I[169]. ACEI is a positive development as it sets four broad priorities with no mention of nuclear and Carbon Capture and Storage/Usage (CCS/CCU)[170].

161. European Commission, Accelerating Clean Energy Innovation, 30 November 2016
162. Other shortcomings could be mentioned, such as the lack of common European vision on Artificial Intelligence which is not an energy-specific issue but may drastically impact the EU energy system as well as EU R&I.
163. European Commission, Energy Technologies and Innovation communication, 2 May 2013
164. The implementation framework of the SET Plan is made of 3 pillars, namely a Steering Group composed of EU member states in charge of the governance; the European Industrial Initiatives (EIIs) composed by EU countries; researchers and industry to better align national, European and industry goals; and the European Energy Research Alliance (EERA) that brings together EU research establishments to implement joint programmes. The EIIs are based on the European Technology Platforms (ETPs) which produce technology roadmaps as well as a transversal roadmap on materials. The SET Plan is also supported by the SET Information System (SETIS) which is coordinated by the Joint Research Centre (JRC), a European Commission in-house research service with more than 2,000 researchers from various fields, working in 7 research institutes.
165. See European Commission, Working Document on Technology Assessment, 2 May 2013
166. Matthias Weber, Dan Andrée and Patrick Llerena, *A new role for EU research and innovation in the benefit of citizens: towards an open and transformative R&I policy*, European Commission, 2015
167. For a deeper look at the organisation and influence of lobbies on EU energy policy making, see chapter 1., box 3.
168. Matthias Weber, Dan Andrée and Patrick Llerena, *A new role for EU research and innovation in the benefit of citizens: towards an open and transformative R&I policy*, European Commission, 2015, p.6
169. Eulalia Rubio and Jörg Haas, "Brexit and the EU budget: threat or opportunity?", Policy Paper No. 183, Jacques Delors Institute, January 2017
170. For a more in-depth discussion on the limited use of nuclear and CCS tecnologies for the energy transition, see Thomas Pellerin-Carlin and Pierre Serkine, "From Distraction to Action – towards a bold Energy Union Innovation Strategy", Policy Paper No. 167, Jacques Delors Institute, June 2016.

3. Despite attempts to simplify the system through pooling all R&I activities under the H2020 programme, **complexity remains**. H2020 indeed involves no less than 8 Commission Directorates General and the JRC when it comes to budget responsibility, and the budget is implemented by 22 different bodies[171] under different types of partnerships.[172] An illustrative example is on R&I for SMEs where the original attempt to simplify the situation through a SME instrument was not sufficient to overcome path-dependency: the instrument is fragmented into 17 distinct budget lines managed by 7 DGs[173]. Complexity is further increased by the fragmentation of national public support schemes to R&I.

On all those three elements, the EU is heading in the right direction, but it should go there faster. As the EU starts to design its post-2020 Framework Programme to support Research and Innovation, it has the opportunity to further simplify and rationalise European instruments supporting R&I.

2.3.2. An end-user centric approach to energy innovation: from NIMBYs to PIMBYs

"There's a lot of talk about drones, but people don't like them, and it's social acceptance that determines whether a robot will work".
Ahti Heinla, CEO of Starship[174]

Innovation is successful when something new to a given organisation is successfully introduced, i.e. used by its end-users. High-tech products can become utter failures if they are not built to fulfil the desire or need of an end-user while many successful innovations require little-to-no technological development (e.g. BlaBlaCar, Drivy).

Energy innovation requires an **end-user-centric approach** to innovation focusing on energy services (e.g. heating or mobility) rather than on technologies. In this instance, the EU could introduce more end-user centric approaches to innovation. To illustrate, this would entail that demonstration projects are not only meant to demonstrate the technological feasibility of a given project, but also its adequacy to meet end-user needs. Embracing such an end-user centric approach mitigates

171. Namely: 5 Commission DGs directly, 4 public-public partnerships, 7 public-private partnerships, 4 executive agencies, the EIT and the European Investment Bank
172. European Parliamentary Research Service, *Overview of EU Funds for research and innovation*, Briefing, September 2015
173. One challenge is therefore not to increase the existing complexity. For instance, As EU Commissioner for Research & Innovation Carlos Moedas is building an "European Innovation Council" (EIC), it is paramount to ensure that the creation of an EIC would be smoothly articulated with InnoEnergy when it comes to energy innovation, as to avoid duplications.
174. *in* Ryan Health, *Politico's EU Playbook*, 12 May 2016

the risk of developing technologies that will not be appropriated by users, while leaving aside other technologies that can be quickly appropriated by its users.[175]

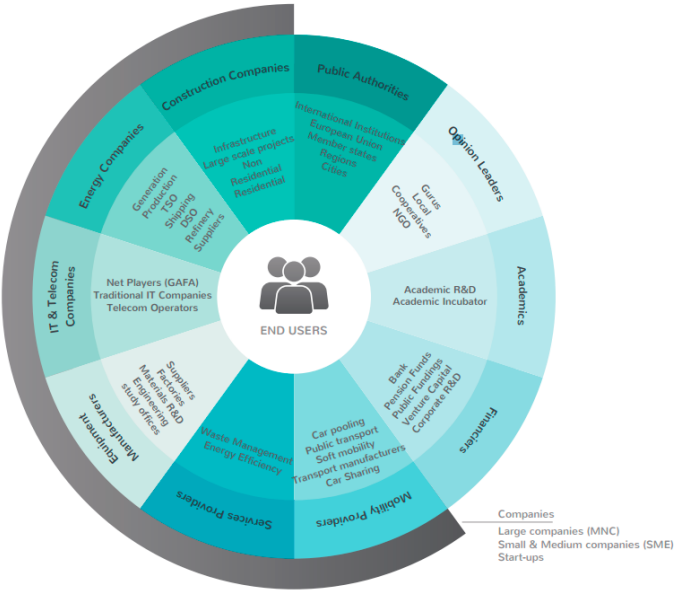
In energy R&I, attention dedicated to end-users and citizens has tended to focus on popular opposition to some energy projects (e.g. windfarms, nuclear power plants, shale gas extraction sites etc.). As citizens may oppose energy projects, a stronger focus has been put on the notion of "social acceptance" where an end-user or citizen is seen as either a passive recipient or active opponent to a technology/project. We rather need to move beyond this dichotomy and embrace the notion of "societal appropriation of energy"[176] that aims at capturing the process through which citizens/end-users can actively introduce new goods and practices, and thus steer change[177]. In energy, it corresponds to an energy transition desired and powered by citizens/end-users themselves. Unlike acceptance, the agenda behind societal appropriation is not about imposing to people what they do not want, but aims at looking for ways to **co-create with citizens** and end-users the energy solutions of tomorrow. In short, the challenge is to enable a change from NIMBY to PIMBY.[178]

In the long term, appropriation of energy may correspond to an individual learning to consider energy as part of his/her social identity, to integrate energy in daily decisions, routines and behaviours. Appropriation of energy could for instance be acquired in childhood[179] through daily management of and recurring experiment with energy; via a process similar to the way notions like **time and money are taught throughout life.**[180] By raising their awareness, citizens become more likely to be better informed when they choose to remain indifferent, oppose or actively support a given energy

175. To illustrate, in the debate over choosing electric cars or hydrogen cars, leaving aside the technological debate, it is clear that electric cars are much more easily acceptable by car users. One of the reasons for this is that, while both electricity and hydrogen pose a risk to the user's safety, European users have been accustomed to managing electricity risks since their childhood by learning how to behave when confronted with them (e.g. when parents teach a child not to put his finders in an electrical outlet).
176. Thomas Pellerin-Carlin and Pierre Serkine, "From Distraction to Action – towards a bold Energy Union Innovation Strategy", Policy Paper No. 167, Jacques Delors Institute, June 2016
177. This notion is already at the core of several start-ups, such as Wivaldy, a start-up aiming at developing an user-friendly app to allow electricity consumers to gain control over their electricity consumption. It is also present in the work done by InnoEnergy (see box 3).
178. The acronym "NIMBY" means "not in my backyard" and is used to name individuals—or organisations—who favour something (e.g. wind power development) as long as it does not directly impact their lives (e.g. people opposing a windfarm from being built in their area). By contrast, our acronym "PIMBY" means "please in my backyard" and can be used to name individuals—or organisations—who suit the word to the action by both advocating for something and literally doing it (e.g. investing money in a windfarm through a crowdfunding campaign).
179. This could be achieved by the use of games or gamified techniques of teaching.
180. Energy is certainly a very complex and technical industry. However, monetary policy and money creation are also very complex processes, and it does not preclude citizens to routinely use money. Similarly, Time is a very abstract concept which is not more natural for human beings than Energy, which is not seen as an obstacle to use this notion every day.

project. This would also ease the inclusion of end-users at the core of an enlarged ecosystem of energy innovation stakeholders (see figure 15)[181].

FIGURE 15 ► An enlarged ecosystem of energy innovation stakeholders



Source: i24c, *Scaling up innovation in the Energy Union to meet new climate, competitiveness and societal goals*, May 2016

181. For an in-depth analysis of innovation ecosystems, see in particular i24c and Carbon Trust, *Industrial innovations driven by multi-stakeholder ecosystems*, September 2016.

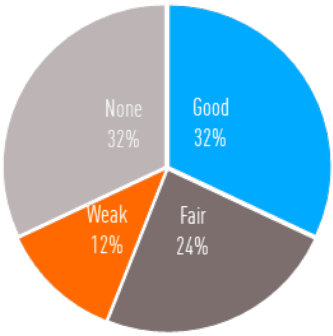
2.3.2.1. Social sciences enable a better energy innovation

In 2007 and 2008 a group of social scientists published two academic articles[182] showing that providing social norm information induces people to reduce their energy consumption. Their work inspired what has become one of the top clean energy start-ups in the world, Opower, recently bought by Oracle for 532 Million USD[183]. Opower's success highlights that technology is an optional component for innovation, while end-user appropriation is critical. This analysis entails that social sciences are important components for innovation in general and energy innovation in particular. Their approaches[184] help to increase the chances that a given innovation tackles societal needs, as well as increase the chances of delivering a cost-efficient and applicable solution.

Yet, when it comes to EU funding, **social sciences are too neglected**. Only 6% of the EU H2020 funding goes to all "social sciences and humanities" (SSH)[185] with the best-integrated SSH disciplines being economics, business and marketing. Disciplines like geography or anthropology, that are critical to understand energy behaviours are nearly absent from H2020 funding[186]. What is even more worrying is that, according to the European Commission, only a third of the "projects funded under topics flagged for SSH[187] show good integration of SSH"[188], while SSH integration is judged to be "weak" in 12% of the projects and inexistent in a third of them (see figure 16).

182. Wesley Schultz et al., "The constructive, destructive and reconstructive power of social norms", *Psychological Science*, 2007. Jessica Nolan et al., "Normative influence is underdetected", *Personality and social psychology bulletin*, 2008
183. https://www.greentechmedia.com/articles/read/oracle-acquires-opower
184. For a literature review on social sciences insights for understanding energy consumption behaviours, cf. Paul Burger et al., *Advances and understanding energy consumption behaviors and the governance of its change: outline of an integrated framework*, Frontiers in energy research, Vol 3, Article 29, June 2015.
185. SSH are defined as the following disciplines: anthropology, economics, business, marketing, demography, geography, education, communication, history, archaeology, ethics, interpretation, translation, languages, cultures, literature, linguistics, philosophy, religion, theology, political science, public administration, law, psychology, sociology. Cf. European Commission, *Integration of social sciences and humanities in horizon 2020*, 2015. p.8
186. European Commission, *Integration of social sciences and humanities in horizon 2020*, 2015., p. 9 & p. 14
187. It is indeed worth pointing out that this poor performance concerns only the projects flagged for SSH, precisely the ones that should have a very good integration of SSH.
188. The quality of the integration of SSH is assessed "in terms of share of partners, budget allocated to them, inclusion of explicit and purposeful contributions, and variety of disciplines involved". European Commission, *Integration of social sciences and humanities in horizon 2020*, 2015., p. 16. Data shown in the graph exclude the projects financed under the part SC6 of H2020 as this section is *de facto* devoted to SSH and inclusion is therefore 100% good. Including SC6 would however not significantly alter the assessment as the share of projects judged to have a good integration of SSH rise from 32% to 40%, while all others decline: Fair from 24 to 21%, weak from 12 to 11% and None from 32 to 28%.

FIGURE 16 ► Quality of integration of Social Sciences and Humanities in EU projects flagged for SSH



Source: Thomas Pellerin-Carlin and Pierre Serkine, based on the data of the European Commission, *Integration of social sciences and humanities in horizon 2020*, 2015

A holistic understanding of the drivers behind individual and collective energy choices is moreover currently lacking[189]. To address this gap, the European Commission recently decided to invest 10 million euros to finance three research projects to help filling this gap[190], which should thus be partially filled by 2019.

Beyond already existing initiatives to foster a **genuine interdisciplinary approach to energy challenges**, the EU could:

- Require students benefitting from an Erasmus grant to have a minor in another discipline than their major one, at least during their year of study abroad. For instance, an automotive engineer could opt for a minor in anthropology.
- Invite EU publically funded teaching and research institutions, such as the College of Europe[191], or the European University Institute to have interdisciplinary master or doctoral programmes on a given topic, such as energy-climate issues.

189. Paul Burger et al., *Advances and understanding energy consumption behaviors and the governance of its change: outline of an integrated framework*, Frontiers in energy research, Vol 3, Article 29, June 2015
190. Those projects started in late-2016. The first one to start is named ENABLE.EU, in which the chapter's author is taking part. The two others are named ECHOES and ENERGISE.
191. The proposal for the creation of a "College of Europe for energy" originates from Michel Derdevet, *Energie – l'Europe en réseaux*, La Documentation française, February 2015.

- Further use the Marie Sklodowska Curie Actions[192] to support transdisciplinary mobility of researchers, rather than focusing mostly on geographical mobility.
- For SSH flagged H2020 projects, a social science analysis of the topic could be required to assess the proposal sent by H2020 grant applicants, as to signal the importance of SSH.

2.3.2.2. Frugal Innovation for a fair energy transition in European and emerging countries

"Growing global energy needs, in particular in emerging markets, present significant export opportunities for European companies to supply low-emission technologies, including, where applicable, "frugal" innovations that are adapted to local conditions. New strategic partnerships, especially with emerging economies, are needed to drive innovation and create markets." European Commission, *Accelerating Clean Energy Innovation communication*, 30 November 2016

Several academics have already looked at ways to include social science analysis as part of a renewed approach to innovation. One such example is the notion of **frugal innovation**[193], which is the process of simplification of a product (removing nonessential features). Such approach to innovation can play a key role in the energy transition, in Europe but also for emerging countries.

The **challenge for emerging countries is to leapfrog** from poverty to clean prosperity, without going through a stage of dirty economy (see 1.1.3.). For Europe, the challenge is to help emerging countries to ensure sustainable energy for all, promote human development while tackling climate change and creating jobs in Europe and in emerging countries.

In emerging countries, technological transfer is not always straightforward, local specificities hinder to directly apply similar processes and technologies, while they foster approaches that would fail or underperform in industrialised nations. Different sets of skills, infrastructures, natural resources, can be an opportunity to think outside the box, thus helping to design innovative products, practices and business models. To illustrate, the "pay-as-you-go" billing

192. Those actions currently support the mobility and training of European researchers. Our redirection proposal would for instance mean that the support of a Marie Sklodowska Curie Action would be granted to a researcher's geographical mobility only if it includes a transdisciplinary mobility.
193. Stephan Winterhalter, *Resource-Constrained Innovation and Business Models in Emerging Markets*, PhD diss., University of St. Gallen, 2015. See also, Navi Radjou and Jaideep Prabhu, *Frugal Innovation – how to do more with less*, The Economist Books, 2015. Other terms than "frugal innovation" exist and have in common to foster the exchanges between innovation in emerging and in developed countries: cost innovation, low-cost innovation, good-enough innovation, jugaad innovation, Gandhian innovation, and reverse innovation.

scheme for electricity (i.e. a prepaid purchase of a certain amount of electricity) is a sound way to bring light and charging points for mobile phones in remote areas. In the same vein, the lack of existing electricity network is an opportunity for decentralised renewable electricity generation. Frugal innovation is thus key to help European companies to conquer emerging markets, but it is also associated to **reverse innovation**: when an innovation first conquers emerging markets before being transferred to developed countries.

Frugal innovation, now endorsed as an element of the Energy Union by the ACEI communication (see quotation supra) should therefore be actively promoted, not only to support emerging countries in developing a low carbon energy system for their economy, creating jobs, and help European companies to enter new markets, but also to **get inspiration from these constrained regions to bring innovations back to Europe**. To promote frugal innovation, the EU might further develop energy innovation in its external relations, using in particular its outermost regions as creators, test beds and showcases for innovations[194] (see chapter 1., section 1.3.4.) than can then be implemented in third countries in collaboration with EEAS, member states embassies and local partners who can assess the situation on the ground and articulate a holistic approach including trade, energy, industry and development aid tools. In that regard, the European Commission should take the lead to propose an initiative for frugal innovation, with a focus on the clean energy transition, to be built and implemented with member states and financially supported by the EIB and the national development banks/agencies[195].

2.3.3. A citizen-based platform for an efficient and democratic way to foster breakthrough innovation[196]

Post-2016 European political context is shaped by Brexit, Trump and the persistence of powerful nationalist forces in key countries. Many question the political establishment's ability to hear what a significant portion of European peoples ask for: having a more direct say in policy making. For energy R&I, this could

194. Enrico Letta, Bertrand Piccard, Herman Van Rompuy, "Why and how Europe should become the world leader of renewable energy?", Jacques Delors Institute, 7 February 2017
195. For a more in-depth discussion on the role of frugal innovation for the energy transition, see Thomas Pellerin-Carlin and Pierre Serkine, "From Distraction to Action – towards a bold Energy Union Innovation Strategy", Policy Paper No. 167, Jacques Delors Institute, June 2016.
196. The author would like to thank Pierre Serkine who has had the original idea for this proposal. A more holistic presentation of this proposal can be found in Thomas Pellerin-Carlin and Pierre Serkine, "From Distraction to Action – towards a bold Energy Union Innovation Strategy", Policy Paper No. 167, Jacques Delors Institute, June 2016.

take the form of a proposal that adopts an open-innovation approach, gives citizens the power to co-create, select, co-finance and implement energy innovation, while including the expertise of innovative firms, researchers and laboratories.

2.3.3.1. Co-creating ideas thanks to crowdsourcing

Crowdsourcing can be used to co-create an idea: the original idea is proposed, contributors collaborate, share comments and suggestions for improvement. This can be done via an open digital platform, inspired by tools already existing in companies like Engie, EDP or ENEL.

The EU should therefore launch **a digital platform where ideas can be freely co-created by everyone**. It would seek to have a **large number of diverse participants** with various backgrounds and cultures to foster "outside the box" thinking and cross-fertilization. Crowdsourcing also leads to an increased quality of the top ideas produced through this process[197]. In other words, crowdsourcing enables the innovation process to foster more and better disruptive innovations, i.e. the innovations that are the most likely to help Europe lead the global clean energy race.

Involving more people in the process is also essential to favour a swift and efficient implementation of innovations. As suggested by the "IKEA effect"[198]: the more we contribute to an endeavour, the more we tend to value its outcome. In the end, contributors to this platform are likely to become grassroots backers of innovation. To engage many and diverse citizens, gamification[199] mechanics should be used on this platform, to cultivate interdisciplinarity, promote and reward contributors.

2.3.3.2. Selecting ideas through democratic selection

The selection of the innovations worth pursuing should resort to the very foundation of our democracies: a vote by all the platform's contributors.

Voting can be a very quick process that reduces time-to-market, a key critic to current EU way of funding innovation. Indeed, H2020 calls may take up to two

197. Andrew King and Karim R. Lakhani, *Using Open Innovation to Identify the Best Ideas*, MIT Sloan Management Review, fall 2013, pp.41-48
198. Norton, M.I., Mochon, D. and Ariely, D., 2011. *The'IKEA effect': When labor leads to love*. Harvard Business School Marketing Unit Working Paper, (11-091)
199. Contrary to a game, which is made to entertain users, gamification is made to engage them, using gaming mechanics such as collaboration, competition and rewarding, to channel and coordinate participants. The gamification dimension could also allow to institutionalise the multidisciplinarity and social diversity in the platform, through the use of various badges (for the socio-economic background, the gender, the age, the type of professional background etc.).

years between the start of the call and the beginning of a project, while such platform could foster the selection of proposals in only a few weeks or months.

Voting is also helpful in ensuring a **good fit between market needs** (represented by citizens themselves) **and innovations**. It moreover helps guaranteeing the democratic legitimacy of the choice of each project, which is likely to enhance the social acceptance and social desirability of the selected projects.

2.3.3.3. Financing innovations through crowdfunding and citizen allocation of EU funding

To finance innovation, crowdfunding[200] already plays a massive role that can be more important than even government public support[201]. It also effectively **empowers citizens by involving them directly**[202].

Crowdfunding moreover helps **reducing time to market and building a community of users**[203] who can actively support the innovation project and play an ambassador role. It is a suitable solution to coordinate multi-level, multi-discipline and multi-national players, **simplify the governance and improve the funding of innovation** by avoiding overlaps and gaps.

In practice, this platform would gather four categories of funders.

- **EU citizens** who fund the projects they like best.
- **EU public money** would be allocated directly by citizens, in the form of a grant or a guarantee. The allocation rule should be very simple, e.g. for each euro invested by a citizen in a project, the EU pours one euro or; alternatively, each citizen using the platform could attribute a small amount of EU money to the project he/she likes best[204].
- **Business angels and venture capitalists** should be involved to increase the leverage effect and demonstrate that citizen-chosen projects can be good investment opportunities.

200. Crowdfunding pools financial contributions from a large number of people.
201. In 2016 in the UK, seed crowfunding provided 40% more funding to UK businesses than the flagship British Government Start Up Loans initiative. Cf. Hunter Ruthven, *Seed crowdfunding outperforms government's Start up Loans scheme in 2016*, Business Advice, 18 January 2017.
202. Crowdfunding schemes varies depending on the platforms, as it can be equity-based crowdfunding (energy cooperative) or lending-based crowdfunding with a guaranteed return on investment. Whatever the scheme, this approach enhances the appropriation of energy infrastructure, mitigating the NIMBY effect and contributing to transform it into a PIMBY effect. Cf. Kristiaan Versteeg, *Tracking renewable energy crowdfunding*, Solar Plaza, 15 September 2015.
203. See for instance, Peter Hesseldahl, *The new normal: from products to platforms and processes*, 10 September 2014
204. Lessons could be drawn from already existing initiatives done by European cities, such as the city of Paris and its participatory allocation of 500 million euros.

- **Local authorities**, especially cities, can co-finance a project, especially those requiring to engage local communities to test the innovation before full deployment or commercialization.

2.3.3.4. Implementing innovations with start-ups or intrapreneurship

Once the energy innovation project is conceptualised, selected and financed, it still has a long way to go to fulfil its potential to become a successful innovation. The two common channels are the creation of a start-up or through intrapreneurship (see section 2.3.4.).

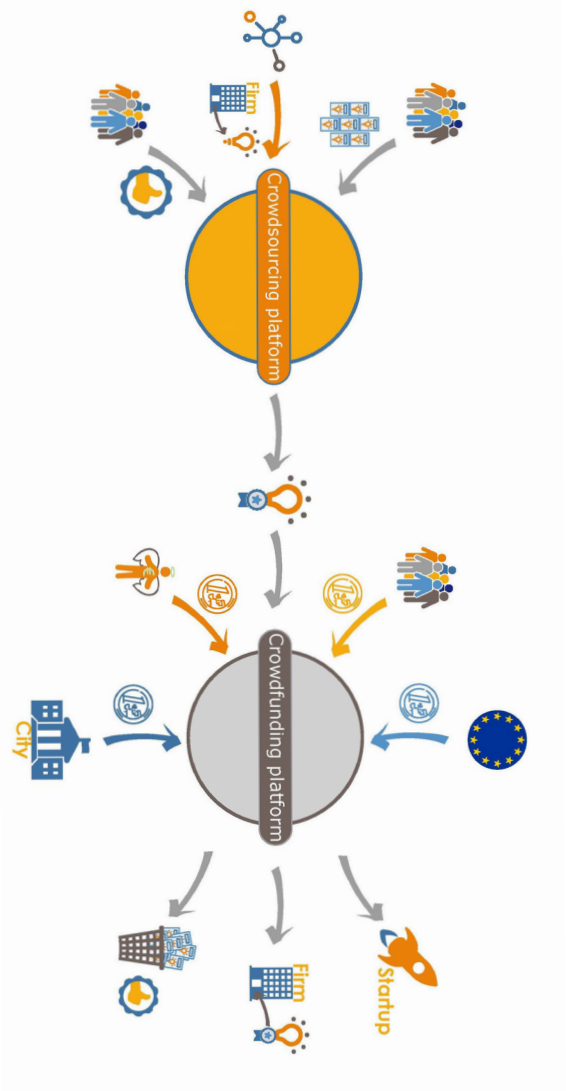
Figure 17 visually summarises our entire proposal. With citizens truly at its core, it may allow the EU to support an innovation process that is more democratic, but also more effective and efficient. Citizen involvement is indeed a way to mitigate the over-influence of some lobbies as engaged citizens would help policy makers to adopt policies serving the European peoples, not merely fitting the partial interests of current main energy stakeholders. It would moreover increase the chances that citizens not simply accept but desire and power the energy transition[205], enabling **a change from NIMBY to PIMBY**.

In more operational terms, this proposal should first be tested to empirically identify its innovative, political and economic value. The European Commission can launch a pilot-project to be operational in 2018, with tens of millions of euros to have real EU money to be allocated by EU citizens. If successful, it could be scaled-up in view of the next Multiannual Financial Framework 2021-2028.

If well implemented, this proposal may yield important strategic results: more and better energy transition innovation projects; a real-life demonstration that the EU is at the forefront of innovative thinking and wishes to give European citizens a greater and more direct say in concrete decisions.

205. For instance, in Germany, around half of the renewable capacity installed between 2000 and 2010 has been installed by citizens. See Noémie Poize and Andreas Rudinger, *Projets citoyens pour la production d'énergie renouvelable : une comparaison France-Allemagne*, IDDRI working Papers, 2014.

FIGURE 17 ► An EU crowd-based digital platform to boost innovation in an efficient and democratic manner



Source: T. Pellerin-Carlin and P. Serkine, Jacques Delors Institute

2.3.4. Transforming incumbents into energy transition tigers: corporate venturing and intrapreneurship

"Corporate entrepreneurship is envisioned to be a process that can facilitate firms' efforts to constantly innovate and effectively cope with the competitive realities that companies encounter when competing in world markets."
Donald Kuratko [206]

Competitiveness by and large rests on the capacity for businesses to "do what no one else can do[207]", something that is first and foremost characterized by their capacity to innovate. An "open and transformative R&I policy, [can make] Europe world leader in the new networked innovation economy, but geared towards the benefit of the citizens. This change will be an important part of a new EU R&I policy in the revised Europe 2020 strategy to ensure that the European recovery is sustainable, based on sustainable growth, knowledge-intensive society, not just the old growth model where productivity is achieved through cost reduction"[208].

This entails a paradigm shift. With innovation at its core, competitiveness is no longer limited to being a defensive policy meant to allow national companies to do what everybody else does, but cheaper—through smaller wages, lesser taxes, smaller energy prices etc. **With innovation at its core, competitiveness can also be an offensive policy meant to help European workers and businesses to innovate and conquer European and global markets** (e.g. see 2.1.2.)

Energy incumbents need corporate venturing[209] to transform their business models to avoid economic collapse—and the related human, social and economic costs. Several energy incumbents[210] are already working with start-ups in order to innovate (see box 4), others are acquiring start-ups or developing in-house innovation hubs. All those tools can be complementary, and can be articulated with a more organic venturing: intrapreneuship.

206. Donald Kuratko, *The entrepreneurial imperative of the 21st century*, Business Horizons, 2009, p.422
207. Andrea Ovans, *What is Strategy Again?*, Harvard Business Review, May 2015
208. Matthias Weber, Dan Andrée and Patrick Llerena, *A new role for EU research and innovation in the benefit of citizens: towards an open and transformative R&I policy*, European Commission, 2015
209. Corporate venturing and strategic entrepreneurship are the two pillars of what is called corporate entrepreneurship. The latter can be seen as the integration of entrepreneurial mind-set into the processes, values, mission, and structure of organisations, while the former deals with the addition of new businesses to these organisations. c.f. Donald Kuratko, *The entrepreneurial imperative of the 21st century*, Business Horizons, 2009, p.421-428
210. For a list of companies that have set up their own venture capital and/or have set up open innovation platforms, cf. i24c, Scaling up innovation in the Energy Union to meet new climate, competitiveness and societal goals, May 2016.

BOX 4 ► NUMA: when start-ups, incumbents and governments work together for the energy transition[211]

NUMA is a global innovation network that accompanies start-ups, public institutions and corporates. Its key mission is to use digital tools (data) to answer human challenges ("NUM" stands for "numérique", the French word for digital, and "UMA" stands for "human"). Created in Paris in 2000, it now has offices in eight cities in the world (Paris, Bangalore, Barcelona, Berlin, Casablanca, Mexico, Moscow and New York). NUMA focuses on building synergies between start-ups, corporates and local authorities like cities to solve the global problems of 2030, with activities in several areas including energy, transport and smart cities. The aim is to combine the speed and innovative capacity of start-ups with the critical mass of big organisations, be they public (e.g. cities) or private (e.g. corporates).
The example of NUMA shows that start-ups can be particularly useful not as stand-alone solutions, but as a critical element of a broader innovation ecosystem, working with cities (through their DataCity programme) and corporates (including energy incumbents). As such, NUMA's experience could inspire the new framework programme for EU research and Innovation that will be implemented between 2021 and 2027 and is currently being conceptualised by a high level group of experts created by the European Commission and led by Pascal Lamy, who should publish its work by June 2017[212].

Intrapreneurship is about creating internal processes to promote innovation by company employees, with the aim of having the said company bringing those innovations to the market. Intrapreneurship is complementary to start-ups as it brings additional benefits to a "start-up only" path: less job destruction, more sustainable company growth, more massive deployment of successful innovations, and the ability to tap into the employee's innovative potential.

Intrapreneurship can unleash the dormant innovative potential of company employees. Not harnessing it is an opportunity cost that make European businesses less competitive than they could be. As a rule of thumb, intrapreneurship is efficient when an environment prone to entrepreneurial initiatives (e.g. flexibility, openness, promotive environment, and collegiality) is created by a company that genuinely embraces the concept of "active innovation"[213].

In 1948, 3M Corp. created its intrapreneuship programme[214], which led to the creation of the "Post-It". In recent years, Facebook created its own programme, from

211. The author would like to thank Clémence Fisher and Nicolas Enjalbert for their key contribution and comments for this box.
212. http://ec.europa.eu/research/index.cfm?pg=newsalert&year=2016&na=na-220916
213. Dirk Meissner and Maxim Kotsemir, *Conceptualizing the innovation process towards the 'active innovation paradigm'—trends and outlook*, Journal of Innovation and Entrepreneurship, 5(1),2016
214. It is a permitted bootlegging policy in which employees can spend 15% of their time to work on their own ideas.

which emerged the idea of the "like" icon. Google also has its "20% time" allowing its employees to spend 1 day a week on a personal idea they have. Beyond that, "Hackathons" are another kind of initiative implemented by some companies to harness creativity and valorise the entrepreneurial initiatives of employees.[215]

Intrapreneuship is also a key to attract, develop and retain talents[216] in Europe and within a specific company. The implementation of an intrapreneurship programme can moreover provide a feeling of accomplishment, fulfil the desire of having a useful work and be used to reward employees, thus enhancing the quality of a given job.[217]

To promote intrapreneuship, public authorities can first help legitimise this tool in the energy industry. As many energy incumbents are still largely owned by EU member states, those states, as forward-looking shareholders, can ask for the development of intrapreneuship programmes within publically owned companies[218]. Public authorities could also provide incentives for companies to get to the next step: fast prototyping of the best ideas via structures such as Fab Labs[219].

CONCLUSION

The energy transition is a key challenge in the 21st century. In Europe, the energy transition has already started and, if European energy business are to survive in this new world, they must innovate to adapt. This is actually a key opportunity for the European economy: by making Europe the place for global energy transition leaders, it allows European workers to reap the benefits of leading the booming global energy transition market, while allowing European innovation to foster the global energy transition needed to fight climate change. To enable the shift from conservative European energy incumbents to energy

215. Internal hackhatons are used by companies such as Facebook, Google, or Microsoft. The well-known button "Like" popularized by Facebook is arguably the most famous outcome of a hackathon.
216. Jack Phillips, and Lisa Edwards, *Managing talent retention: An ROI approach*, John Wiley & Sons, 2008. p.1
217. "A powerful employee value proposition includes tangible and intangible elements, such as an inspiring mission, an appealing culture in which talent flourishes, exciting challenges, a high degree of freedom and autonomy, career advancement and growth opportunities, and a great boss or mentor." from Günter Stahl, et al. *Six principles of effective global talent management*, Sloan Management Review 53, No.2, 2012.
218. For instance, the French company La Poste—the former postal monopoly—has established an intrapreneurship programme since 2014, leading to the creation of several start-ups by its employees under the umbrella of La Poste. See Chloé Dussapt, « La Poste lance ses start-up grâce à l'intraprenariat », *Challenges*, 16 June 2016.
219. A Fab Lab is a workshop where machines, materials and electronic tools are available for people to design and produce unique goods through digital fabrication. A bottom-up approach to technology, Fab Labs aim to unlock technological innovation and promote social engineering.

transition tigers, public support is critical and should come from the EU, member states and local authorities.

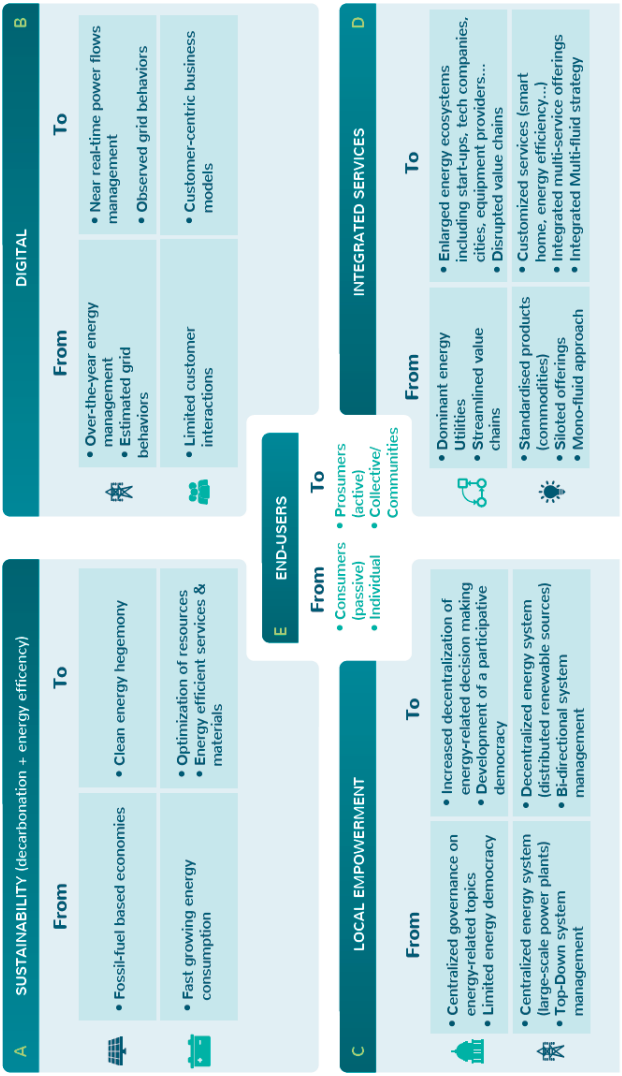
EU academia and businesses are already well-positioned to lead the global clean energy race. EU R&I instruments have evolved very positively in recent years and should be further improved, especially as the Trump administration opens a window of opportunity for Europe to outperform the US and become the global centre of energy innovation, with all the economic, scientific and soft power assets such a position yields.

To deliver a more democratic, competitive, fairer and swifter energy transition, the EU should not copy the US model, but proudly develop an European energy innovation path, walking on its two legs: start-ups and intrapreneuship, powered by creative research, enabled by patient EU, national and local public support, with the aim of fostering the transformation of energy incumbents into the energy transition tigers, able to roll-out innovations in a swift and massive way.

In more concrete terms, this entails to adopt a more end-user centric approach (rather than a technology-centric approach) to innovation, to work on societal appropriation of energy, embed social sciences' findings in energy innovation and develop frugal innovation approaches for EU and emerging markets. It also entails to innovate within EU innovation policy, for instance via testing an EU-supported platform where ideas would be co-created, democratically selected, crowdfinanced—with a contribution from the EU budget allocated directly by citizens. To increase the chances of successful adoption of innovations, intrapreneurship should be promoted as a complementary tool to European start-ups in the energy transition.

All in all, the EU ship has a capable crew of entrepreneurs and researchers, and enough public and private investment capacity that can blow in its sail to safely navigate towards a clean energy future. The Energy Union provides the right compass, but Europe should set its own course: ignoring the US Sirens' songs and avoiding the reefs of immobilism, the EU must truly place citizens at the helm to keep the heading. Only then can Europe lead the global clean energy race.

ANNEX 1 : A PARADIGM SHIFT OF OUR ECONOMY DRIVEN BY FOUR MEGATRENDS



3. Financing the Energy Transition in Europe: Towards a More Holistic and Integrated Approach

by Eulalia Rubio

The EU needs to transform its way of producing and consuming energy to drastically cut GHG emissions and deliver on the Paris Agreement. This transformation requires major investments in low-carbon assets and infrastructures. According to the Commission, about €379bn investments are needed annually in the energy sector over the 2020-2030 period, mostly in energy efficiency, renewable energy sources and infrastructures.

Meeting these investment needs is challenging in the current economic environment. Despite the incipient economic recovery and a context of very low interest rates, private investment remains weak if compared to pre-crisis levels, and many member states have limited budgetary margin of maneuver. In addition to that, investment in low-carbon projects is hampered by various obstacles, ranging from the lack of effective carbon price to specific policy and technological risks or the existence of capacity gaps among potential project developers and investors.

There are many measures already in place, at both national and EU level, to support low-carbon project development and remove obstacles to low-carbon investment. However, too often, policy support measures are designed and carried out independently at different levels of governments, with little or no coordination. There are also serious concerns as regards to the cost-effectiveness, relevance and distributional impact of some of these policy instruments. There is hence potential to improve actions in support to low-carbon investment, through more coordination and harmonisation of national policy schemes, exchange of best practices and the expansion and improvement of existing EU programmes.

Dedicated public support instruments for low-carbon investment are just part of the response to the low-carbon investment challenge. A move towards a low-carbon economy will only be possible if there is a general re-allocation of capital from high-carbon to low-carbon assets and infrastructures. This requires the establishment of a common and effective carbon price covering all economic activities as well as the integration of climate considerations into all public and private investment decisions. Such a holistic approach to the financing aspects of the energy transition is gaining ground in Europe. A High-Level Group of independent experts has been recently set up to reflect on how to build up a sustainable financial system. It is important that the work of this Group leads to concrete and ambitious policy measures and to make parallel efforts to align public investment decisions to EU's climate goals.

Finally, a key question for the years to come is how to distribute the financial cost of the transition. The energy transition will have positive effects on growth and employment, but in the short-term the measures put into place to decarbonise the energy system will ineluctably entail specific net costs for certain segments of the society, either in form of higher taxes and levies, stricter regulations or higher energy prices. Different political choices and measures can lead to a different distribution of the burden. It is crucial to take this into account and carefully handle the distributional consequences of these various measures, as only a fair distribution of costs can guarantee the political and social sustainability of this major long-term transformation.

This chapter offers some general reflections and policy recommendations on how to improve the overall policy framework supporting the financing of the energy transition in Europe. After an overview of investment needs and costs, sections 3.2. and 3.3. provide some general reflections on how to deal with the low-carbon investment challenge and how to ensure an appropriate distribution of costs. Sections 3.4., 3.5. and 3.6. develop more specific analysis and policy recommendations to improve carbon pricing policy measures (3.4.), dedicated public support measures for low-carbon investment (3.5.) and actions to incorporate climate considerations into all public and private investment decisions (3.6.).

3.1. Estimating investments needs and costs

The transition to a low-carbon economy will prompt major changes in the entire economy but the most important and transformative changes will be in the way of producing and consuming energy. This will require more and different types of investments in the energy sector. In particular, decarbonising the energy system encompasses more investment in renewables and less in conventional power (even if some is needed, at least temporarily, to guarantee back up capacity). It requires an expansion and better integration of EU's electricity networks to adapt to a renewable-dominated energy market (with more intermittent, decentralised and geographically concentrated production). Finally, major investments are needed to improve the energy efficiency of all equipment, productive processes and infrastructures, in order to reduce the level of energy consumption in our economies.

A move towards a low-carbon energy system also implies a change in the components of energy costs, with a major increase in capital expenditures (CAPEX) and a decrease in operational expenditures (OPEX) and fuel purchases. This is because of two reasons. First, contrary to fossil-fuel power stations, renewable plants require high upfront capital costs but very low operating costs. Second, a growing deployment of renewables together with a reduction in energy consumption will logically entail a reduction in fuel purchases.

BOX 1 ► What are energy-related investments?

The production, transmission and consumption of energy entail different monetary costs. Investment costs or capital expenditures (CAPEX) are just one of these costs, together with operational costs (OPEX) and costs from fuel purchases.

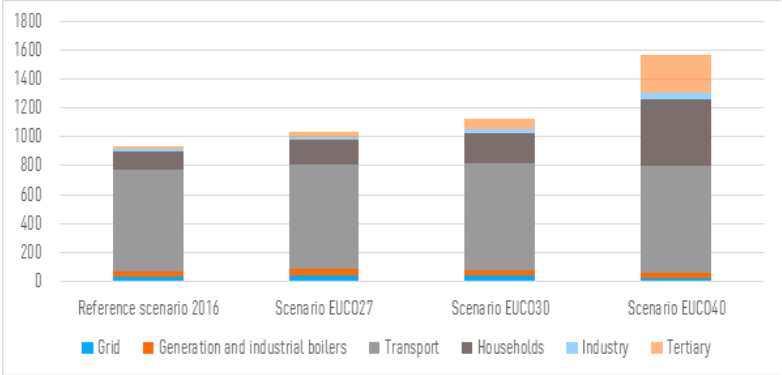
CAPEX can be of two types:

- Investments on the supply side, that is, the purchase or refurbishment of assets that extract, transform or transport energy (e.g. gas pipelines, renewable plants, electricity grids).
- Investments on the demand side, which includes purchases of energy equipment (e.g. new appliances to better manage consumption for households and firms, electric vehicles etc.) and energy efficiency investments in existing assets (e.g. renovation of buildings improving their thermal integrity). These second type of investments are more difficult to track, as are sometimes treated as part of a broader investment not classified as "energy" investment (e.g. renovation of a building).

Estimating the exact amount and type of investment needed to decarbonise the EU's energy system as well as the changes in the structure of energy costs is not easy. It depends on a myriad of policy choices and external factors which are difficult to anticipate. In particular, policymakers can choose different long-term paths to decarbonise the economy (e.g. different in the level of ambition as regards to the deployment of renewables or the reduction of energy consumption). Each of these scenarios implies different investment needs—in power generation, gas and electricity grids, energy efficiency—and different impacts on energy prices and costs. With all these caveats in mind, it is worth having a look at the existing official estimations of the implications of different long-term decarbonisation paths for Europe.

Figures 1 and 2 present the energy-related investments and energy system costs in different long-term scenarios developed by the Commission. They include a reference or "business-as-usual scenario" (REF2016), which projects energy developments on the basis of policies adopted until the end of 2014, and three decarbonisation scenarios (EUCO27, EUCO30, EUCO40) which differ in their level of ambition as regards the reduction of energy consumption by 2030[220].

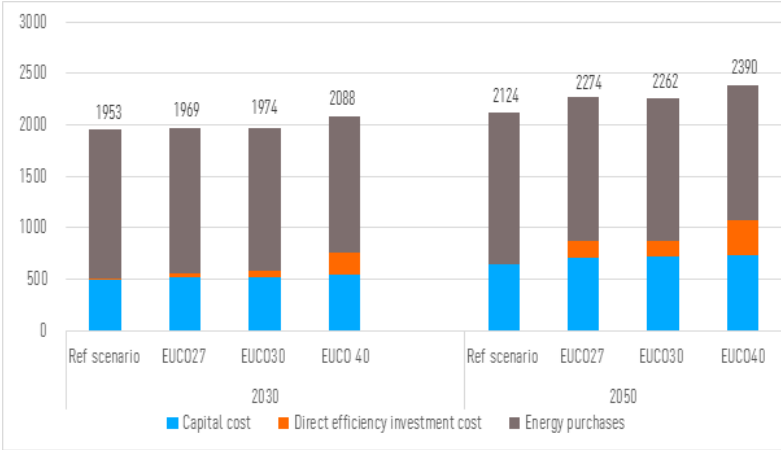
FIGURE 1 ► Energy-related investments needs between 2020 and 2030 in different scenarios (annual average, in €bn2010)



Source: Commission Staff Working Document. Impact assessment accompanying the proposal for a Directive on Energy Efficiency, Brussels, 30.11.2016, SWD(2016) 405 final, part 1/3, table 22, p.66

220. The scenario "EUCO27" assumes the adoption of policy measures to ensure the attainment of the 2030 EU climate targets—that is, reducing at least 40% of GHG emissions, ensuring 27% of renewables and reducing energy consumption by 27% by 2030—. The scenarios "EUCO30" and EUCO40 introduce more ambitious measures to ensure a 30%/40% reduction of energy consumption respectively by 2030. Source: European Commission, "Impact assessment accompanying the proposal of Directive on Energy Efficiency" (SWD(2016) 405 final), 2016.

FIGURE 2 ► Total net costs of the energy system in different long-term scenarios, 2030 and 2050



Source: Commission Staff Working Document. "Impact assessment accompanying the proposal for a Directive on Energy Efficiency", Brussels, 30.11.2016, SWD(2016) 405 final, part 2/3, table 16, p.87.

As expected, all decarbonisation scenarios entail higher investment costs than the reference scenario. However, one should note that the investment needs in the reference scenario are non-negligible, amounting to 232bn/year (if we include only the energy sector) or 937bn/year (if we include both energy and transport). This reveals the existence of important investment needs in the EU energy sector driven by other motivations than climate goals (such as the need to replace ageing infrastructures, guarantee EU's energy independence or eliminate "energy islands" in the Union). Another interesting aspect to highlight is that the investment needs in the supply side are important but those on the demand side are much higher. No matter which path we choose to decarbonize our economy, massive investments are needed to reduce energy consumption in the transport sector. Households and services' investment in energy should also increase significantly, particularly if the EU chooses a decarbonisation path strongly axed on energy efficiency efforts.

To have an idea of the challenge ahead, it is interesting to compare these investment needs with current levels of investment in both energy supply and demand. A 2016 EIB report does this exercise for various economic sectors, drawing on estimates and findings from different sources (European

Commission reports, academic studies, EIB data and research). In the field of energy, the report concludes that there is an investment gap of around 100bn/year, most of it related to investments in energy efficiency (table 1).

TABLE 1 ► Investment needs and gaps in the energy sector (annual average, in €bn)

	REQUIRED[1]	CURRENT (ANNUAL INVESTMENT, AVG. 2001-2015)[2]	GAP
Power generation	53	41	12
Energy networks (gas and electricity)	64	47	18
Energy efficiency	112	42	70
Total	230	130	100

1. Estimated annual investment needs between 2016-2030 under "reference scenario"; 2. Annual investment in EU28 over the period 2001 to 2015
Source: EIB, "Restoring EU competitiveness 2016 updated version", Luxembourg: EIB, 2016

Finally, a crucial question is to which extent increases in capital expenditures will be offset by decreases in OPEX and fuel purchases. According to Commission's estimates, this will happen but only to a certain extent. In other words, decarbonisation will lead to decreases in OPEX and fuel purchases but these will fall short to offset all upfront investment costs. In consequence, total net energy costs for the society will be higher than in the reference scenario, both by 2030 and 2050 (figure 2)[221]. This impact on net energy costs, however, has to be relativized. To start with, whereas the cost of energy will increase, the shift towards a low-carbon economy will have positive effects for the whole economy which will compensate for the increase of energy costs. According to the Commission, an EUCO30 scenario (that is, achieving a 40% greenhouse gas reduction, a renewable target of 27% together with an energy efficiency target of 30% in 2030) could lead to an increase of up to 1% in GDP by 2030 and a 0.2% increase in net employment. A crucial pre-condition for this to happen, however, is appropriate access to external finance by households and business. This is because if external finance for low-carbon investments is available, businesses and households will be able to do the required investments

221. Notice however that, by 2050, the cost in a scenario based on a 30% reduction in energy consumption (EUCO30) is slightly lower than the cost of the scenario based on a 27% reduction in energy consumptions (EUCO27).

and expand their capacity without meeting significant constraints ("loan-based" case). On the contrary, if households and businesses cannot borrow ("self-financing" case), the GDP and employment impact will be lower or even negative as the growth potential of new economic activities will not be entirely unlocked, and part of the new investment will come at the expenses of investments in other sectors of the economy (crowding out effect)[222].

Another thing to take into account is that there is a high potential for policy measures' improvements and technology cost reductions that can lower investment costs. Technological progress as well as non-technological innovation (see chapter 2., section 2.3.2.) can further reduce investment costs in renewables and can also favour market penetration of energy efficiency technologies. As regards to policy measures' improvements, one should keep in mind that, in the Commission's scenarios, capital costs are annualised and the annual cost is calculated on the basis of sector-specific discount rates. In the case of energy efficiency investments, these discount rates take into account the cost of capital but also non-monetary obstacles to investment. According to some experts, the Commission currently applies inappropriately high discount rates, leading to an over-estimation of these costs[223]. Even if the discount rates were appropriate today, more and better policy support to energy efficiency investments are likely to reduce obstacles to investment in the coming years and make the energy transition cheaper.

3.2. The low-carbon investment challenge

As seen in the previous section, the energy transition requires a major capital shift from high-carbon to low-carbon assets and infrastructures, particularly in the energy and transport sectors.

To a certain extent, this capital shift can occur without major public involvement given the appropriate regulatory incentives are in place and providing private actors (households, corporates) have adequate information on climate risks and opportunities. In fact, households and private firms are investing more on low-carbon, either

222. European Commission, Impact assessment accompanying the document "Proposal for a Directive of the European Parliament and of the Council amending Directive 2012/27/EU on Energy Efficiency" (SWD(2016) 406 final), part 1/3, Brussels, 30.11.2016
223. Hermelink, A and de Jager, D (2015), *Evaluating Our Future. The crucial role of discount rates in European Commission energy system modelling*, The European Council for an Energy Efficient Economy (ECEE) & ECOFYS

as a result of higher regulatory standards (e.g. energy efficiency standards on construction of new buildings), for-profit calculations (e.g. corporates and households improving the energy efficiency to reduce the electricity bill) or other motivations[224].

In particular, firms are increasingly proactive in the transition to a low-carbon economy, reflecting the growing recognition of new market opportunities and awareness of long-term climate risks. In the run-up to COP21, thousands of businesses have announced individual engagements in the framework of various business-related initiatives put into place under the umbrella of a global platform called NAZCA (Non-State Actor Zone for Climate Change) and launched by the Peruvian Presidency of COP20[225]. There are now 30 business-focused initiatives for climate, encompassing 3.356 participants around the world, and the momentum continues to grow with an almost 17% overall increase in private sector participants across the various business-focused initiatives since the signature of COP21 (UN Global compact 2016)[226]. EU firms are well-represented in these initiatives, with 42% of signatory firms located in the EU (against 19% located in the US). EU firms are also well-represented in some of the main business-related initiatives, such as RE100 (box 2).

BOX 2 ► RE100, the commitment of big firms to 100% renewable power

RE100 is a global, collaborative initiative of the world's most influential companies committed to 100% renewable power, led by two non-profit organisations, The Climate Group and CDP (Climate Disclosure Project). It was launched in September 2014, in the run-up to COP21, and it counts with 87 major multinationals, including major EU firms such as H&M, Ikea, Unilever, ING Bank or La Poste.

RE100 encourages companies to adopt the fastest possible timeline for reaching 100% renewable electricity, and to publicly set an end goal year and interim targets. So far, 42 RE100 members have set a goal of achieving 100% renewable electricity by 2024, with 12 having committed to end goals before 2015. The most recent data (2015) collected from RE100 members shows that 11 had already reached their target of 100% renewable electricity before 2015 (such as the Gatwick Airport in Amsterdam) or are expected to do it by 2017 (Google). Others have made significant progress to increase its share of renewables. For example, Goldman Sachs went from 14% renewable electricity in 2014 to 86% in 2015 and H&M went from 27% to 78%. Another interesting achievement is the potential for many members of RE100 to influence their suppliers in developing countries to transition to 100% renewable power. Apple has taken the

224. Citizens are not pure "homo economicus", and many voluntarily engage to fight climate change for environmental reasons. As for corporates, taking strong commitments for climate change may be a rational decision to rise the value of their brands and improve their image vis-à-vis consumers.
225. http://climateaction.unfccc.int/companies
226. UN Global Compact, "2016 Status Report: Business contribution to global climate action", November 2016

lead on this. On joining RE100, the firm announced that its China suppliers Solvay Specialty Polymers (which supplies antenna bands for iPhone), and Catcher Technology (which supplies aluminium), would both work to use 100% renewable energy for all of their Apple production by the end of 2018.

Source: RE100 annual report 2017 "Accelerating change: how corporate users are transforming the renewable energy market".

The potential collective impact of the initiatives on emissions is substantial. However, there are a number of gaps in the coverage of initiatives. Apart from the fact that most of the business engaged are in developed countries, some high-emitting sectors are lagging on climate commitments (such as trucking, railroads, airlines, and construction companies, which only have 40% of its Forbes 2,000 members with climate actions on NAZCA). Financial companies, like real estate and insurance companies, are also lagging, with only 42% of its Forbes 2,000 members on NAZCA[227]. Besides, in some sectors such as energy efficiency, the effort in low-carbon investment is still largely based on self-financing[228]**.** Given the magnitude of the effort required, there is a need for specific policy, financial and regulatory measures to further favour the access to private capital for these sectors.

Today, there are various market failures and obstacles that reduce the capacity and willingness of capital markets to invest in low-carbon assets and infrastructures. A first obstacle is the overall investment context in Europe. Despite the incipient recovery and the ECB policy of ultra-low interest rates, traditional private investors (commercial banks, institutional investors) are still reluctant to invest in long-term risky projects. In addition to that, new prudential regulations have made more difficult for banks and insurance to take long-term investment positions, and in some countries banks remain burdened by non-performing loans, despite the ongoing deleveraging efforts[229]. The EU has already launched some initiatives to address these problems. Since 2014, there has been a general revision of the bank and insurances' prudential rules introduced after the crisis in order to correct for possible negative effects on investment and growth[230]. In addition to that, the new Investment Plan for Europe

227. Hsu, Angel, "4 charts that explain climate action from cities and companies", *The Huffington Post*, blog, 22 April 2016
228. The EIA estimates that today's energy efficiency investments are self-financed to the extent of 60% from the budgets of governments, industries or households (IEA, Special Report. World Energy Investment Outlook, 2014. P 154).
229. European Commission, Winter Economic Forecast 2017, Institutional Paper 048, February 2017
230. For instance, some changes have been introduced to the new Directive establishing a new prudential regime for insurance companies, Solvency II, in order to provide a more favourable treatment to certain infrastructure assets.

(so-called Juncker Plan), launched in 2015, has established a new EU-EIB mechanism (the European Fund for Strategic Investments—EFSI), which will allow the EIB to take more subordinated positions in strategic projects of European interest and, by doing that, mobilising more private investment for these projects[231]. While these initiatives seem to work, and the overall context of investment in Europe is gradually improving, the level of investment in the EU (as % of PIB) is still below its pre-crisis level.

Apart from the general weakness of investment in Europe, investment in low-carbon energy sectors is hampered by specific market failures, such as the lack of an effective carbon price, high technological and policy risks, the small size and heterogeneous nature of the projects or capacity and informational gaps among potential project developers and investors. As discussed in sections 3.5. and 3.6., there is general awareness on these obstacles and various policy measures are in place, both at EU, member states and local level, to address these problems. However, there is much potential to improve the effectiveness and overall coherence of these interventions.

While many of the investment projects linked to the energy transition offer attractive long-term financial returns for private investors, it shall be noted that some of them will still need to be directly financed by the public sector. This is particularly the case for basic energy and transport infrastructures which do not yield high economic returns (or yield negative returns) but are nevertheless necessary for other public reasons (e.g. infrastructures connecting rural or highly deserted areas) or for projects having a strong social dimension (e.g. improving the energy efficiency of buildings rented or owned by low-income households). In addition to that, the current low-interest rate context offers an opportunity to finance low-carbon energy infrastructures at low prices. In this respect, public financing of low-carbon projects through debt can be seen as an intelligent way to respond to the double challenge of low growth and climate change.

231. For a more detailed explanation of the Juncker Plan see Rubio, Rinaldi, Pellerin-Carlin (2016), "Investment in Europe: making the best of the Juncker Plan", Study, Jacques Delors Institute, April 2016

3.3. The need to secure an appropriate distribution of costs

As discussed in section 3.2., the energy transition will have positive effects on growth and employment, but in the short-term the measures put into place to decarbonise the energy system will ineluctably entail specific net costs for certain segments of the society, either in form of higher taxes and levies, stricter regulations or higher energy prices. A key question is how to distribute these financial costs of the transition. Different political choices and measures can lead to a different distribution of the burden, and it is important to be aware of the distributional consequences of these various choices, as only a fair distribution of costs can guarantee the political and social sustainability of this major long-term transformation.

A basic starting point when discussing these issues is to acknowledge that climate change actions present the characteristic of "public goods" (that is, goods producing non-divisible benefits for the whole society). As for other public goods, the government is therefore called to play a major role in guaranteeing the contribution of all citizens (e.g. through taxes, regulations or public debt) to the production of the good. This basic principle however has to be enriched and complemented with other considerations.

First, the financing of climate change actions should be inspired as much as possible on the polluter pays principle, which holds that the cost of negative environmental externalities shall be borne by those originating it (the polluter). In the case of carbon mitigation, this implies the establishment of an effective carbon price signal for all goods and services. In the EU, carbon is lightly priced or not priced at all in many sectors (see section 3.5.) and therefore there is potential to apply more systematically this logic. However, the logic of polluter-pay has its own limits: in some cases, the inelasticity of demand implies that the impact on final consumption will be rather weak, at least in the short term (e.g. the introduction of surcharges for diesel has limited short-term effects if the stock of vehicles in a country is mostly diesel-based). In addition to that, one should be aware of possible negative side-effects of pricing policies, particularly competitive and social effects. In this respect, some form of exemptions and/or compensation may be necessary to guarantee an appropriate carbon price in a way that is economically sufficient, socially fair and politically sustainable. There are some intelligent ways of doing so. In some member states, exemptions have been introduced in the early years before being gradually phased-out, thus giving time to adjust to the price signal.

In others, exemptions have been made conditional on the achievement of certain targets, defined through voluntary agreements with the government.

BOX 3 ► Carbon taxation: intelligent ways of introducing compensations and exemptions

The energy and CO_2 taxation system in Sweden has a system of exemptions granted to several industry sectors. The latest reform in 2009 required a reduction or abolition of these exemptions following a calendar established between 2011 and 2015.
In other countries, exemptions are conditional on the achievement of certain targets defined through voluntary agreements with the government. For example in the Netherlands large industrial electricity consumers receive a refund from the energy tax if they have entered long-term energy efficiency agreements with the government. In the UK, energy intensive business can sign Climate Change Agreements (CCAs) with the government, which make them eligible to receive a discount from the Climate Change Levy in return for meeting energy efficiency or carbon-saving targets.

Source: IEEP, *Environmental Tax Reform in Europe. Opportunities for the Future.* Final Report, 30 May 2014

Second, different ways of financing climate-action measures can have different distributional effects that may endanger the political support to the project. Particular attention shall be paid in this respect to the way of financing support schemes for renewables. In countries such as Germany, in which feed in tariffs are financed through levies, these schemes impose an important burden on all households, particularly on low-income ones[232]. To avoid this to happen, some authors suggest that renewable schemes should not be financed through levies on energy consumption but instead through the general tax system[233]. Given the progressive nature of the general tax system, they argue, wealthier households would then bear a higher burden than low-income households in the financing of renewable subsidization. This solution however has the problem that, by eliminating levies, it reduces the price of electricity and thus weakens the role of the price as incentive to reduce electricity

232. Poor households spend proportionately more on energy, and so are more exposed to energy price shocks. On average, across the EU in 2014, energy accounted for 8.6% of total expenditure for households in the lowest income quintile and just 4.3% for those in the highest income quintile. See https://ec.europa.eu/energy/sites/ener/files/documents/macro_energy_resilience_and_vulnerability.pdf
233. Bardt et al (2012) cited by Frondel, Manuel et al (2015), *The Burden of Germany's Energy Transition—An Empirical Analysis of Distributional Effects*, Ruhr Economic Papers, Ruhr-Universität Bochum (RUB), Department of Economics

consumption. Another solution could be maintaining the levies but complementing them with compensatory means-tested cash transfers for poor households and grants or other type of support for energy efficiency investments in poor households (see chapter 4. for a more detailed discussion of possible arrangements).

BOX 4 ► Distributional effects of the German feed-in tariff system

In Germany, electricity generation from renewable sources is supported through a system of feed-in tariffs created by the Renewable Energy Sources Act in 2000 (Erneuerbare-Energien-Gesetz, EEG). Under this scheme, utilities are obliged to pay technology-specific feed-in tariffs far above own production cost to those who produce renewable electricity. Ultimately, though, it is the industrial and private consumers who have to bear the cost induced by the promotion of renewable energy technologies through a surcharge on the price of electricity, called the EEG levy.

After the introduction of the EEG levy, electricity prices for German households have virtually doubled. This has hit hard poorly for many low-income households, which devote a higher percentage of their revenues to electricity. Besides, whereas wealthy citizens have the capacity to invest and thus can profit from the support to renewables, less well-off citizens cannot invest in renewables and thus have to buy all the electricity to the grid.

On top of that, there are exceptions to the EEG for energy-intensive companies. These exemptions not only cause distortions between the companies of the manufacturing sector but also substantially increase the burden of private consumers and other sectors of the German economy.

Third, it is also important to improve the cost-effectiveness of public measures in support to decarbonisation. As discussed in section 3.6., there are evidences of windfall profits in the functioning of national schemes in support of renewables and over-use of grants to finance low-carbon projects that could have been supported through more cost-effective means (loans, guarantees, risk-sharing instruments able to attract private finance). There is also a general lack of coordination between EU and member states' actions, A more appropriate and targeted use of public funding in support to decarbonisation implies savings for all citizens.

Finally, there is a generational issue to take into account when discussing ways of financing the effort of decarbonisation. Climate change actions taken today will provide benefits for the current and future generation and thus it makes full sense to support part of the climate change effort through debt financing. As seen before, another argument for using debt is the context of ultra-low

interest rates which has significantly reduced the cost of borrowing for both private investors and public administrations.

3.4. Setting an effective carbon price: an essential (but not sufficient) pre-condition

An essential condition to induce a capital shift from high-carbon to low-carbon investment is to incorporate the cost of carbon in the price of all goods and services. This can be done in different ways—through carbon markets, direct CO_2 taxes, taxes and charges on the input or output of products, the establishment of regulatory obligations and standards or the use of a shadow or social cost of carbon to guide public investments decisions.

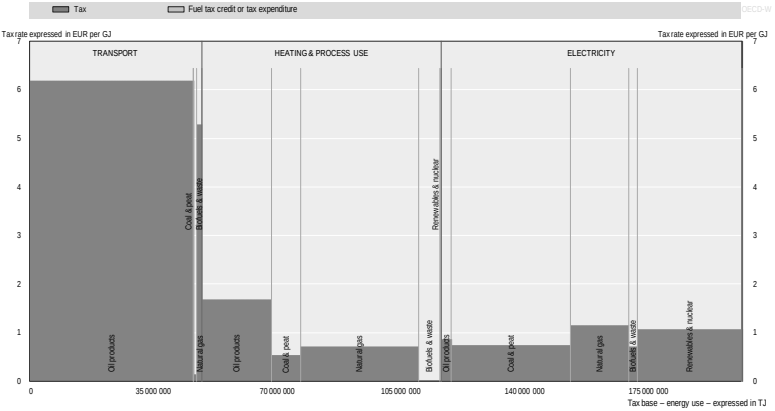
At the EU level, there is a need to improve carbon pricing signals. To start with, the carbon price set in the ETS market is too low to effectively disincentive investment in high carbon activities. Since the establishment of the EU Emissions Trading System (EU ETS), CO_2 price followed a rapid and overall decreasing path, dropping by 68% between 2008 and 2015. The EU institutions are now negotiating a reform which will include the creation of a "Market Stability Reserve", a mechanism with the capacity to intervene in the market to try to raise the price by reducing the supply CO2 quota, but it is quite clear that the new mechanism will not resolve the problem. A better way to improve the ETS system would be include a sort of floor-price. This has already been done in the UK power sector[234], but to avoid competitiveness distortions and the fragmentation of EU climate policy the floor price should be set at the EU level. The establishment of a EU floor price was recently proposed by France in the framework of the ETS reform, but no consensus was found on this proposal. The establishment of such a system could be nevertheless possible in the framework of a broader "Energy Union Deal" (see chapter 1.for more details).

Even if the ETS system is improved, one should not forget that it covers less than half of total EU GHG emissions. The rest of the emissions are either not priced at all or priced through national taxes which are not always sufficiently high, vary a lot across economic sectors and are insufficiently coordinated at the EU level.

234. The UK established a "carbon floor price" in 2011 that electricity generators have to pay for carbon allowances. Starting from £15.70 in 2013, this minimum price steadily escalates by roughly £2/year and it is expected to reach £30 in 2020 and £70 by 2030. Sandbag, *The UK Carbon Floor Price*.

Figure 3 shows the different tax treatment of fuel use across sectors in OECD countries. As can be seen, there is significant variation, which is explained by the existence of different policy considerations such as social justice (e.g. low taxes for use of fuel in residential heating), competitiveness considerations (low or zero taxes for certain industries or sectors such as steel) or fiscal efficiency (high taxes on transport, where price elasticity is low and tax revenues more stable). While some of these policy considerations are justifiable, the result is that there is no uniform price signal on CO_2 emissions that would be consistent with a social cost of carbon. It would be better to ensure a more homogeneous price for carbon and try to attain the other goals through other means (e.g. directly transferring resources to poor households or weak economic sectors instead of reducing energy taxes—see chapter 4. for more details).

FIGURE 3 ► Different tax rate on fuels across sectors in OECD countries (expressed in euros per tonne of CO2 emitted)



Source: OECD (2013), *Taxing Energy Use: A Graphical Analysis*

Energy taxation in the EU is also insufficiently coordinated. The importance of environmental taxation varies a lot across member states, and on average it has been declining over recent years in most countries. In 2011, the Commission proposed to revise the Energy Taxation Directive by including a single minimum rate for CO2 emissions (20 per tonne of CO2) to all sectors not covered by the EU ETS. This would have allowed to harmonise carbon pricing both across

sectors and countries. However, after three years of negotiations, the proposal was withdrawn due to lack of political agreement in an area where unanimity is required. A possible way to overcome veto blockages is to pursue harmonisation in the framework of an enhanced cooperation between like-minded and/or neighbouring countries (see chapter 1.).

While more harmonisation of existing national energy taxes would be welcomed, an even more ambitious move would be to establish a common EU carbon tax that could be also used to finance the EU budget. This was proposed in a 2009 study by Laurent and Le Cacheux[235] and has been recently evoked in the report by the High-Level Group on Own Resources published in January 2016[236].

Another aspect to take into account is the need to ensure alignment of all taxation system to climate goals. Property taxes, or various corporate income tax provisions, may encourage carbon-intensive choices. For instance, tax regimes on company car use and commuting expenses can favour certain modes of transport over others and influence how much employees travel[237].

To secure an adequate price on carbon, it is also essential to remove all subsidies to high-carbon production and energy consumption. According to the latest Commission's report on energy prices and costs, EU direct fossil fuel subsidies for electricity and heating stood at €17.2bn in 2012 and fossil fuel subsidies in transport were estimated at €24.7bn[238]. An 2014 ECOFYS study reaches similar conclusions: according to this study, support to the supply of fossil fuel energy amounted to €16.3bn in 2012, representing more than 16% of total public support to energy[239]. Besides, €27bn were spent in support to energy demand, typically in form of tax exemptions on the consumption of energy. The EU should help member states to define long-term strategies to progressively phase out these subsidies.

Finally, it is important to take into account that adequate carbon pricing, while essential, is not enough to induce a shift towards low-carbon investment. Prices are not the only reason why private investors do not invest on low-carbon assets; there are other policy and market failures whose correction requires

235. Eloi Laurent and Jacques Le Cacheux, "An ever less carbonated Union? Towards a better European taxation against climate change", Study No. 74, Jacques Delors Institute, 2009
236. *Future financing of the EU. Final report and recommendations of the High Level Group on Own Resources*, December 2016
237. OECD, Aligning policies for the transition to a low-carbon economy, 2015
238. European Commission, *Energy prices and costs in Europe*, Brussels, 30.11.2016 COM(2016) 769 final
239. ECOFYS (2014a), *Subsidies and costs of EU energy-Final report*, 2014. Study commissioned by DG Energy

more targeted interventions in form of regulations, direct public funding, technical assistance or others.

3.5. Improve measures in support to low-carbon energy investment

The EU has already made significant progress in decarbonising its economy and part of this has been thanks to the establishment of dedicated policy schemes and financial instruments in support to private low-carbon investment. The level of support provided through these policy measures is significant, particularly in the sector of renewables, where public support amounted to €157bn between 2008-2012[240]. There are however serious concerns as regards to the cost-effectiveness, relevance and distributive impact of these various measures.

A common concern in many fields (renewables, energy efficiency) is the lack of coordinated approach. National schemes in support for renewables are not harmonised and only slightly coordinated, which prevent the exploitation of economies of scale and regional advantages in climate across Europe. As for energy efficiency, there are about 200 energy efficiency financing schemes in the EU[241], which various schemes addressing the same sectors and the same beneficiaries in the same member states, leading to ineffective, uncoordinated and fragmented use of public finance.

There are also overlaps and lack of coordination between different EU-level interventions. As shown in table 2, there are at least eight different EU funding streams providing financial support to private low-carbon energy investment. Many of these programmes address the same sectors or the same beneficiaries, and there is some evidence of overlaps, lack of complementarity and even competition between different EU financing initiatives[242].

240. ECOFYS (2014a), op.cit.
241. See Table 5 page 146 of Commission Impact assessment accompanying the Proposal for a Directive of the European Parliament and of the Council amending Directive 2012/27/EU on Energy Efficiency (SWD(2016) 405 final PART 3/3, 30.11.2016).
242. For instance, the evaluations on the functioning of the new European Fund for Strategic Investments (EFSI) have pointed out at the risk of competition between EFSI and the Structural and Cohesion Funds as well as the fact that EIB tend to use EFSI to finance projects that would have been in the past financed through CEF.

TABLE 2 ► Overview of the main EU-level funding opportunities for low-carbon energy investment

	PROVIDING FUNDING FOR:				FORM OF FINANCE	TOTAL AMOUNTS INVESTED
	Renewables	Energy efficiency	Sustainable transport	Electricity networks and smart grids		
ERDF and Cohesion Fund	X	X	X	X	Grants and financial instruments	37.4bn allocated to low-carbon energy projects between 2014-2020, of which 16.5bn to sustainable transport, 13.2bnto energy efficiency, 4.8bn to RES and 2.9 bn to energy systems (smart distribution, high-efficiency cogeneration and district heating) (1)
Connecting Europe Facility (CEF)			X (only PCIs*)	X (only PCIs*)	Grants and financial instruments	€5.4bn allocated to pan-European energy infrastructures, €24bn to transport infrastructures between 2014-2020 (2)
Horizon 2020	X	X	X	X	Grants, financial instruments and technical assistance (ELENA and MLEI)	€6bn earmarked to non-nuclear energy research between 2014-2020 (3) Technical assistance to support development of bankable sustainable energy projects (ELENA and MLEI): 97min spent between 2009 and 2016 (4)

LIFE	X	X	X	X	Grants, financial instruments and technical assistance (PF4EE)	€864mn to co-finance small climate mitigation and adaptation projects between 2014 and 2020 (of which €80mn to support PF4EE, a financial instrument for energy efficiency projects) (5)
EIB lending	X	X	X	X	Direct and intermediate loans	€15bn/year invested in climate mitigation lending (mostly in renewables and sustainable transport) between 2010-14 (6)
EFSI (Juncker Plan)	X	X	X	X	Debt, mezzanine instruments, guarantees and equity financing	€2.2bn invested in Energy Union priorities between June 2015 and September 2016 (7)
Marguerite Fund	X			X	Equity investment	----
European Energy Efficiency Fund (EEEF)	X	X			Debt, mezzanine instruments, guarantees and equity financing	117mn invested from 2011 to 2015 (8)

*PCIs: Projects of Common Interest.
Sources: (1) European Commission, Dg CLIMA, Mainstreaming of climate action into ESI funds, May 2016; (2) Connecting Europe Facility; (3) Horizon 2020;(4) Pwc, *Evaluation of the Project Development Assistance implemented under the Intelligent Energy Europe Final Report*, report delivered to DG ENERGY, February 2016; (5) LIFE regulation and two financial instruments; (6) EIB, "Evaluation of EIB financing of Climate Action (mitigation) within the EU 2010-2014", September 2015; (7) Ad hoc audit of the application of the Regulation 2015/1017 (the EFSI Regulation), Final Report, 14 November 2016; (8) European Energy Efficiency Fund, Advancing Sustainable Energy for Europe, Annual Report 2015

The following sections provide some ideas on how to improve existing support measures to low-carbon investment through more coordination of national policy measures, exchange of best practices and the expansion and improvement of existing EU programmes.

3.5.1. Reforming market support schemes for renewables and promote a more optimal distribution of renewables across Europe.

Investment in renewables has showed substantial growth over the last decade, both in the EU and worldwide. The flow of capital invested in renewables in the EU jumped from $27bn in 2004 to more than $120bn in 2011, and while it has declined since then (it was at around $55bn in 2015), it remains nonetheless high in comparison to other regions of the world, representing over 85% of total EU's investment in energy generation[243].

The rise of investment on renewables has been partly driven by declining construction costs of renewable technologies but it has also been helped by supporting policies to renewables. This support comes in different ways (investment grants, soft loans, tax exemptions, priority treatment in grid regulations...), but the most important support is from market schemes aimed at providing security of revenues, either by fixing the price at which renewable production has to be sold (feed-in tariffs, feed-in premiums) or fixing the volume of renewables to be produced through quota obligations (requiring energy suppliers to purchase a quota of renewables, or green certificates representing the production of such energy quota obligations) or through competitive tendering or auctions.

In Europe, the cost of these market schemes for renewables is significant. According to a ECOFYS study, it amounted to €157bn between 2008-2012[244]. While the significance of this figure has to be relativized in historical perspective[245], and public support to renewables has stalled in recent years, there are many evidences of inefficiencies and windfall profits in the functioning of national renewable schemes.

In particular, in schemes fixing the prices, there have been difficulties to revise and adapt support levels to the different maturity of technologies and decreasing costs of production. This has produced windfall profits for certain renewable producers, and sudden policy reversals[246]. In schemes fixing the volume, renewable producers are more exposed to market prices. However, such

243. IEA, 2016, *op.cit.*
244. ECOFYS (2014a), *op.cit.*
245. The same study notes that between 1974 and 2007 the nuclear sector has received around 78% of the public funding, of which the majority on nuclear fission.
246. In some cases, the resulting reaction to overspending has been a sudden retroactive adjustment of the tariff, increasing policy risks and uncertainty for investors (e.g. in Spain).

schemes offer significantly less revenue certainty for investors, and by rising the risk of the investment, they have in some cases increased the cost of capital to a prohibitive level. Finally, tender/auction schemes tend to favour large projects and market concentration (as usually only larger companies with sufficient financial and technical capacities can participate and cope with the complexity of auction mechanism. Taking into account these different characteristics and weaknesses, what seems more optimal is to combine different market schemes, e.g. using auction/tenders for large projects and mature technologies and maintaining responsive feed-in tariff schemes with frequent tariff adjustments for small-scale projects (Grau 2014)[247].

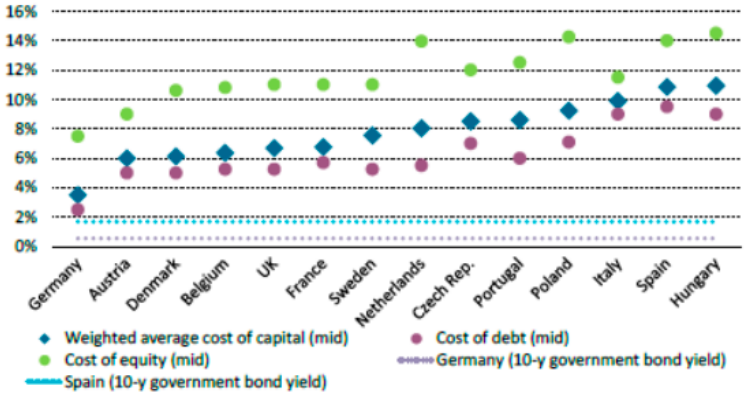
In addition to reforms to national support schemes, it is important to foster a more optimal distribution of renewable generation throughout Europe. In effect, the existence of different national schemes with little coordination is in itself a major source of inefficiency, as it prevents the exploitation of economies of scale and regional advantages in wind power and climate across Europe. Even if the EU Renewables Directive allows for some forms of cooperation between national renewable schemes, in practice there is only one example of joint transnational renewable scheme (the Swedish-Norwegian joint green certificate scheme). Thus, national schemes rest focused on the support to renewable production in its own territory. These results in the paradoxical situation that, by far, Germany (the country having the most generous renewable scheme support system) experienced the globally strongest increase in photovoltaics (PV) capacities, with which electricity can be produced from solar energy, despite the fact that the average number of sunshine hours per year is much lower than in other EU countries, such as Greece, Portugal, or Spain. In 2010, out of the total of 29 327.7 megawatt (MWp) of PV capacities that were installed in 2010 in Europe, 17 370.0 MWp originated from Germany. This corresponds to a share of almost 60%, whereas the respective shares of much sunnier countries such as Greece and Portugal were as low as 0.7% and 0.44%[248].

Fostering the use of cooperation mechanisms is part of the solution, but another way of promoting a more optimal distribution of renewables is by helping reduce the differential in costs of capital for renewable projects in Europe.

247. Thilo Grau (2014), "Comparison of Feed-in Tariffs and Tenders to Remunerate Solar Power Generation", DIW Berlin, Discussion Paper 1363
248. German Council of Economic Experts (2011), "Chapter 6: Energy policy: Effective Energy Transition only in the European Context", in Annual Report 2011/12, *Assume responsibility for Europe*

The relative under-deployment of renewable production in certain eastern and southern European countries is partly explained by lower levels of support and specific risks related to renewable developments, but it also partly reflects high levels of country risk priced into the cost of equity and debt (figure 4). The reduction of this cost of capital gap should be one of the guiding criteria for the allocation of EIB loans to renewables.

FIGURE 4 ► Cost of capital estimates for onshore wind projects by country, 2015



Source: International Energy Agency, World Energy Investment 2016, p. 130

3.5.2. Support interconnection

An important part of the decarbonisation agenda is the ability to rely on a broad geographic basis to bring low-carbon generation to consumption centres and accommodate variable supply with limited disruptions. In particular, a more integrated energy market would help reduce the variability of supply induced by some renewable electricity sources (especially wind), reduce the variability of supply thanks to more diverse energy behaviours by consumers, and, by increasing the size of the market, reduce the need for back-up carbon-intensive capacity mechanisms.

Integrating the electricity market requires both physical infrastructure interconnecting national grids and regulatory integration and cooperation to facilitate Union-wide trade in electricity. As regards physical infrastructure, the EU has set itself a goal of rising interconnection capacity to 15% by 2030.

According to the 2016 Ten Year Network Development Plan (TYNDP), to reach this number interconnection capacities in Europe should double by 2030 on average[249].

The most relevant and needed interconnection infrastructures are in the list of key European energy infrastructure projects defined as Projects of Common Interest (PCIs). The EU level favours the development of these projects by requiring member states to streamline and accelerate permit procedures, proposing a clear regulatory regime and through some EU-level dedicated financial instruments, particularly the Connecting Europe Facility (CEF). Despite all these measures, there are still some aspects that hamper the implementation of these projects.

First, while the EU regulation on energy PCIs[250] requires member states to accelerate and simplify permit granting procedures for these projects, national permit procedures for cross border projects are still complex and constitute the main reason (58%) for delays reported by PCIs project promoters[251]. The problem mostly lies on the lack or weak implementation of existing EU regulations' dispositions[252].

Second, although PCIs are meant to be a priority at a European level, many of them are not recognized as a national priority in all concerned member states and are thus not included in the respective National Development Plans. This generates uncertainty and disincentive potential private promoters to take clear financial engagements for these projects[253].

Third, whereas the total expected investment cost of the 109 energy PCIs is €52.5bn[254], EU budget for energy PCIs is very small. The CEF budget for energy PCIs amounts to only €5.4bn for the whole 2014-2020 period, and even if it consists of grants and financial instruments managed by the EIB (and thus have the capacity to leverage additional private funding) it is very limited[255].

249. ENTSO-E, *2016 Ten Year Network Development Plan—Executive report*
250. Regulation (EU) No 347/2013 of 17 April 2013 on guidelines for trans-European energy infrastructure
251. ACER, *Consolidated report on the progress of electricity and gas projects of common interest for the year 2015*, July 2016
252. For instance, the EU regulation obliges member states to create a "one-stop-shop" in charge of managing permits for PCIs but according to a report commissioned by the European Commission, even though member states have by now established a "one-stop-shop", in practice these offices have not been given sufficient powers to perform their duties (ENTSO-E, *A push for Projects of Common Interest*, Insight Reports, 2016)
253. ACER, *ibid.*
254. ACER, *op.cit.*
255. The original budget for CEF energy was €5.85bn but in November 2015 CEF budget was cut in order to liberate funds to finance the new EU guarantee fund supporting EFSI.

Recently, additional EU funding has come from the new European Fund for Strategic Investment (EFSI). Indeed, the Fund has invested 290 million on energy infrastructures in the first year of functioning, mobilising €2.8bn of total public and private investment[256]. However, not all this funding has gone to energy PCIs. Besides, existing evaluations show that the complementarities between CEF and EFSI have not been exploited and the two funds have been used as competing instruments, with the EIB using EFSI to finance projects that would have been eligible for CEF-financial instruments[257].

As regards CEF, one should also highlight that an important part of the funding disbursed so far has gone to gas networks[258], despite the fact that the CEF regulation[259] specifies that the planned financial budget must be mainly allocated to electricity infrastructure projects, "based on the expected preponderance of electricity in Europe's energy system over the next two decades". There is a risk that some of these gas networks become unnecessary in the medium-term as a result of further deployment of renewables and energy efficiency efforts.

The focus on gas networks reveals that sustainability aspects are not sufficiently integrated in the procedures for the selection of CEF projects, and that short-term considerations usually prevail in the allocation of funding (see box 5). It also reveals that energy demand projections used for CEF funding are not in line with EU climate objectives and the new Energy Efficiency First principle[260]. This is due to a larger problem with the European Commission consistently over-estimating future gas demand. The projections it uses are not done in-house but by external contractors, and appear so flawed that in a 2015 report the European Court of Auditors stated that "The [European] Commission has persistently over-estimated gas demand … and needs to restore the credibility of the forecasts it uses."[261] Fixing this problem requires projections to be done by an independent body with relevant expertise (see chapter 1. for more details).

256. European Commission, "The Investment Plan for Europe and Energy: making the Energy Union a reality", Fact Sheet, June 2016
257. EY, *Ad-hoc audit of the application of the Regulation 2015/1017 (the EFSI Regulation)*, Report commissioned by the European Commission, 14 November 2016
258. By the end of 2016, 75 actions have received funding from CEF energy, amounting to a total of 1.2bn. Almost 70% of the funding (824mn) has gone to gas projects. See CEF Energy, key figures.
259. Regulation No. 1316/2013 of 11 December 2013 establishing the CEF
260. According to a paper by the European Climate Foundation, the gas demand projections used for funding decisions under the Connecting Europe Facility 21 are 30% higher than the Commission's reference scenario for gas demand in 2030. They are 72% higher than projections if a 30% energy savings target is met.
261. European Court of Auditors, "Improving the security of energy supply by developing the internal energy market: more effort needed", Special Report n°16, 2015 : point No. 70, p.37

BOX 5 ► Climate-related considerations in the selection of CEF energy projects

Projects that receive support from CEF go through a two-stage selection procedure. They should be first defined as "projects of common interest" (PCIs) through a specific criterion and processes involving a range of stakeholders and external experts as well as the Commission. To become PCIs, projects go through rigorous assessment that includes climate change factors. However, according to a 2015 evaluation report on climate mainstreaming in centrally managed EU funding programmes[262], "there is no guarantee that climate change issues—mainly GHG emissions balances and consideration of vulnerability to climate change impacts—have been assessed thoroughly or that options to maximise climate action have been strongly considered".

Being defined as PCIs does not give automatic right to CEF funding. To receive funding, the project must apply to specific calls for proposals and it only obtains funding if it is well-ranked according to several award criteria established by the CEF regulation (general award criteria) and by the specific Work programmes announcing the calls for proposal (specific award criteria). These award criteria include aspects such as the maturity of the action, impact and number of member states involved, soundness of the implementation plan, the grant's contribution to overcoming financial obstacles or the priority and urgency of the action. As noted by the 2015 evaluation report cited above, none of the award criteria used so far refer to climate change or even sustainability aspects of the CEF projects.

3.5.3. Optimize direct financial support to renewables

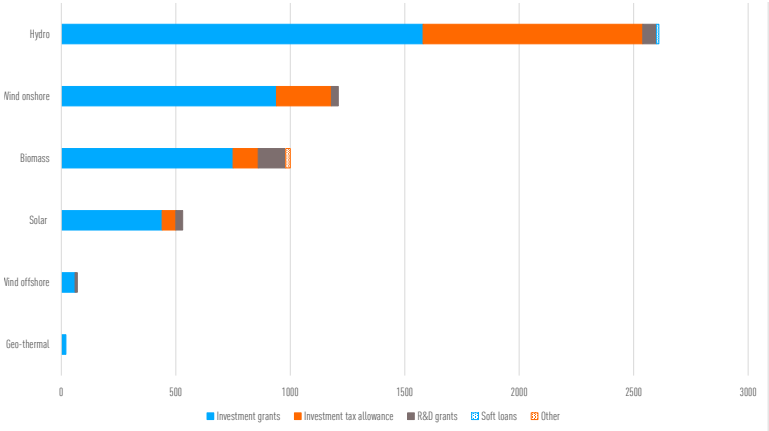
In addition to the support provided to renewables through market schemes (feed in tariffs, feed in premiums, auctions and tenders), public authorities support investment in renewables through direct funds, be in form of grants, soft loans, tax exemptions or other type of financial support.

According to a 2014 ECOFYS study[263], the financial support to renewables through grants, soft loans and tax exemptions amounted to €5.4bn in 2012. This figure includes both support from the national and the EU level. The figure 5 does not include the support provided by public financial institutions such as the EIB or the National Promotional Banks (NPBs), which play a significant role in the provision of concessional and non-concessional lending, guarantees or other risk-sharing support and equity investment. The EIB support to renewables, for instance, amounted to €3.3bn in 2015 (EIB 2016)[264] and

262. Milleu Ltd, Study on climate mainstreaming in the programming of centrally managed EU funds, Final report produced on behalf of DG CLIMA, 2015.
263. ECOFYS (2014a), op.cit.
264. EIB activity report 2015, EIB, 2016

KfW's support to renewables was estimated at €7.93bn in 2012 (Cochran et al 2014)[265]. In the case of the EIB, most of the support is provided in form of direct loans to large-scale renewable projects (particularly wind onshore and offshore projects)[266].

FIGURE 5 ► Direct financial support to renewables per type of intervention and technology, 2012 (in millions of euros)



Source: ECOFYS 2014[267]

A thorough analysis of the cost-effectiveness of these various forms of financial support is out of the scope of this paper but some general points can be raised as regards to the potential of these financial instruments and the way of optimize their use.

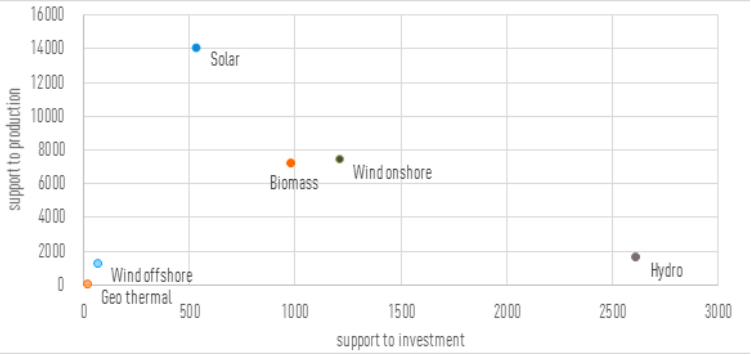
A first important point is the need to ensure complementarity between policy measures in support to renewables. As seen in section 3.5.2., member states already provide significant support to the deployment of renewables through market-based schemes that guarantee a minimum revenue for their production (feed in tariffs, feed in premiums, auctions and tenders). Direct financial support through grants and loans should be complementary to that, by focusing on immature RES technologies or on projects confronted to some particular

265. Cochran, I. et al. (2014), "Public Financial Institutions and the Low-carbon Transition: Five Case Studies on Low-Carbon Infrastructure and Project Investment", OECD Environment Working Papers, No. 72, OECD Publishing
266. EIB Evaluation of EIB financing of Climate Action (mitigation) within the EU 2010-2014. Synthesis report, September 2015
267. ECOFYS (2014a), op.cit.

obstacles (e.g. small-scale projects, RES projects in member states in which the cost of capital for long-term risky investment is prohibitively high...).

Figure 6 shows the level of support to production (that is, through market-based schemes) and the support to investment (through grants, tax allowances or soft loans) per different RES technologies. Overall, there is an inverse relationship between these two types of support, which seems to indicate some complementarity between RES support interventions. However, the graph also shows that, in aggregate terms, some RES technologies (wind offshore and geothermal) receive much lower public support than others (solar, hydro and wind onshore)[268]. Given that these two RES technologies (geothermal and wind off shore) are also those for which deployment is slower than expected according to member states' National Renewable Action Plans[269], increasing the level of public support for them seems advisable.

FIGURE 6 ► Support to production vs support to investment per RES technologies in the EU (national +EU support), 2012 (in million€)



Note: support to production includes feed-in tariffs, feed in premiums and RES quotas with tradable certificates. Suppport to investment includes grants, soft loans and tax allowances.
Source: own elaboration based on data from ECOFYS 2014

Another worrying aspect is the type of financial support provided to RES. As seen in figure 5, around 75% of financial support is in form of grants, with a

268. The picture changes if we look at support in relative terms (that is, per MhW of electricity produced). In relative terms, solar is by far the RES technology receiving more support (220€ per MWh), followed by Wind offshore (€120 per MWh), Biomass (€60 per MWh) and Wiind onshore (€50). Geothermal and Hydo are those receiving less support (€10 per MWh). Source: ECOFYS 2011, annex 3.
269. European Commission, Renewable Energy Progress Report 2017

minimal part of it consisting of R&D grants. This is surprising, given that RES projects are for the most part financially viable even if suffering from specific technological, regulatory and financial risks, and grants seem only appropriate to support the development of RES technologies in the pre-commercialisation phase.

A second point is the need to guarantee the added value of EU-level funding. A 2014 audit from the European Court of Auditors (ECA) analysing 24 RES projects financed by cohesion policy funds in the period 2007-13 concludes that the European Structural and Investment Funds (ESIF) had a limited EU added value in this area. The audit points in particular at risks of funding replacement in certain member states, in which ESIF funds were simply used to complement national grants for RES creating situations of deadweight, and with no "operational value added" on the investment projects financed[270]. The ECA also concludes that the allocation of public funds to RES generation was not based on a systematic analysis of efforts needed at national or regional level to reach the EU objectives in RES deployment, and that the operational programmes did not establish performance indicators for assessing the contribution of the EU funds to the committed RES targets.

ESIF programming has surely improved in the 2014-20 period, as member states are now required to plan their interventions in accordance to a strategic document negotiated with the Commission (Partnership Agreement), and in particular to align ESIF investments on RES to their National renewable Energy Action Plans (NREAPs). However, at the micro-level, risks of overlap and funding replacement between EU and national spending may still exist. For the post 2020 period, EU regulations should make sure that procedures and criteria for the selection of projects systematically include an analysis of additionally vis-a-vis national support schemes.

3.5.4. A more coordinated approach to boost energy efficiency investment

While the EU has made significant progress in energy efficiency and while the EU's 2020 objective has been already met, the level of investment in energy efficiency in Europe is still below its economic potential[271]. There is also growing recognition on that more ambitious energy efficiency targets for 2030 would be beneficial in that

270. European Court of Auditors, "*Cohesion policy funds support to renewable energy generation—has it achieved good results?*", Special Report No. 6, 2014
271. EEIF Report, "Energy Efficiency – the first fuel for the EU Economy. How to drive new finance for energy efficiency investments", February 2015

they would help attain EU´s long-term climate goals in a more cost-efficient manner and would have positive effects in terms of jobs and growth.

At the EU level, there is now full recognition on the need to strengthen efforts in energy efficiency investment and much has been done in this direction over the last years. Apart from a revision of the EU's directive on energy efficiency and the Commission´s proposal to raise the EU's energy efficiency target for 2030, the amount of European structural and cohesion funds devoted to energy efficiency has significantly increased (from €6.1bn in 2007-2013 to €18.4bn in 2014-2020) and there have been improvements in their use and geographical allocation. The EIB has also defined energy efficiency as a priority[272], and the creation of the European Fund for Strategic Investment (EFSI) has allowed the Bank to increase by three its lending to energy efficiency projects (from €1.29bn in 2012 to €3.62bn in 2016)[273] . Finally, various dedicated EU-level instruments have been created over the last years to unlock private investment on energy efficiency and help structure energy efficiency projects, such as:

- The European Energy Efficiency Fund (EEEF), a public-private partnership created in 2011 by the European Commission, the European Investment Bank (EIB), the Cassa Depositi e Prestiti (CDP) and Deutsche Bank.
- The "Private Finance for Energy Efficiency"(PF4EE), a financial scheme created in 2014 as part of the LIFE Programme
- A series of Project Development Assistance facilities, among which the European Local Energy Assistance (ELENA), that provides technical assistance to local authorities to help them develop bankable sustainable energy projects[274].

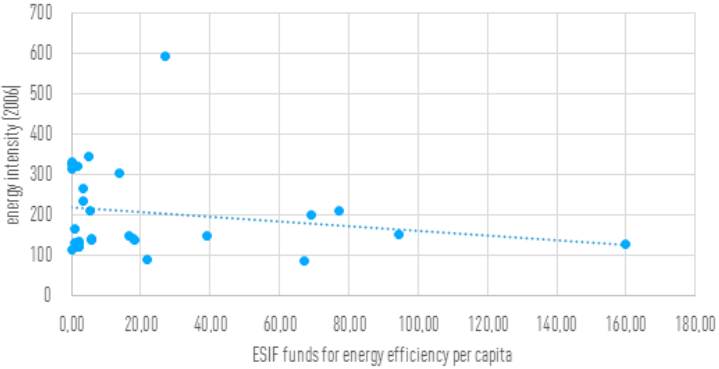
BOX 6 ► Improvements in the geographical distribution of ESI funds for energy efficiency

The amount of ESIF in support to energy efficiency has not only increased during the last programming period, but there is also evidence of qualitative improvements in the way of using these funds. One of these evidences regards the geographical distribution of ESIF funds. As shown in graphics 7 and 8, unlike in the previous programming period[275], there is now a clear correlation between amounts of ESI funds allocated

272. EIB Climate Strategy, September 2015
273. Isidoro Tapia, EIB support to energy efficiency, including the European Fund for Strategic Investments, PPT presentation at the seminar "Financing energy efficiency: lessons from successful Horizon 2020 projects and other initiatives across Europe", Brussels, Residence Palace, 30 March 2017
274. These PDA facilities are financed by the programme Horizon2020, and comprise 4 ELENA facilities (European Local Energy Assistance), managed by four public banks (EIB, KfW, CEB and ERDB), and the MLEI facility (Mobilising Local Energy Investment) managed by the European Agency for small and medium-size enterprises (EASME).
275. See Thomas Pellerin-Carlin,-chapter Juncker Plan study (2016)

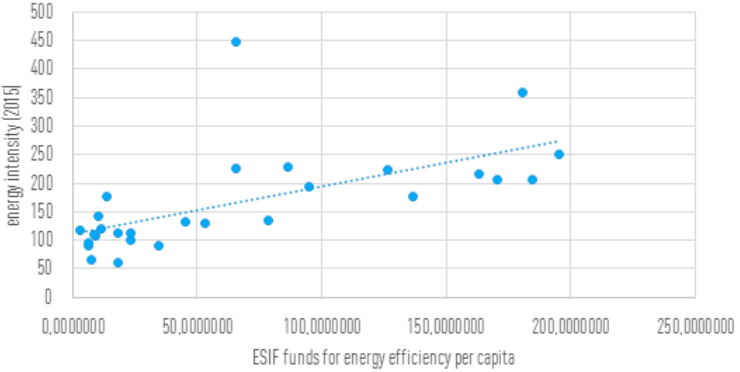
to energy efficiency and member states' energy intensity (which is a proxy of investment needs in energy efficiency). This better geographical alignment of ESIF funds probably reflects the improvements introduced in the ESIF programming procedures, particularly the obligation by member states to plan their interventions in accordance to a strategic document negotiated with the Commission (Partnership Agreement) and to align the use of ESIF with National Energy Efficiency Action Plans.

FIGURE 7 ► Energy intensity vs ESIF spent on energy efficiency (per capita), 2007-2013



Source: own elaboration with data from DG REGIO and Eurostat

FIGURE 8 ► Energy intensity vs ESIF allocated to energy efficiency (per capita), 2014-2020



Source: own elaboration with data from DG REGIO and Eurostat

In its Communication "Clean Energy for all Europeans" of November 2016, the Commission has announced its intention to "put energy efficiency first". As part of this commitment, it has included a new EU financial initiative to unlock private investment on energy efficiency and renewable investment in buildings. Called "Smart Finance for Smart Buildings", this new initiative aims at unlocking up to €10bn of additional public and private funds until 2020 (box 7). The initiative is well-conceived, and addresses many of the challenges highlighted by a working group of experts in an influential 2015 report[276], namely: the need to optimise the use of public funds through more efficient blending of grants and loans, the need to support aggregation of small-scale projects to reduce transaction costs and attract large financial actors, and the importance of providing free-of-access, reliable and trusted energy efficiency investment performance data to reduce uncertainty for private investors. However, it is a partial initiative (as only covers the sector of buildings, representing 40% of total energy consumption) and, more importantly, its success crucially depends on collaborative action at the member states' level.

BOX 7 ► The "Smart Finance for Smart Buildings" Initiative

The "Smart Finance for Smart Buildings" initiative is a new initiative launched by the European Commission to support the deployment of energy efficiency measures and use of renewable energy sources in buildings. The initiative contains various measures, particularly:

- A commitment by the EC and the EIB to support the establishment of dedicated investment platforms for energy efficiency investments in buildings. The goal is to set up one of these platforms in each MS. Platforms would enable the combination of different funding strands (ESIF, EFSI, national funds) and the deployment of attractive financing products for actors in the energy efficiency market.
- A commitment to encourage member states to develop local or regional "one-stop-shops" for energy efficiency project developers, covering the whole range of needs (information, technical assistance, structuring and provision of financial support, monitoring of savings).
- A reinforcement of the EU project Development Assistance Facilities for public authorities (ELENA and MLEI), with an increase of their annual budget from 23mn in 2015 to 38mn in 2017.
- The establishment of a De-risking Energy Efficiency Platform (DEEP) database, an open access database providing information of the technical and financial performance of over 7,000 energy efficiency projects across Europe.
- The development of guidance material on how to evaluate the risks and benefits of energy efficiency investments.

276. EEIF Report, ibid.

To fully unlock the potential of the energy efficiency market and optimize the use of public funds, further action is needed.

First, it is of utmost importance to guarantee full implementation of EU legislation on energy efficiency. As pointed out in the EEFIG report, the provision of project development assistance certainly helps developing energy efficiency projects but only when combined with strict building regulations, complementary policies forcing decision makers and private actors to focus on energy savings (e.g. ambitious energy efficiency targets for public authorities, energy savings obligations for energy suppliers) and the removal of all perverse incentives (such as subsidies to energy consumption). EU regulations on energy efficiency targets and energy performance of buildings are ambitious, and the Commission has recently proposed to updated them upwards. However, the effective transposition of EU regulations at the member state level is weak and partial. The current Energy Efficiency Directive, adopted in 2012, has still not been legally transposed in many member states (despite the fact that the period for doing it ended in 2014), and according to the Commission the main reason for this lack of transposition is the lack of political willingness. In the coming years, the Commission shall take more decisive action to secure the transposition of these Directives. A way of doing so could be by clearly requiring the transposition of the directives as ex-ante conditionality for the use of ESIF funds in the field of energy efficiency. A complementary way forward is to empower national actors who can engage to ensure the proper enforcement on EU law at the national level (see chapter 1., section 1.2.4-5.).

Second, and related with the previous point, the Commission should pressure member states to develop a medium-term strategy to get rid of all distortive tax subsidies to energy consumption, which hamper investments in energy efficiency (see chapter 1.).

Third, there is a need to better coordinate and streamline the various EU and national programmes providing finance and support to energy efficiency projects. According to the Staff Working Document accompanying the proposal of EU directive on energy efficiency[277], today there are about 200 energy efficiency financing schemes in operation across different member states and at least 6 different EU funding strands providing support to energy efficiency projects. In some cases,

277. Impact assessment accompanying the proposal for a Directive of the European Parliament and of the Council amending Directive 2012/27/EU on Energy Efficiency Brussels, 30.11.2016 SWD(2016) 405 final PART 1/3

various schemes address the same sectors and the same beneficiaries in the same member states, with different intensity of public support and competing solutions.

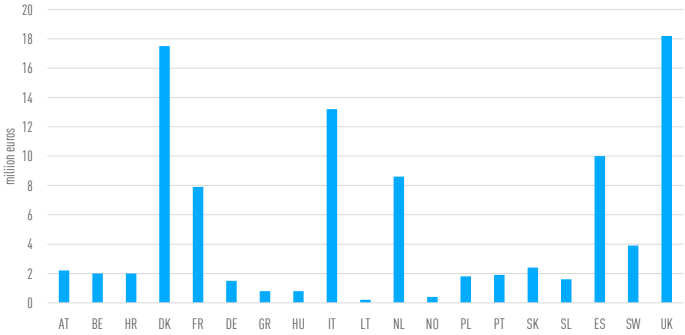
Establishing "one-stop-shops" at national and regional level (as proposed in the "Smart Financing for Smart Buildings" initiative) is essential to reduce risks of overlaps and secure coordination. However, the same effort has to be done at the EU level. In principle, the new European Investment Advisory Hub (EIAH) created by the Juncker Plan is mandated to act as a "single point of entry" for all authorities and project promoters requiring information and project assistance for investments within the Union[278]. To date, however, the capacity of the EIAH itself is not yet sufficient to perform this role. This is partly explained by the short time the EIAH exists (it was created in September 2015), but the budget allocated to EIAH is very limited and the capacity of the EIAH to reach all the whole territory in the Union depends on the establishment of voluntary agreements for the provision of services with National Promotional Banks (NPBs) or other local partners (e.g. cohesion policy's management authorities). As NPBs and national governments do not have the same capacity to provide such services, there might be inequalities in the capacity of EIAH to reach the territory[279]. To prevent this to happen, the budget of the EIAH should be enhanced. It would be also recommendable to set up a program to encourage the exchange of staff between NPBs involved in the provision of EIAH services[280].

Fourth, related with the last point, there is a need to guarantee the added value of EU interventions vis-à-vis national-level interventions. In many cases, this additionality stems from the capacity of EU-level policies to reduce territorial inequalities, helping those territories having the greatest needs and/or those least equipped to face these needs. In the case of energy efficiency investment, there is a strong correlation between needs and capacities: those EU member states having the largest investment needs in energy efficiency are mostly located in central and eastern Europe, and they are also those having the largest capacity gaps and least experience in the use of financial instruments. Thus, logically, they should be the main target for EU-level interventions. However, whereas the geographical distribution of ESIF funds for energy efficiency responds to this logic (see box 7), this is not the case for the provision of other EU-level technical assistance.

278. Article 14.2 a) of EFSI regulation: *:" The EIAH shall provide services in addition to those already available under other Union programmes, including: (a) providing a single point of entry for technical assistance for authorities and project promoters (..)*
279. See Rubio Eulalia, Rinaldi David and Pellerin-Carlin Thomas, "Investment in Europe: Making the best of the Juncker Plan", Studies and Reports No.109, Jacques Delors Institute, March 2016
280. Rubio et al, op. cit.

If we look at the geographical distribution of the 97 projects funded by ELENA and MLEI, for instance, the first two countries by number of projects are the UK and Denmark, which are both countries ranking very well as regards to the energy intensity of their economies and with public administrations well-experienced in sustainable energy field and the use of financial instruments. This bias towards countries having powerful public administrations and sophisticated financial markets seems to be present in other EU technical assistance facilities: thus, for instance, the UK also appears as the main beneficiary of the technical assistance provided by the new European Investment Advisory Hub (EIAH)[281].

FIGURE 9 ► Geographical distribution of Project Development Assistance (PDA) grants between 2009-2016 (€mn)



Source: PwC, Evaluation of the Project Development Assistance implemented under the Intelligent Energy Europe. Final Report. February 15th 2016

Finally, while the EU focus on buildings is understandable (as it is the sector with greater potential for energy efficiency savings), it is also essential to take bold action in the field of transport. Transport's final energy consumption has decreased by 6% between 2005 and 2013 but about 40% of this reduction is estimated to be due to the economic crisis, with stabilisation of passenger traffic and a fall in freight traffic. If nothing is done, there is a risk that transport's energy consumption increases again as the EU economy recovers its shape.

281. EY, Ad-hoc audit of the application of the Regulation 2015/1017 (the EFSI Regulation) Final Report, 14 November 2016 https://ec.europa.eu/commission/sites/beta-political/files/ey-report-on-efsi_en.pdf

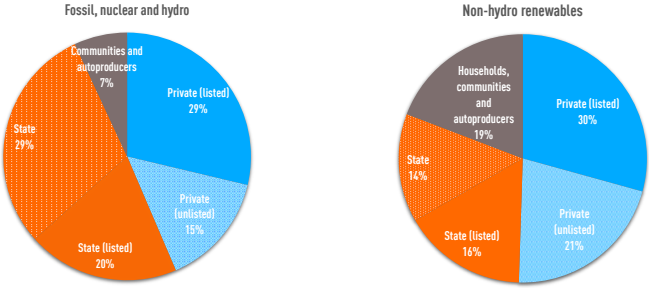
The investment needs in the field of transport are massive (figure 1). Action is needed in two fronts. First, we need decisive actions to support the deployment of electric vehicles. This requires strengthening EU regulation and procedures to control vehicles' CO2 emissions, removing all distortive tax exemptions on fuel and supporting (through regulatory measures and direct financial support) the development of alternative fuels and the deployment of charging points (see chapter 1.). Second, it is essential to ensure that all public investments in transport infrastructure are aligned to EU and national climate commitments.

3.5.5. Support citizens' empowerment

While investment in the energy sector has traditionally been made by large companies on the basis of their own retained earnings, with the rapid growth of renewables the ownership structure of energy supply is changing, and so the profile of investors in the energy market.

In particular, new investors such as households, local energy communities and prosumers are playing a significant role in the expansion of renewables and they now own around 19% of the non-hydro renewable capacity in the world (figure 10). In the EU, the figures are even higher: non-traditional investors now own more than half of the non-hydro renewables capacity [282] and in countries such as Denmark private individuals own 85% of the country's wind turbines.

FIGURE 10 ► Ownership of global power generation assets in 2012



Source: IEA, 2014

282. IEA 2014, p.110

This decentralisation is a positive trend, and it has been recognised as such by the European Commission. Placing citizens at the core of the transformation allows them to take ownership of the energy transition and also to better control their energy costs. However, to convert citizens into active prosumers and give them control over consumption, public authorities need to put into place a favourable regulatory and financial context. As regards the regulation, the Commission has recently proposed a revision of the Directive on the internal market for electricity which, among other things, includes changes to enhance the capacity of citizens to manage consumption, store or sell self-produced energy in the market. It has also proposed changes to allow local actors (associations, cooperatives, non-profit organisations) build and manage their own distribution networks through the establishment of local energy communities (LECs). All these changes are key for more democratisation and decentralisation of the energy market, and need to be supported.

As regards finance, one should be aware of the fact that citizens do not usually have the financial means and capacity to undertake investments in energy production (e.g installation of a solar panel in the roof, of a wind turbine for farm use) or in energy efficiency (e.g. rehabilitation of old building) based on their own resources, and thus that they are largely dependent on access to external sources of finance. Small-scale citizens' investment is also hampered by high transaction costs, lack of awareness on potential sources of public support, a general lack of skills to assess costs and opportunities for low-carbon investment and lack of experience with the financial sector.

Some actions could be put into place to enhance and improve support to citizens' empowerment.

To start with, there is a need to strengthen support to local authorities engaged in the energy transition. Local authorities are crucial actors in the fight against climate change. They often have at least partial control on urban and transport planning, waste and water management and in some cases public power utilities. They are closer to citizens, and therefore local action can also more easily allow citizen participation. In addition to that, local and regional authorities can play a crucial role in support to citizen investment in energy efficiency, smart metering and renewables. With the establishment of dedicated low-carbon funds, programmes or other types of financial schemes, they can bundle dispersed individual projects into systemic investments and make them bankable. They can also serve as intermediates between citizens and low-carbon national or EU funding opportunities, which are usually unknown and difficult to approach for citizens.

Many local and regional authorities are already playing this role. The Covenant of Mayors covers 7,300 local authorities representing 230 million EU citizens, and these authorities have taken strong commitments in favour of climate, particularly with the development of Local Sustainable Energy and Climate Action Plan (SECAP) and the participation in a voluntary system for monitoring the implementation of these plans. The Covenant helps these local authorities by publishing guidance materials and tools, promoting networking and the exchange of best practices through dedicated events and city twinning programmes and providing information of EU funding opportunities such as ESIF, European Local Energy Assistance (ELENA) or the European Energy Efficiency Fund (EEEF).

BOX 8 ► The Covenant of Mayors for Climate and Energy

The Covenant of Mayors for Climate and Energy gathers around 7,300 local and regional authorities across the EU that voluntarily commit to implement the EU's climate and energy objectives on their territory. Signatory public authorities pledge action to support implementation of the EU 40% greenhouse gas-reduction target by 2030 and the adoption of measures to tackle adaptation to climate change.
In order to translate this political commitment into practical measures and projects, Covenant signatories commit to submit a Sustainable Energy and Climate Action Plan (SECAP) outlining the key actions they plan to undertake and to report every two year on the implementation of this plan, on the basis of a common monitoring and reporting template.

Source: www.covenantofmayors.eu

Most EU funding opportunities, however, target national and regional authorities, not local authorities. There is only one specific EU programme to provide technical assistance to local authorities, the Project Development Assistance (PDA) programme, but it has a limited budget. According to the Covenant of Mayors' website, on June 2017, of the 7.408 Covenant of Mayors' signatories, 5.875 have presented a Sustainable Action Plan and 4.653 plans have been approved by the EC. However, "only" 94 projects have been supported under the PDA, and most of the beneficiaries are big cities. There is a need to extend EU technical assistance in support to local authorities, and to make sure the latter arrives to small municipalities. The European Commission, for instance, could encourage member states to reserve part of its structural funding to support local authorities engaged in the energy transition.

A second important step is reinforcing the capacity of local commercial bank to finance low-carbon projects, particularly in the field of energy efficiency. In the EU, more than in other developed economies, banks play a crucial role in financing investments of consumers and enterprises. They often have a rich knowledge of the local market as well as a pre-existing relation with the potential investors. However, too often they lack the skills and capacity to identify investment opportunities related with energy efficiency, and their investment horizons are shorter than those required for these types of low-carbon energy projects.

Public promotional banks play a major role in supporting commercial banks' lending on low-carbon projects. The German National Promotional Bank (KfW), for instance, has a long record in supporting small-scale energy efficiency and renewable projects through intermediated financing by local financial institutions. They give programmatic loans to the commercial banks to invest in these areas, hence inducing the banks to finance on these areas while building on these local financial institutions' knowledge of their respective markets.

Funding alone, however, is not always sufficient. Local banks require technical assistance and support to assess risks and benefits of small scale low carbon projects. In this respect, the EU has also launched an interesting pilot programme to support the role of commercial banks on low-carbon investment. The programme, called "PF4EE" (private funding for energy efficiency), is managed by the EIB and provides both funding and technical assistance for commercial banks financing energy efficiency projects. The approach of the programme is very interesting, but its size is still modest. It seems advisable to extend this programme in the years ahead and/or replicate it at national level.

3.5.6. Unlock the potential of the green bond market for the energy transition

Green bonds are a relatively new class of assets that are very promising for expanding the investment in low-carbon technologies and infrastructures. They differ from conventional bonds in the commitment of the issuer to exclusively use the funds raised to finance or re-finance "green" projects, assets or business activities.

The first green bond was issued in 2007, and since then, the market of green bonds has grown exponentially, with the annual issuance in green bonds amounting to $40bn in 2015. The issuers of green bonds are multiple; approximately half

of the green bonds are issued by governments, municipalities or public financial institutions and the other half are issued by big financial and non-financial corporates, including public utilities (OECD 2015)[283].

Green bonds have many benefits. They help issuers better communicate their sustainability strategy and responsible investors broaden their investment portfolios. They provide institutional investors with an important stream of resources to finance their long-term climate strategies. At the same time, however, green bonds encounter some problems and have a number of limitations. A major problem is the lack of common green definitions and standards, which may hamper the environmental integrity of these bonds and poses risks of "green-washing" if the market continues to expand (Shishlov et al, 2016[284]). Another problem is that, so far, green bonds have not stimulated new investments on low-carbon projects. This is because green bond issuers are for the most part big companies and/or public actors having no problems to access to external finance. Thus, these actors would have been able to finance the same green projects or activities even in the absence of green bonds.

To convert green bonds into effective instruments to mobilise additional investment for low-carbon projects there is a need to correct these two problems. In particular, apart from supporting the establishment of common definitions and standards of "greennees" and common monitoring and reporting procedures, EU public authorities should develop specific policy initiatives to make sure "green bonds" have a genuine additional effect, that is, that they serve to mobilise investment for projects which would not have been financed otherwise. Two policy initiatives could be envisaged.

First, there is a need to bring smaller and risky projects to the green bond market. In theory, this can be done by pooling risk through securitisation (that is, issuing green "asset backed securities" to finance a pool of small low-carbon projects) but the market is not doing it enough. The EU and member states could encourage this practice by providing public guarantees to this type of green bond pooling projects.

Second, member states could incentivize the use of green bonds to finance low-carbon projects clearly aligned with national long-term decarbonisation

283. OECD, *Green bonds: Mobilising the debt capital markets for a low-carbon transition*, policy perspectives, December 2015
284. Igor Shishlov, Romain Morel and Ian Cochran, *Beyond transparency: unlocking the full potential of green bonds*, june 2016, Paris, I4CE

strategies. This could be done through tax exemptions or other measures to lower the cost of capital of certain ´green bonds. This type of measure would require strict monitoring and evaluation procedures to identify the eligible green bonds.

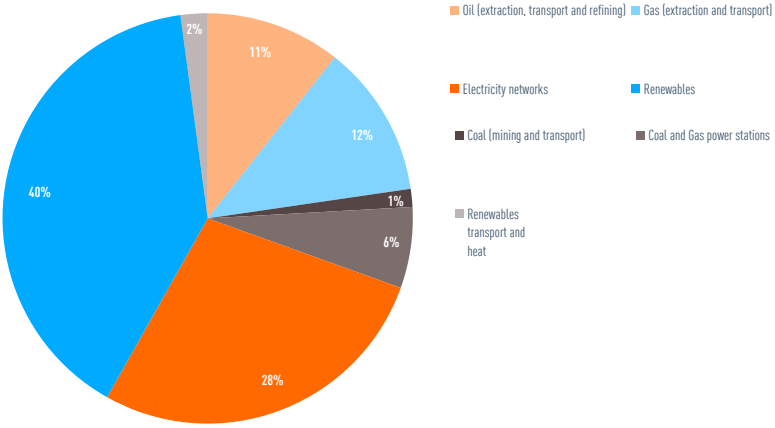
3.6. Incorporate climate considerations in all public and private investment decisions

Having more and better dedicated public measures in support to low-carbon investment is important, but not enough to secure the energy transition. A move towards a low-carbon economy will only be possible if there is a general re-allocation of capital from high-carbon to low-carbon assets and infrastructures.

This requires the establishment of a common and effective carbon price covering all economic activities but also the integration of climate considerations into the functioning of the whole financial system and effective climate mainstreaming for all public investment decisions. Public and private investment in the world and its financing is still biased towards high-carbon and insufficiently resilient to the consequences of climate change. Despite the growing commitment of private investors in favour of climate, green investment still accounts for only 1-2% of institutional investors' portfolios[285] (around 1-2%, figure 4) and only 0.2% of total bond issuance in the world is made up of labelled green bonds. If we look more particularly at the energy sector, there has been a major push in investment on renewables, but fossil-fuel investment (that is, extraction and transport of fossil fuels and coal and gas power stations) still represents 30% of total investments in energy supply (figure 11). As many energy-related investments typically imply a horizon of 10-15 years or more, continuing to invest in high-carbon projects will lock our economies into the wrong long-term path.

285. Rademaekers, K. et al (2017), *Assessing the European clean energy finance landscape, with implications for improved macro-energy modelling*, study for the European Commission, DG Energy.

FIGURE 11 ► Investment in power supply in the EU, 2015



Source: IEA, World Energy Investment 2016

3.6.1. Towards a "Green" Capital Market Union

The move towards a low-carbon economy requires a mindset change among financial institutions and actors, and a general redefinition of rules governing the financial system. In other words: "financing climate change requires changing finance"[286].

Aligning the financial system to climate goals is good for the society as a whole but it is also a rational strategy from the point of view of private actors. They urgently need a better understanding of the relevant climate-related investment risks, which the Financial Stability Board (FSB) has divided into three categories: physical, transitional, and liability. For this purpose, they need more uniform data and methods to assess these risks and opportunities, and a pre-requisite for that is more and better disclosure and reporting of GHG emissions by non-financial and financial corporations.

From the point of view of public authorities, it is also important to assess and control the potential risks that climate change poses for the stability of the whole financial system. The last financial crisis has shown the significant and

286. Schellhubner, Hans Joachim et al, *Financing the Climate- Change Transition*, Project Syndicate, Nov 14 2016

long-lasting effects that financial crises have on economies and societies, and thus the need to carefully assess risks and provide the right prudential framework to prevent them to materialise, which is critical to overcome what Bank of England Governor Mark Carney has termed the "tragedy of horizon" (that is, the tendency of private financial actors not to factor in long-term risks into their decision-making practices)[287].

BOX 9 ► Climate Risks

The Financial Stability Board (FSB) divide climate risks into three groups:

- "physical risks", referring to risks of extreme weather events or major negative impacts of climate change on natural resources. These physical events can cause major operational disruptions in the corporate sector and households, endangering their capacity to service debt and in turn impacting the financial sector.
- "Transition Risks", referring to the risks for financial and non-financial corporates to fail to adjust to the low-carbon transition. Thus, for instance, policy measures to curb emissions can leave fossil-fuel companies saddled with "stranded assets" (large scale of carbon reserves that can be no longer exploited), or can entail rising operating costs for firms emitting high levels of CHG emissions.
- "Liability Risks", referring to the risk that climate change damages translate into large and unforeseen liabilities to insurers through third-party liability policies such as personal indemnity or corporate director's and officer's insurance.

Awareness of the risks that climate change pose to the whole financial system has been building among member state financial regulators: The Bank of England's Prudential Regulation Authority (PRA) recently published an assessment of climate risk to the UK insurance sector, identifying how physical, transition and liability risks may affect firms and policy holders and this approach has been taken up by other European central banks. In Sweden, the Financial Services Authority (FSA) published an assessment of banks' internal rules for credit and lending from an environmental perspective in December 2015, and in France the recent Energy Transition Act mandates the government to report on how to assess climate-related risk in the banking sector, and requires asset managers and institutional investors to report how climate related risks—both physical and transition risks—are taken into account and how their asset allocation contributes to the low carbon transition.

287. Mark Carney, "Breaking the tragedy of the horizon – climate chance and financial stability", Speech at Lloyd's of London, 29 September 2015

BOX 10 ► French initiatives to green the financial sector

Since 2015, the French Energy Transition Act provides a medium and long-term strategy for the transition towards a low carbon and sustainable economy in France. Article 173 of this law aims at integrating climate-related issues into the decision-making process of non-financial and financial companies. In particular, the article imposes quite advanced climate disclosure obligations for financial and non-financial corporates. All listed companies and/or large non-listed firms (financial and non-financial) shall report on the climate risks incurred and their level of direct and indirect emissions. The article also mandates the government to report on how to assess climate-related risk in the banking sector, and requires asset managers and institutional investors to report how climate related risks—both physical and transition risks—are taken into account and how their asset allocation contributes to the low carbon transition.

There is a need to harmonise these different initiatives building on national initiatives and best practices and render them coherent in the context of a long-term EU strategy. A High-Level Group of independent experts has been recently set up to reflect on how to build up a sustainable financial system. It is important that the work of this Group leads to concrete and ambitious policy recommendations, and that EU actors commit to give proper follow-up to the Group's recommendations. Given that the EU has already defined a long-term strategy for its capital market (the so-called Capital Market Union), it is also important to incorporate the required measures into this existing strategy (that is, to "green" the Capital Market Union) rather than setting up a parallel, second-class strategy to move towards a sustainable financial system.

3.6.2. Improve climate mainstreaming practices in public promotional banks

Public promotional banks play a crucial role in supporting governments' efforts to mobilise private investment in low-carbon projects and infrastructures. Many of these banks have developed dedicated programs and activities in support to low-carbon energy transition and have set themselves specific targets in this field. However, in addition to financing low-carbon activities, these institutions (with the exception of some such as the UK's Green Investment Bank) also finance traditional, potentially fossil-fuel intensive, projects and companies. As investment in "brown" infrastructure normally exceeds their investment in low-carbon-oriented activities, it is important to integrate climate change considerations into all investment decision-making in order to avoid public banks being financing high-carbon projects incompatible with EU's and national's decarbonisation paths.

Many of the biggest European public promotional banks (such as the EIB, the German Kfw or the French CDC) are pioneers in integrating climate indicators and criteria into their investment decisions. They do so by combining quantitative and qualitative methods applied both at the upstream policy level and at the downstream project level.

BOX 11 ► Two levels of investment decision-making in public promotional banks

Public promotional banks differ from commercial banks in that they are subjected to a mandate to provide financing to the economy in line with certain policy priorities. Investment decision-making in these institutions can be divided in two parts:

- **Upstream/Policy Level**: At this level, institutions establish the broader framework of their investment strategies, defining investment priorities (and exclusions) in terms of geography, sectors or technologies. This is usually laid down in the Institution's Investment Policy or Strategic Plan.
- **Downstream Project Level**: Using the criteria established at the Policy Level, potential projects go through detailed analysis, including an assessment of economic, social and environmental impacts of the project at the local level, financial analysis of a given project's return on investment and a risk-based exposure analysis.

Qualitative methods refer to the analysis of basic qualitative data of projects, activities or sectors and their classification as contributing to, being neutral, or counterproductive to climate objectives. They are mostly used at the upstream policy level and allow public promotional banks to establish specific quantitative climate objectives, often expressed in percentage of commitments, signatures or total financial flows to climate-positive sectors. The EIB and KfB, for instance, are committed to a target of 25% and 30% respectively of all investment to be climate-related.

Quantitative methods refer to tools and metrics to quantify the volume of GHG emissions, energy use of other climate impacts of individual projects or of a portfolio of projects and to compare them to a baseline or counter-factual scenario (in order to assess the level of emissions reduced). All major European public promotional banks have introduced these type of tools to assess the climate impact of projects financed and the overall impact of their portolios. Climate information is usually incorporated in the downstream project level. It can serve to screen projects (e.g. excluding projects surpassing a certain carbon emission ceiling), or be incorporated in the economic assessment of project options and serve to improve the design and technical specifications of the project. The EIB shows many good practices on how to mainstream climate in the assessment of project proposals (box 13).

BOX 12 ► Climate mainstreaming in project selection and appraisal at the EIB

Apart from having an overall quantitative climate objective of 25% of all investment in climate-related interventions, the EIB presents various best practices as to how to mainstream climate in project selection and appraisal. Since 2013, the EIB counts with an "Emission Performance Standard" (EPS) whereby the institution systematically screens energy-intensive projects and excludes those where the emissions are likely to reach 550gCO2/kWh or more. Furthermore, the EIB has committed to systematically assessing the scope for cost-effective improvements in resource use, in particular energy efficiency projects. This includes an assessment of whether projects use the best available technologies. EIB requires project promoters to demonstrate that different efficiency options have been explored, and that the best available techniques (BAT) have been identified.
Finally, the EIB calculates the "shadow price of carbon" and integrates it into the economic analysis of all projects. The values used for the damage associated with a tonne of emissions in 2010 range between EUR 10 to 40 with a central value of EUR 25 per ton of carbon dioxide equivalent. This base value is estimated to increase annually between 2011 and 2030 by different rates depending on different scenarios.

Current qualitative and quantitative methodologies are static assessment tools that identify the climate impact of an action at a given point of time. They not include valuable qualitative information on the context of the project and the coherence and impact of the contribution to the broader long-term decarbonisation pathway, which is necessary for institutions to better-align their activities. a narrow focus on the end of carbon emission of the project may render eligible a project which is at odds with the long-term decarbonisation strategy (i.e. energy efficiency investment in coal-fired power plant). Likewise, classifying all rail projects as contributing to long-term low-carbon objectives can be misleading as it also includes rail investment linked to coal mining and transport. In the future, hence, thinking in terms of "transition-coherent" and "transition incoherent" rather than classifying investments as "climate specific" and "climate related" will be necessary.

In addition to that, it should be taken into account that many public promotional banks are also large asset managers. They invest important amounts of funding on financial assets (stocks, bonds, etc.) or physical assets, either to generate revenue to finance public-interest development projects (as in the case of the French CDC) or to assure a certain level of liquidity (in the case of the EIB and the German KfW). These assets can be related to economic activities that are incompatible with a low-carbon, and thus it is important that public promotional banks take also climate considerations into account in their financial asset

management practices. The Caisse des Dépôts offers a good example of how to actively integrate climate in the assets management policy.

BOX 13 ► Integrating climate into the investment strategy: The CDC's responsible investment charter

CDC has been active in integrating environmental, social, and governmental issues into its investment strategy, cementing its commitment through the approval of its Charter for Responsible Investment in 2011. This document sets out the principles that guide Caisse des Dépôts and its subsidiaries as "accountable" financial actors. The issues specifically relating to energy and climate are the following:

• Investments in real-estate:

- Favour the acquisition of highly energy-efficient and environmentally-friendly buildings, as well as the renovation of its existing portfolio assets in order to improve energy efficiency performance
- By 2020 , all new buildings in the investment portfolio should generate energy; renovated existing properties should demonstrate low-energy consumption; and all new buildings should be located close to public transport services.

• Investments in infrastructure projects:

- All direct investments in infrastructure projects are based on an asset-specific impact analysis for energy, CO2, biodiversity, and water criteria;
- Prioritisation of projects emitting the least greenhouse gases.

• Investments in regional development:

- comprehensive support to urban and regional projects fitting into the framework of CDC-"sustainable cities and regions" approach

3.6.3. Extend the use of green public procurement

As said in section 3.1., while a major private sector engagement is crucial to move towards a low-carbon economy, the public sector will still play a role in financing basic energy and transport infrastructures of public interest. Many of these infrastructures are constructed through public procurement, and since low-carbon projects tend to be more expensive than alternatives, there is no incentive for the private sector to nuclide them in public bidding processes unless it is explicitly required. In addition to that, public administrations are also important purchases of services and equipment. By changing their patterns of consumption they can shape support low-carbon objectives, generate new markets and provide examples of good practice for business and consumers.

According to the OECD[288], 72% of OECD countries already have policies encouraging green procurement at the central government level. However, here are still important challenges and constrains in the use of green procurement, such as pressures for fiscal consolidation, procurement officials' tendency to stress "value for money" considerations, lack of technical knowledge on how to integrate environmental standards in the procurement process, lack of accurate life-cycle costing (only 16% of countries implement a life-cycle cost evaluation systematically when evaluating proposals in public procurement process) and the absence of reliable monitoring mechanisms to evaluate if green public procurement achieves its goals.

The EU already supports the use of "green" procurement practices at national level by developing guidance in this area, but more could be done to promote the use of these practices. A possibility for instance could be imposing some minimum criteria of green procurement for all procurement of EU funding projects.

CONCLUSION

The energy transition poses two main challenges from a financial point of view. The first is to induce a major capital re-allocation from high-carbon to low-carbon assets and infrastructures. This is essential to meet the investment needs related to the decarbonisation of the energy and transport system but also, and maybe more importantly, to avoid "lock in" effects that could be created by investing in high-carbon infrastructures today. The second challenge is to minimise and secure an appropriate distribution of costs. While the energy transition may have positive long-effects on EU growth and employment, in the short-term the measures put into place to decarbonise the economy will entail important net costs for certain segments of society. It is important to improve as much as possible the cost-effectiveness of these measures (be taxes, regulations, market support schemes or public financial instruments), and carefully handle their distributional consequences, in order to guarantee the political and social support to this transition.

This paper analyses the magnitude of both challenges for Europe—the "investment" and the "cost" challenge—and offer some general reflections on how to tackle them. A key message from the paper is the need to adopt a holistic and integrated approach. A holistic vision implies looking beyond core climate policy

288. OECD/IEA/NEA/ITF, *Aligning Policies for a Low-carbon Economy*, Paris, 2015

instruments. This is particularly important to meet the investment challenge: too often, discussions on how to finance the energy transition are narrowly focused on ways of extending and improving dedicated support measures for low-carbon investment. While more and better targeted measures are necessary, a move towards a low-carbon economy will only be possible with a major reallocation of capital from high to low carbon areas. This requires effective carbon pricing covering all economic activities as well as the integration of climate considerations into all public and private investment decisions.

An integrated approach refers to the need to coordinate and, in some cases, harmonise actions at the EU level. This is particularly important to meet the "cost" challenge. In the EU, measures supporting low-carbon investment are often designed and carried out independently at different levels of governments, with little or no coordination. Not only this leads to an inefficient and fragmented use of public resources, but the lack of integration is in itself a source of inefficiencies. Thus, for instance, uncoordinated carbon taxation create market distortions, and the existence of national renewable schemes with little coordination prevent the exploitation of economies of scale and regional advantages in wind power and climate.

4. A "Social Pact" for the Energy Union

by Sofia Fernandes

The Energy Union seeks to adopt a holistic approach to the energy transition (see chapter 1.). However, it does not yet feature a strong social dimension that would grant decision-makers and citizens the necessary visibility and enable a better understanding of these issues, thus paving the way for determined action to rise to the challenge and garnering the popular support needed to make a success of the transition.

There are numerous social challenges associated with the energy transition.[289] The energy transition profoundly transforms the entire economy and modifies the labour market. New "green" jobs are created in the renewable sector as well as in energy efficiency. Some existing jobs are redefined and require upgrading of workers' skills. Other jobs are destroyed, notably in the fossil energy sectors and in industries with high greenhouse gas (GHG) emissions. Questions arise as to the support to be offered to the workers concerned, their training needs and the quality of new jobs. The challenge is to maximise the job-creating potential of the energy transition while mitigating its negative impact. This is imperative to ensure the "just transition" envisaged by the Paris Agreement.[290]

The social impact of the energy transition goes well beyond repercussions on employment. All Europeans are affected as citizens and consumers. Cleaner energy, coupled with a reduction in energy consumption, helps reduced air pollution and contributes to the improvement of citizens' health. The energy transition also offers consumers the opportunity to better manage their energy consumption and/or produce their own energy, thus reducing their energy bill. Finally, the energy transition—which must be inclusive—represents an opportunity to lift more than 50 million Europeans out of energy poverty.

289. For a definition of the energy transition, see the introduction.
290. Preamble of the Paris Agreement (December 2015) in which the signatories committed themselves to take "into account the imperatives of a just transition of the workforce and the creation of decent work and quality jobs in accordance with nationally defined development priorities".

Putting these issues at the heart of the Energy Union is, of course, primarily a question of social justice. The success of the energy transition will be put into question if workers are "left behind" or if the most vulnerable are excluded from the gains it promises. But adding a social dimension to the Energy Union is also justified on economic and political grounds. In a context of high unemployment, especially among young people, it is essential to fully exploit the potential for job creation in emerging sectors, just as it is crucial to make sure that the transition will not plunge some European regions into economic decline, a major source of structural unemployment. Finally, the nationalist surge across the continent underlines the fact that the EU has not sufficiently addressed questions surrounding the political sustainability of its structures and policies. The EU must turn away from elitism and refashion itself as a popular project at the service of the peoples of Europe. Within the framework of the Energy Union, the social dimension is an essential component underpinning the project's political sustainability and its ownership by as many stakeholders as possible which, in turn, is a prerequisite for the success of the energy transition.

The opportunities and challenges facing Europe's "workers" and "citizens/consumers" must therefore rank high on the agenda of the Energy Union. The latter comprises five key dimensions to which a sixth must urgently be added: the "Social Pact for the Energy Transition" that will tackle the social challenges of the transition.[291]

This chapter presents an outline of the "social pact" that will ensure the energy transition is a just transition, and not just a transition. It is structured in two parts. The first is devoted to workers; it analyses the impact of the energy transition on employment in Europe (4.1.1.) and presents the main course of action able to meet the challenges of the energy transition (4.1.2. to 4.1.4.). The second part looks at citizens/consumers and stresses from the outset that it is crucial to emphasise and take full advantage of the opportunities afforded by the energy transition, notably in terms of public health (4.2.1.) and increases in purchasing power through better management of energy consumption (4.2.2.). Then, the issue of energy poverty in Europe is broached. The energy transition represents a unique opportunity to eradicate this phenomenon in Europe (4.2.3.). The concluding section summarises the recommendations for establishing a "social pact for the energy transition".

291. The five closely related areas on which the Energy Union project is based are: (i) energy security, solidarity and trust; (ii) internal energy market; (iii) energy efficiency; (iv) decarbonisation of the economy; (v) research, innovation and competitiveness.

4.1. A just transition for workers: reducing insecurity and maximising opportunities

For wider society to rally behind the energy transition, it is not only the environmental benefits—which are sufficient in themselves—that are highlighted but also the economic and social advantages it brings, and in particular its positive impact on job creation. Presented at the end of 2016, the European Commission's communication on "Clean Energy for all Europeans" illustrates this point: among the arguments for a more ambitious energy-efficiency target for 2030 (a 30% increase instead of 27%) it singles out the creation of 400,000 additional jobs.[292]

Numerous studies have been carried out to assess the job-creating potential of the energy transition, which naturally depends on the political resolve with which this transition is implemented and the level of public and private funding attached to it (see chapter 3.). Despite these uncertainties, we know that the energy transition leads to the creation of jobs in new emerging sectors, but it also entails job losses and restructurings in the fossil-energy and high GHG emissions sectors. The impact of the energy transition on the labour market is not limited to the sole quantity of jobs; the quality of the new jobs is just as important.

This chapter first offers an overview of the opportunities and challenges of the energy transition for the European labour market (4.1.1.). On this basis, the key employment-related features of the social pact that should be at the heart of the Energy Union will be outlined: the aim must be to boost the employment potential of the energy transition and to anticipate the attendant risks in order to mitigate them, while ensuring an equitable sharing of the inevitable costs of this process (sections 4.1.2. to 4.1.5.).

4.1.1. The impact of the energy transition on employment in Europe

In this section, we present some elements that allow for a better grasp of the job creation potential of the energy transition (4.1.1.1.) and the challenges the reduction of carbon emissions poses for carbon-intensive sectors and regions that are heavily dependent on these activities (4.1.1.2.).

292. European Commission, *Clean Energy for All Europeans*, 30 November 2016, p5

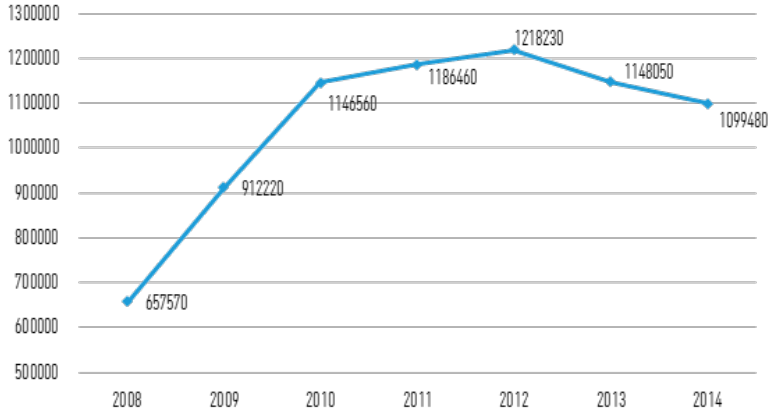
4.1.1.1. Renewable energies and energy efficiency: what potential for job creation?

Among the objectives of the Energy Union, the development of renewables and the improvement of energy efficiency are synonymous with creating new jobs and redefining existing ones.

A 2012 European Commission working paper estimated that by 2020 the development of renewable energies could create up to three million jobs, with gains in energy efficiency adding or maintaining another two million jobs.[293]

In recent years, employment trends in the renewable-energy sector highlight the job-creation potential of the energy transition: according to EurObserv'ER data, between 2008 and 2014, the number of jobs in renewable energy has increased by almost 70% (figure 1). There were more than one million jobs directly or indirectly linked to renewable energies in the EU in 2014.

FIGURE 1 ► Employment figures in the renewable-energy sector in the EU 27 (2008-2014)



Source: EurObserv'ER database (for the period 2008-2013); EurObserv'ER, The State of Renewable Energies in Europe, 15th annual overview barometer 2015 (for the year 2014)

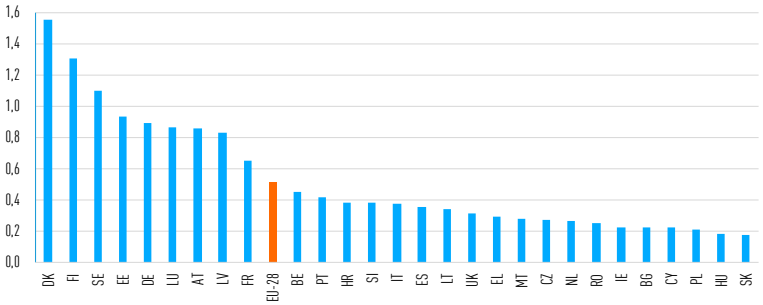
Despite this spectacular increase, the target of 3 million new jobs by 2020 will not be met for employment in renewable energies has been noticeably contracting since 2012. Even though part of this downturn can be attributed to

293. European Commission, *Exploiting the Employment Potential of Green Growth*, SWD (2012) 92, 18 April 2012, p8

structural factors (such as the shrinking photovoltaic sector where the production of solar panels is increasingly being relocated to China), cyclical factors play a more important role, according to the 2015 EurObserv'ER barometer. In the midst of a financial and budgetary crisis, the majority of member states have decided to reduce investments in renewable energy, with predictably negative effects on employment in the sector.[294] By contrast, the US and Chinese governments have implemented stimulus packages that significantly increased investment in the renewables sector (see 4.1.4.1.).

Employment in renewables is unevenly distributed across the EU (figure 2). In the EU-28, jobs in renewable energies accounted for 0.52% of total employment in 2014, with a much higher share in some member states. The Nordic countries have the highest proportion of workers in the renewables sector (the figure for Denmark, Finland and Sweden stands at 1.55%, 1.3% and 1.1% respectively). In the case of Finland and Sweden, these figures are the consequence of a highly developed biomass industry, whereas in Denmark, wind energy makes up almost 75% of renewable-energy jobs (the Danish company Vestas is the world leader in wind power). In southern and central European countries, the employment share of renewables is lower.

FIGURE 2 ► Jobs in renewable energies in the EU in 2014 (direct and indirect jobs as share of total employment)

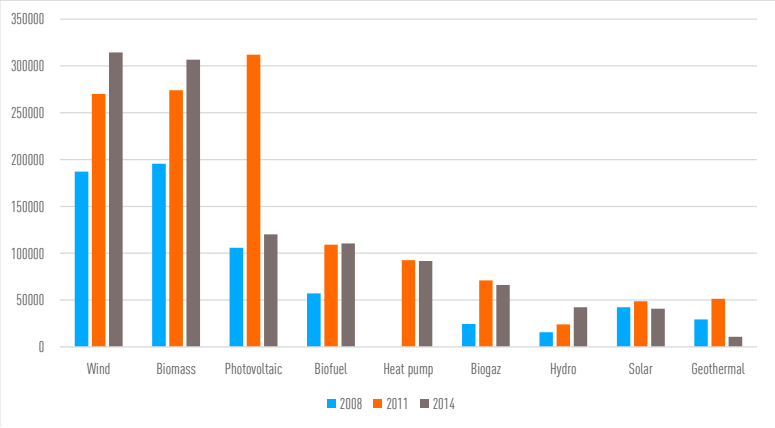


Source: Author's own calculations based on Eurostat data (for total employment figures) and EurObser'ER, The State of Renewable Energies in Europe, 15th annual overview barometer 2015 (for job numbers in the renewable-energy sector).

294. There are exceptions to this general tendency of employment figures in the renewable-energy sector to fall in the wake of the crisis, as the available annual EurObserv'ER data show. In the UK, Luxemburg and Malta, they have risen by 90 %, 130% and 500 % respectively between 2011 and 2014.

Of the different sources of renewable energy, wind and biomass boast the highest employment figures across the EU (with more than 300,000 jobs each), which rose significantly between 2008 and 2014 (as opposed to employment in photovoltaics which contracted sharply between 2011 and 2014).

FIGURE 3 ► Total employment in renewable energy by technology in the EU-27 by energy source



Source: Data available in EurObserv'ER's 9th, 12th and 15th annual barometers of the state of renewable energies in Europe. * For heat pumps the data are for 2012 and 2014

In addition to renewable energies, energy efficiency is a source of new jobs, while redefining existing jobs, especially in construction (renovation and insulation of buildings for example). A study by *Cambridge Econometrics* published at the end of 2015 estimates that in 2010 "jobs in energy efficiency" amounted to more than 900,000 in the EU-28.[295] If calculated as a share of total employment, these jobs represent 0.44% of employment in the EU as a whole. Unlike the situation for renewable energies, the countries of Central Eastern Europe have higher employment ratios in energy efficiency than the EU average (due to poor insulation in most of these countries).

295. *Cambridge Econometrics*, Assessing the employment and social impact of energy efficiency, November 2015, p7. This study defines "employment in energy efficiency" narrowly as "employment in firms whose principal activity is the supply of goods and services for which the main motivation for purchase by the customer is to save energy".

TABLE 1 ► Total estimated employment in the production of energy-efficiency-related goods and services in EU countries in 2010

	NUMBER OF JOBS	% OF TOTAL EMPLOYMENT
CZ	31 000	0.64
MT	1 000	0.62
EE	3 000	0.55
IT	119 000	0.54
HU	20 000	0.54
SI	5 000	0.53
BG	16 000	0.53
PL	79 000	0.52
SK	12 000	0.52
RO	43 000	0.52
LT	6 000	0.49
HR	8 000	0.49
DE	179 000	0.48
LV	4 000	0.48
PT	22 000	0.48
LU	1 000	0.46
FI	11 000	0.46
AT	17 000	0.43
SE	18 000	0.41
ES	72 000	0.39
BE	17 000	0.38
IE	7 000	0.38
FR	94 000	0.37
EL	15 000	0.35
DK	9 000	0.34
UK	93 000	0.33
NL	26 000	0.32
CY	1 000	0.26
EU-28	929 000	0.44

Source: *Cambridge Econometrics, Assessing the employment and social impact of energy efficiency,* November 2015, p41.

The impact of improved energy efficiency will not be limited to "employment in energy efficiency" (whether new or redefined jobs). The study adds that if we use a broader definition of "employment in energy efficiency", which includes companies whose goods and services can potentially bring energy savings (even if they are not purchased primarily to this end), the number of jobs in energy efficiency would rise to 2.4 million. Moreover, as the European Commission has pointed out, goods and services that improve energy efficiency also have important spill-over effects on employment across the economy through multiplier effects induced by changes in prices and income—the "double dividend". For example, reducing the energy bills of households through greater energy efficiency will allow them to spend a larger share of their income on other goods and services.[296]

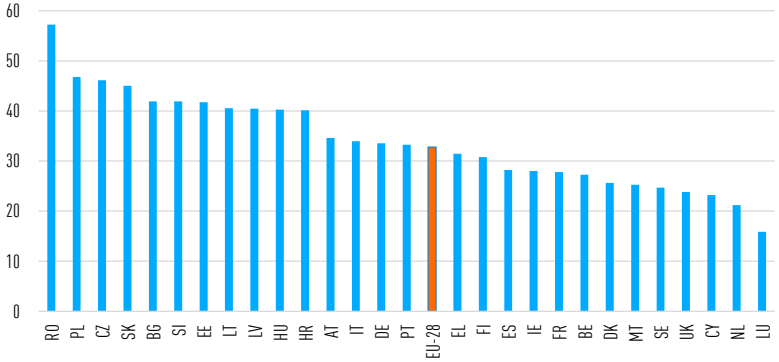
In conclusion, there are more than two million jobs in the EU in renewables or energy efficiency. According to the Commission's "Clean Energy for All Europeans" package, there is a potential to create an additional 900,000 jobs by 2030 (of which 400,000 in energy efficiency), provided that—public and private—investment is sufficiently mobilised (see chapter 3.).

4.1.1.2. Redefined jobs and job losses related to GHG emission reductions

If the energy transition creates a significant number of jobs, there are also sectors suffering from job losses or in which existing jobs are being redefined. The main sectors concerned are those with a high carbon intensity: energy production and manufacturing (accounting for 26% and 19% of GHG emissions in the EU, respectively), agriculture (12%), transportation (11%) and construction (11%, including other services).[297] These sectors were responsible for almost 33% of total EU employment in 2015, or about 70 million workers (see figure 4). The share of employment in the most polluting sectors differs considerably between EU countries. These jobs make up 57% and 47% of total jobs in Romania and Poland, respectively, compared to 16% in Luxembourg and 21% in the Netherlands. The rate is well above the EU average in all Central and Eastern European countries.

296. European Commission, *Employment in Europe 2009*, October 2009, p117
297. Eurostat data for 2014

FIGURE 4 ► Employment in sectors with high GHG emission as a percentage of total employment in 2015



Source: Author's calculations based on data from Eurostat's European Labour Force Survey (LFS).

However, in terms of employment, the transition to a low-carbon economy does not impact all polluting industries in the same way (see box 1). In agriculture, transport and construction, it is above all a matter of transforming existing jobs, or even creating new ones, rather than enduring job losses. The risk of job destruction exists primarily in the energy and manufacturing sectors. Fossil fuel-based energy production and extraction are gradually giving way to renewable energies.

BOX 1 ► Key employment trends in the carbon-intensive sectors resulting from the energy transition

- **Energy:** the shift from fossil-fuel-based power generation to renewable energy will entail job losses in sectors dependent on the use of fossil fuels such as coal mining and in the supply chains in the oil industry, but will create new jobs in other sectors;
- **Transport:** the transition from fossil fuels to electric power should not have a negative impact in terms of jobs. Still, the structure of this sector may profoundly change if autonomous vehicles are used more widely (affecting drivers' jobs) and consumers increasingly abandon the ideal of individual car ownership (affecting employment in car manufacturing);
- **Agriculture:** the development of biomass and more environmentally friendly agriculture (which is more labour intensive) represents an opportunity in terms of job creation;

- **Construction:** the objective of increased energy efficiency (specifically that of buildings) positively impacts employment in this sector.
- **Energy-intensive industries:** the impact on employment may be negative if (A) the sector is exposed to international competition and (B) public policies (notably in the guise of the European emissions trading scheme) raise production costs significantly compared to other regions in the world without offering any form of compensation. To ensure the competitiveness of industries at risk of relocation due to the costs of climate policies, the EU has already put in place measures intended to prevent "carbon leakage".

Source: European Commission, *European semester thematic fiche - Green jobs: employment potential and challenges*, 2015.

Coal mining exemplifies the difficulties encountered by these sectors. In 2015, the coal industry directly employed 185,000 workers in the EU, compared to more than 240,000 in 2012, a drop of more than 20% over the course of three years. This decline is partly attributable to the decline in European coal production, which is in turn related to falling coal consumption in Europe, the increasing automation in the sector and the changing dynamics of global trade.[298]

92% of coal mining jobs in the EU are concentrated in five states: Poland (54%), Germany (13.6%), the Czech Republic (9.7%), Romania (8.1%), Bulgaria (6.3%). OECD data show that the costs of adjustment are distributed unevenly across regions because the coal industry is highly geographically concentrated (the geographic concentration index is highest in Poland and the Czech Republic).[299] In some European regions coal mining companies are still among the biggest employers. The gradual reduction of these activities or, in some cases, their complete dismantling are severely affecting the regions concerned.

298. British Petroleum, *Statistical Review of World Energy 2016*, 65th edition, June 2016
299. OECD, *The jobs potential of a shift towards a low-carbon economy—final report for the European Commission*, Paris, 4 June 2012, p48

TABLE 2 ► Number of persons employed in the coal industry in the EU in 2012 and 2015

	2012	2015	CHANGE 2012—2015
PL	128 000	99 498	-22%
DE	34 200	25 068	-27%
CZ	22 000	18 000	-18%
RO	21 000	15 042	-28%
BG	13 000	11 765	-10%
EL	7 500	4 919	-34%
UK	5 800	1 975	-66%
SK	3 700	2 190	-41%
ES	3 400	3 324	-2%
HU	2 100	1 655	-21%
SI	1 600	1 274	-20%
EU	240 600	185 000	-23%

Source: Euracoal, Coal industry across Europe, 6th edition, 2017

In manufacturing, the industries where internal transformations are more likely to result in job losses are those that fit two cumulative criteria. Firstly, energy represents an important part of their production costs and the increase in energy costs is therefore large enough to significantly impact the cost of production. Secondly, these industries are exposed to global competition and consequently this increase is likely to put imported products at an advantage.

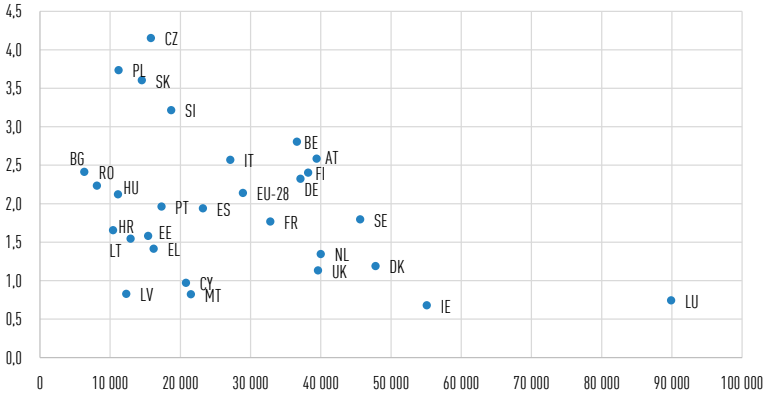
Several studies have shown that the key energy-intensive industries subject to a significant degree of global competition are metallurgy (iron, steel and aluminum), the paper and pulp industry, and the chemical and non-metal industry (cement and glass).[300] A global approach to the energy transition (see chapter on governance) nevertheless also requires us to see the gains the energy transition holds in store for these industries. The deployment of wind turbines increases the demand for steel and correspondingly creates jobs in this sector. The same applies to the demand for aluminum, which goes up as measures to limit CO2 emissions from vehicles encourage manufacturers to use lighter

300. Manfred Bergmann, Andreas Schmitz, Mark Hayden and Katri Kosone, "Imposing a unilateral carbon constraint on energy-intensive industries and its impact on their international competitiveness—Data and analysis", Economic papers n° 298, European Commission, December 2007

materials (such as aluminum or certain synthetic materials). Thus, a sector-by-sector study should take into account not only the costs but also the benefits of the transition resulting from higher demand for certain production-types.

Figure 5 shows the employment share of the sectors most likely to experience job losses as a result of the energy transition (the above-mentioned energy-intensive industries and the mining sector). This indicator is related to the per capita GDP of each country. The graph illustrates that some Central and Eastern European countries with per capita GDP levels below the EU average are particularly vulnerable to the risk of job losses due to the energy transition (the Czech Republic, Poland, Slovakia, Slovenia, Bulgaria and Romania) insofar as the employment share of the sectors in question is higher than the EU average.

FIGURE 5 ► Employment in the mining, chemical, metallurgical, non-metallic products, paper and pulp sectors as a percentage of total employment in 2015 and GDP per capita at current prices in 2015 (Euro)



Source: Author's own calculations based on Eurostat database.

The OECD has emphasised that, within the EU, the relative concentration of the sectors most likely to suffer job losses in countries with relatively low per capita GDP (see figures 4 and 5) goes hand in hand with a concentration of eco-innovation in some higher-income countries (notably the Nordic countries and Germany), suggesting that the labour market costs and benefits associated

with the energy transition may be unevenly distributed across countries—and potentially in a regressive manner.[301]

4.1.2. Turning a challenge into an opportunity: how to anticipate and organise the adjustment in sectors/regions at risk from job losses

In 2010, the EU Employment Committee published a report presenting four possible scenarios for a "greening of the labour market". The most pessimistic outlook is characterised by net job losses, as large job losses in the polluting sectors would not be offset by the creation of new jobs in the "green" sectors. The more optimistic scenario, in turn, is based on successful "green growth", with "carbon leakage" at manageable levels (notably through efficient energy technologies and greener production methods in the traditional sectors) and net job creation[302].

Depending on the policies pursued, the EU will move toward a more or less favourable scenario. As the OECD stresses, one of the peculiarities of the structural change associated with the energy transition is that the latter is largely driven by government policies (which is not the case, for example, for other transitions induced, to name but one example, by the revolution in information and communication technologies). Hence the importance of anticipating and organising the adjustments in sectors and regions threatened by job losses and responding to them through public action.

This implies a holistic approach that integrates the different public policies as presented in the chapter 1. As proposed in the chapter 2., the EU must assert an innovation-based industrial policy to address the adjustment issues of certain sectors. Regional policy must also address the problems faced by regions affected by the accumulation of various restructuring effects. Social and employment policies must facilitate the adjustment process by avoiding structural unemployment, guaranteeing the adequate supply of skills required for new jobs and making sure the inevitable costs are shouldered in an equitable manner.

301. OECD, *The jobs potential of a shift towards a low-carbon economy—final report for the European Commission*, Paris, 4 June 2012, p46
302. For further information on the four scenarios: Employment Committee, *Towards a greener labour market— The employment dimension of tackling environmental challenges*, Final report adopted by EMCO on 10 Novembre 2010, p7

4.1.2.1. Limiting, offsetting and spreading job losses over time

As far as the transformation strategy for sectors / regions that are potentially disadvantaged by the energy transition is concerned, three necessary steps can be outlined: i) anticipate change; (ii) organise and steer the process of change; (iii) provide accompanying social measures (see 4.1.3.).[303]

The first step is to identify the sectors / regions at greatest risk. It is necessary to evaluate the extent of the challenge facing these sectors and regions on the basis of research and data analysis and to conceive a transition towards a more environmentally and socially sustainable local economy. To the extent that the energy transition is not just passively endured but actively steered by national governments and European institutions, the process of anticipating and planning for change must go hand in hand with the definition and implementation of energy targets.

Thus, the best responses to the challenges facing the different sectors/ regions concerned can be identified and promoted. These responses will include (i) the adoption of measures to limit and spread over time the destruction of jobs; and/or (ii) the adoption of measures to compensate for job losses—measures that will be inevitable if the regions concerned are to not find themselves in a situation of economic decline, which would (in addition to its disastrous economic and social consequences) undermine citizens' support for the energy transition and could lead to a further rise of nationalism in Europe.

Job losses resulting from the pursuit of the target for GHG emission reductions could be reduced if major technological and behavioural changes were introduced into the production process to reduce the negative environmental impact of carbon-intensive industries (for example by developing economically viable technologies for carbon capture and storage, switching from fossil fuels to renewables or using "low-carbon" cement from waste recycling).[304] While this change often depends on the individual choices of private actors, these choices can and should be encouraged by public authorities. For example, an important part of the reorientation from fossil fuels to renewable energy sources now takes place in large energy companies (e.g. electricity companies) where management is committed to retraining its workforce.[305]

303. GHK, The Impacts of Climate Change on European Employment and Skills in the Short to Medium-Term: A Review of the Literature Final Report, vol. 2, May 2009, p2
304. OECD, *The jobs potential of a shift towards a low-carbon economy—final report for the European Commission*, Paris, 4 June 2012, p78
305. OECD, *Ibid*, Paris, 4 June 2012, p109

BOX 2 ► The social pillar of the CARS 2020 action plan for the European automotive industry

The objective of the action plan for the automotive industry presented by the European Commission in 2012 is to have contributed to the strengthening the EU automotive industry by 2020. This action plan builds on the vision of a competitive and sustainable industry for 2020 and proposes concrete measures to be taken on issues relating to emissions, research funding, electromobility, road safety, new skills, smart regulation, trade negotiations and international harmonisation. The action plan includes four pillars, including a social one aimed at anticipating adaptation and mitigating the social impact of industrial adjustment processes. The social pillar features a series of initiatives:

- to encourage the use of the European Social Fund (ESF) for retraining and the upgrading of skills
- to identify good practises and to promote a proactive approach to restructuring based on consultations with representatives from the regions where the automotive sector plays an important role, labour offices and industry representatives
- to embolden, in the case of plant closures and significant cuts to the workforce, member states to consider using the European Globalisation Adjustment Fund (EGF)

The European Commission is currently working on non-legislative and legislative proposals for the transport sector. These proposals, to be presented in the summer/autumn of 2017, should allow for a timely update of this 2012 plan.

Source: European Commission, *Action plan for the EU automotive industry in 2020*, Memo 12-845, 8 November 2012

The action plans presented by the Commission on the future of several industrial sectors (CARS 2020, Construction 2020), which set out the priorities for action in terms of investment and innovation funding, proposals for the revision of European regulations or measures to mitigate the social impact of industrial adjustments, illustrate the key role the EU has to play in this area (see box 2). It is necessary to draw lessons from these initiatives and examine in which other sectors such an approach could yield promising results. This could happen in conjunction with the establishment of a European industrial policy for the energy transition within the framework of the European Commission's "Clean Energy Industrial Forum".[306]

Despite these advances, a major restructuring of various economic sectors and/or regions will take place. It is important to organise this process at regional and local level, for example by arranging a gradual and orderly cessation of mining activity in order to spread over time the measure's impact on

306. European Commission, *Clean Energy for All Europeans*, COM(2016) 860, 30 November 2016

local employment and thus to better accompany workers, allowing for professional and/or geographical mobility.

When significant reductions in employment are anticipated in certain regions, it is essential to envisage a deep restructuring to reposition these regions and to put them on a sustainable socio-economic development path. This has already happened in the past and it would be useful to draw the lessons learned from these past experiences. In 2016, the Foundation for European Progressive Studies (FEPS) published a study looking at three successful cases of regional (Bilbao in Spain and the region of North Rhine-Westphalia in Germany) and sectoral (coal in the UK) restructuring.[307]

The anticipation and planning of restructuring therefore requires an ability to identify new sectors that will compensate for the loss of economic activity and the jobs cuts resulting from the decline of certain sectors. Denmark offers a good example: the development of wind power came to replace the fledgling shipyard industry.

BOX 3 ► Bilbao—a case of successful restructuring

Bilbao is one of the most successful examples of a deep transition. In the 1970s, the industrial structure of Bilbao was dominated by large manufacturing industries (steel, shipbuilding and mechanical engineering). The city suffered severely from the economic crisis of the 1970s, which resulted in a sharp increase in unemployment between 1975 and 1985. The city's economic and social plight was compounded by the considerable environmental damaged wrought by the local concentration of polluting industries.
Yet the region, which would have needed urgent action, was only restructured at the end of the 1980s. In 1991, the "Strategic Plan for the Revitalisation of Metropolitan Bilbao" was adopted, creating two agencies whose task was to facilitate and manage change: "Bilbao Metropoli-30" and "Bilbao Ría 2000". The plan's objectives comprise: (i) urban renewal, (ii) environmental response, (iii) the strengthening of cultural identity and (iv) the development of a knowledge-based high-tech sector. The Spanish government agreed to shoulder the costs of industrial relocation and has paid for early retirement schemes for workers over 50 years of age. The Basque government was for its part entrusted with the task of rebuilding the city by developing new sectors of activity. Industrial employment fell sharply from 48% of total employment in 1975 to 22% in 2005. However, the unemployment rate fell from 25% in the 1980s to 11% in 2004 and the number of jobs in the metropolitan area rose from 267,000 in 1995 to 380,000 in 2005.

Source: Sanjeev Kumar, Arianna Americo and Charlotte Billingham, *The new social contract: a just transition*, Foundation for European Progressive Studies, Brussels 2016

307. Sanjeev Kumar, Arianna Americo and Charlotte Billingham, *The new social contract: a just transition*, Foundation for European Progressive Studies, 2016

4.1.2.2. Bringing the social partners and local authorities to the fore

Anticipating and planning change should follow a bottom-up approach for it is the actors closest to the companies and workers concerned that must be the drivers of the transition. The energy transition must be based on efficient cooperation between local authorities and the trade unions, insofar as there is a popular consensus on the need for the energy transition (see chapter 1.).

The FEPS study on the successes of regional and sectoral restructuring highlights some common features of the three transitions analysed.[308]

The first is the need for a break with the past in order to undertake a transition process that will take a long time (one or two decades, perhaps even more). To this end, it is essential to get the social partners on board so they can have their say on the sectoral action plans and/or regional restructuring in order to find a compromise between the needs of traditional industries and the need for renewal.

A second common feature among the three restructurings is the need for political consensus and ownership of the transition by political leaders. This is especially important for regional and local leaders who are accountable to the local population. Since the transitions take many years, it is necessary to "depoliticise" the transition plans in order to ensure a degree of continuity between governments.

Finally, there must be a clear sharing of responsibilities among the different actors. Regions need to focus on transformation, whereas national governments and the EU should concentrate on measures supporting the sectors affected by job losses. The FEPS study foregrounds the importance of the EU Structural and Cohesion Funds for financing the transition.

308. See Sanjeev Kumar, Arianna Americo and Charlotte Billingham, *Ibid*

4.1.3. Supporting those "left behind" by the transition and ensuring an equitable sharing of the inevitable costs

4.1.3.1. Reducing the insecurity resulting from job losses and the redefinition of jobs

In its 2015 communication on the Energy Union, the European Commission argues that "an energy transition that is just and fair will therefore require re-training or up-skilling of employees in certain sectors and, where needed, social measures at the appropriate level."[309]

Guidance and social support measures are essential to avoid or at least mitigate the negative social consequences (in particular an increase in structural unemployment) of sectoral/regional adjustments linked to the transition to a low-carbon economy. This must take the form of adequate income replacement benefits coupled with an effective activation of the recipients of these benefits. It must be ensured that the flows of workers from declining companies to firms with growth potential will be undergirded by income security and training schemes for new jobs. This is an essential precondition for achieving the desired reallocation of workers while defusing potential opposition to energy transition policies.

BOX 4 ► Programmes to support workers in the German coal mining sector

As late as the 1950s, the hard coal mining sector employed more than 500,000 workers in Germany. By 2007, their number had plummeted to 33000. In 2015, there were only 10,000 jobs in hard coal mining left. The drastic reduction in employment in this sector was cushioned by a package of social measures, which ensured the continued cooperation of trade unions and attenuated structural unemployment in the regions most dependent on coal mining.

In the 1960s, Germany introduced compensatory payments and transitional subsidies for workers affected by job cuts. These includes two types of support:

- "Financial adjustment aid" (Anpassungsgeld), which is available to workers in hard coal mining who have lost their jobs and who are over 50 years of age. On average, the aid amounts to about 13,500 euros per year and is paid for five years (in 2015, a total of 116 million euros was spent on this financial aid).
- "Adjustment allowance" (Anpassungsbeihilfe), aimed at helping younger workers to move to other sectors of employment. This allowance covers training, travel and relocation costs.

Source: Sabrina Schulz and Julian Schwartzkopff, "Instruments for a managed coal phase-out—German and international experienes with structural change", *Briefing paper,* E3G, July 2016

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309. Communication from the European Commission, *A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy*, COM(2015) 80 final, 25 February 2015, p17

In order to provide the most appropriate response to workers affected by the transition, it is useful to look closely at their individual profiles. In spite of the great heterogeneity of situations, studies—in particular those conducted by the OECD and the European Commission—show that low-skilled and/or elderly workers are overrepresented in many energy-intensive sectors (although there are exceptions such as the electricity and chemical industries).[310]

This may complicate the transition, as empirical research has established that low-skilled and older workers face above-average transition costs, resulting in longer periods of unemployment and a loss of earnings when they return to work.[311]

The question is whether targeted programmes are needed to provide additional support to workers most severely impacted by the energy transition. This could take many forms. For the transitions in Bilbao (see box 3) and North Rhine-Westphalia, to name but two examples, plans for early retirement have been introduced as social support measures.

4.1.3.2. For the creation of a European Energy Transition Adjustment Fund

At EU level, the Commission should propose the establishment of a European Energy Transition Adjustment Fund. This fund would help member states to finance training, retraining, support and entrepreneurship measures for workers who have lost their jobs as a result of major structural changes brought about by the energy transition (the Commission could derive lessons from what has been done in 2006 for the "losers" of globalisation with the creation of the European Globalisation Adjustment Fund (EGF), see box 5). As early as 2011, the International Labor Organisation suggested expanding the scope of the EGF to include adjustment processes arising from the "greening" of the economy.[312] In addition to the economic arguments for such an instrument, there are considerations of equity: it would be unfair for the whole population to reap the benefits of the energy transition when the adjustment costs are borne only by a small minority of workers.

The Energy Transition Adjustment Fund could be financed by revenue from the EU Emissions Trading Scheme (EU ETS). The European Parliament has recently put forward a proposal which goes in this direction, stating that

310. OECD, *The jobs potential of a shift towards a low-carbon economy—final report for the European Commission*, Paris, 4 June 2012; European Commission, "Exploiting the Employment Potential of Green Growth", SWD (2012) 92, 18 April 2012
311. OECD, *Ibid*, p50
312. International Labour Organisation, *Towards a greener economy: the social dimensions*, 2011

"member states should also address the social aspects of decarbonising their economies and use auction revenues to promote skill formation and reallocation of labour affected by the transition of jobs in a decarbonising economy".[313] Failing this, it could be financed by the EU budget, as is the case today with the EGF.

BOX 5 ► The European Globalisation Adjustment Fund

The European Globalisation Adjustment Fund (EGF) was created in 2006 to help workers who have lost their job as a result of globalisation-related major structural changes in international trade (e.g. when a large company outsources its production to non-EU parts of the world) or in the wake of the global economic and financial crisis. The GEF co-finances projects that include measures such as jobseekers' assistance, vocational guidance, financial aid for studies, training and retraining, coaching and mentoring, entrepreneurship and setting up a business.

In general, the EGF can only intervene when more than 500 workers have been laid off by a single company (including its suppliers and downstream producers) or when a large number of workers are laid off in a particular sector in one or more neighbouring regions.

The Union may co-finance up to 60% of the cost of the reinsertion into the labour market of workers made redundant. The EGF has a very small budget, amounting to no more than 150 million euros per year. In practise, the first demand came from France on 9 March 2007 and concerned 1345 redundancies among Peugeot subcontractors who lost their jobs due to increased competition, particularly from Asia, in the market for small cars. Since then, the Commission has received 148 applications for EGF co-financing from 21 member states for a total amount of nearly 600 million euros, to help 138,888 dismissed workers and 2,944 unemployed persons who do not receive any education or training (NEET). The three sectors receiving the most GEF funding are: (i) automotive manufacturing, (ii) computer products and electronic components, and (iii) machinery and equipment.

Source: European Commission, Employment, Social Affairs and Inclusion.

4.1.4. Maximising the job creation potential of the energy transition

If the energy transition holds considerable potential for job creation in the EU, its realisation should not be taken for granted. As a case in point, the expected target of three million jobs in renewables by 2020 will not be reached, not least because of the policy decisions since 2010 (see 4.1.1.).

313. European Parliament, Cost-effective emission reductions and low-carbon investment, adopted on 15 February 2017

4.1.4.1. Providing the necessary investment and promoting innovation

The first condition for maximising the job creation potential is to make the necessary investments in renewable energies and energy efficiency (see chapter 3.). The decline in employment in renewable energy since 2012 has been largely due to investment cuts.

According to the annual report of the United Nations Environment Program (UNEP), investment in renewable energy fell by 14% in Europe in 2015, while increasing by 17% in China and by 19% in the United States. In 2011, Europe accounted for 44% of global investment in renewable energy. Today it only makes up 17%, compared with 36% for China (see table 3). The Ernst & Young Renewable Energy Country Attractiveness Index is topped by the United States, followed by China and India, as the most attractive locations to invest in renewable energy projects. Of the ten most attractive countries, only two are European: Germany (raking fifth) and France (coming in at seventh place).[314]

TABLE 3 ► Investment in renewable energy (in billions of dollars)

	2011	2014	2015	CHANGE 2014-2015
World	278.5	273	285.9	5%
United States	49.1	37	44.1	19%
Europe	122.9	62	48.8	-21%
China	47.4	87.8	102.9	17%
India	12.8	8.3	10.2	22%

Source: United Nations Environment Program (UNEP), *Global trends in renewable energy investment 2016*, 2016.

If Europe is serious about creating more green jobs, it must invest more in renewables and energy efficiency. To meet the EU's energy targets for 2030, the European Commission estimates that it is necessary to invest around 379 billion euros each year over the period 2020-2030, mainly in energy efficiency, renewable energy sources and infrastructure.[315] These investments are a significant source of growth, notably for countries in the South that have favourable climatic conditions

314. Ernst & Young, *Renewable Energy Country Attractiveness Index*, October 2016
315. European Commission, *Clean energy for all Europeans*, COM(2016) 860 final, 30 November 2016

for the development of solar energy and where the housing stock is in need of renovation and thermal insulation (see 4.2.).

But if European countries should invest in the energy transition, they also have to set out on their own specialised path in order to remain competitive. The experience of renewable energies in the EU, particularly photovoltaics, has left little doubt as to the stiff competition from China. With a large majority of the solar panels installed in EU countries imported from China, the European priority should not be to recover market share on existing solar panels, but rather to invest in the next generation of solar panels. To this end, industrial and innovation policy proposed in the chapter 2. will be key.

4.1.4.2. Identifying the skills needed for new jobs

Increasing investment and strengthening innovation policy are necessary but not sufficient conditions to maximise the job creation potential of the energy transition. In order to make the most of the dynamic set in motion by the transition to a low-carbon economy—while simultaneously facilitating this transition—it is therefore essential to guarantee a supply of skilled labor and to avoid a skill deficit, which, according to the European Centre for the Development of Vocational Training (Cedefop), is already noticeable in certain sectors in some countries.[316] Additionally, vocational training can help some workers to become innovators within their companies (see chapter 2., particularly the section on intrapreneurship).

The energy transition must have an impact on education and training policies in order to ensure the development and provision of the skills needed for new jobs or those redefined by the demands of a low-carbon economy.

The skills component of the energy transition is centred on two priorities: (i) to better identify and anticipate the skills needs created by the energy transition so that the competent authorities and stakeholders can adapt to change; (ii) to encourage workers to acquire these skills.

For several years now, the EU has initiated various exercises aimed at identifying the skills required for new jobs, whether linked to the energy transition or other challenges such as the digital transition. These include the "EU Skills Panorama"

316. See for instance CEDEFOP, *Green skills and environmental awareness in vocational education and training—synthesis*, Research paper No.24, Luxembourg, 2012, 9: "Some skill shortages persist, particularly for sheet-metal workers, electricians and insulation workers. Germany, Finland and the UK report sizable skill shortages in these occupations".

initiative, which provides an overview of short- and medium-term employment prospects and skills needs at European, national and sectoral level. The latter dimension of this exercise is fundamental and would benefit from greater stakeholder input at the sectoral level, in particular sector skills councils and sectoral skills alliances.

This EU exercise is a good starting point. Yet an exclusive "one size fits all" approach would not be useful given the differences between member states in terms of business sectors. The member states must draw on the results of this European exercise to draw conclusions and lessons for their respective labour markets.

In this diagnostic exercise, the introduction of a second element to identify those skills of workers in the declining sectors that are in high demand for new occupations would be salutary. The aim is to maximise the upgrading of skills rather than the acquisition of new skills for workers. This reduces training costs and enhances the skill base of workers who have to retrain.

4.1.4.3. Promoting skills acquisition—towards a "Green Erasmus"?

Once skill needs for new or redefined jobs in the energy transition have been identified, member states must modify or adapt vocational qualifications and the corresponding education programmes in order to respond to the new demands of the market. Numerous examples of good national practice exist. In Spain, for example, the region of Navarra has seen a sharp increase in the provision of renewable energy training, in particular through the creation of a fully-fledged training centre (box 6).

In order to promote careers in these new jobs, while it is certainly necessary to ensure a match between the supply of training and the needs of companies this by itself is not enough to guarantee that workers will embrace the professional trajectories offered by the transition. Indeed, there are two further challenges.

Firstly, these new jobs remain little known, making it unlikely that a young worker will set out to pursue a career in a profession with which he is unfamiliar. It is therefore urgent—for local and European (by creating greater transnational awareness) rather than national authorities—to communicate better and to furnish more information.

Secondly, there is the issue of the attractiveness of these jobs. As the European Commission has demonstrated, some member states wanting to develop "green" employment are confronted with the difficulty of attracting young people to

manual jobs with poor working conditions and low wages.[317] European and national authorities should strive, alongside the social partners, to improve the status of these new jobs.

Moreover, several studies indicate that the acquisition of skills in new or redefined energy transition-related jobs would benefit from two developments in the education systems of the member states: (i) an increase in the number of young students in science, technology, engineering and mathematics (STEM); (ii) the development of vocational education and training (VET) since most countries, the OECD argues, "regard a well-functioning VET system as an essential element for green growth".[318]

An EU initiative that could make a significant contribution to promoting and showcasing energy transition professions would be to put in place a green component of the Erasmus Pro programme, which the Commission announced at the end of 2016 and which, by 2020, will enable 50,000 apprentices and trainees to participate in six- to twelve-month mobility programmes in another member state. The Commission could allocate part of the funds for this initiative (which will need to be reinforced from 2020 to reach more young people) to mobility programmes aimed at apprentices from sectors that offer training for jobs in the energy transition. This would also have the advantage of encouraging young people to pursue training schemes in growth sectors, which will help reduce youth unemployment in Europe.

Lastly, it is essential to pay particular attention to the training needs of worked employed by SMEs and self-employed workers. The OECD's research has shown that SMEs struggle to upgrade the skills of their workers and to adapt them to the changing employment requirements of the energy transition. Another study on energy efficiency recalls that while there is strong potential for employment in the construction sector due to increased energy efficiency, the workforce may suffer from a skill deficit linked to high rates of self-employment in this sector.[319] This might make it difficult to meet the emerging skill needs and could slow progress towards improved energy efficiency. For example, in response to this challenge, Spain has adopted the "Emplea Verde" program, which aims to create

317. European Commission, *Exploiting the employment potential of green growth*, SWD (2012) 92, 18 April 2012
318. OECD, *The jobs potential of a shift towards a low-carbon economy—final report for the European Commission*, Paris, 4 June 2012, p96
319. *Cambridge Economics*, *Assessing the employment and social impact of energy efficiency*, November 2015, p93

1,000 new "green" companies and to train 50,000 workers that are either self-employed or employed by SMEs.[320]

BOX 6 ► The Navarre experience: expanding the provision of training schemes for the renewable energy sector

In the 1980s and 1990s, the Spanish region of Navarre suffered from a severe economic downturn when high oil prices impaired the competitiveness of its single large industrial employer, a Volkswagen car plant.
Unemployment soared to a peak of 13% in 1993. The regional government responded with active industrial policy measures, including worker retraining, to expand the renewable energy sector. A rapid and successful development of a wind power industry followed, facilitated by the favourable geographical and climatic conditions of the region alongside a clear corporate and public strategy. The region expanded the share of its electricity production derived from renewable sources to 65%.
From 2002 onwards Navarre has been implementing its Environmental Training Plan. In cooperation with the Confederation of Entrepreneurs of Navarre and the Navarre Industry Association, the regional government identified the main skills shortages in the region through a project entitled "Strategic talent in the renewable energy sector", and on the basis of its findings set up CENIFER, a public training centre for renewable energies, which became a major training provider for the sector. In 2006, the country's first graduate programme for electrical engineers in wind and solar electricity was launched at the Public University of Navarre.
Between 2002 and 2006, employment in renewable energies across Navarre increased by 183%. In 2007 alone, 100 companies and over 6,000 jobs in renewable energies were created. Unemployment dropped to 4.76%. Even in the economic and employment downturn of 2009 Navarre maintained the lowest unemployment levels in Spain. This achievement bears witness to the success of a policy mix which incorporated environmental and skills measures in a proactive response to an economic crisis with a view to long-term dynamic development.

Source: United Nations, *Just transition of the workforce, and the creation of decent work and quality jobs, technical paper,* 26 October 2016.

4.1.5. Guaranteeing the quality of new and redefined jobs

The number of studies on the quantity of jobs created by the energy transition contrasts with the limited information on the quality of these jobs, in particular in terms of: (i) wages, (ii) coverage through collective bargaining, and (iii) health and

320. Website of *DG Employment, Social Affairs and Inclusion* of the European Commission

safety at work. Nevertheless, some trends emerge which present both opportunities and challenges when it comes to improving the quality of jobs.

The energy transition, to be sure, requires investment in research and innovation to develop and implement new, less polluting production methods. Several studies contend that low-skilled jobs will be replaced by more skilled jobs. This demand for more skilled workers should be accompanied by correspondingly higher wages. Similarly, jobs that will be redefined and entail the upgrading of workers' skills—particularly in the construction sector—will arguably lead to wage gains.

However, the energy transition does not only create high-skilled jobs. New employment in renewable energy also relies on low-skilled labour. For these jobs, there is indeed a risk of wage losses. For example, in the traditional manufacturing and extractive industries, which are highly unionised, the coverage through collective bargaining in the new sectors could be weakened, which could negatively affect workers' pay levels and benefits. For the energy transition to favour the creation of "decent" work, to quote the term used in the Paris Accord, it is necessary to involve the social partners at all levels.

The commitment of the social partners is also key for addressing health and safety issues. Even though "cleaner" technologies and products are more likely to reduce the risk of exposing workers to harmful substances—thus diminishing the health risks for workers—new risks associated with new or redefined jobs in the energy transition should be carefully assessed. The social partners play a fundamental role in identifying and evaluating any new risks. It will then be up to the European authorities to adapt the existing European health and safety regulations accordingly.

4.2. An inclusive transition for citizens/consumers: making sure everyone benefits

Europeans are affected by the energy transition as workers (see 4.1.), citizens but also as consumers. The second component of the "social pact" for the Energy Union must ensure that the energy transition brings a series of tangible benefits to all Europeans. First and foremost among these benefits is the positive impact on public health, whether by reducing air pollution through the use of cleaner energy sources or by providing better thermal comfort—for poor households in particular—through renovation measures and improved energy efficiency (see 4.2.1.).

In addition to this, consumers can slash their energy bills by reducing their energy consumption. To do this, consumers must play their part (by changing their consumption behaviour) but also by choosing more energy-efficient goods, opting for heating systems that are less energy intensive, initiating construction work to limit heat and energy loss in their home or producing their own energy (becoming "prosumers"). Public authorities should facilitate their taking a more active role, which is advantageous to energy consumers, and offer protection and guidance in an energy market that is often perceived as complex (see 4.2.2.).

The main risk of the energy transition for consumers is that some of them—especially those affected by or at risk of sliding into energy poverty—will be excluded from the benefits of this process. Without adequate public policy, the energy transition could drive a wedge between those consumers able to take full advantage of the transition and others who, for lack of improvement in terms of energy efficiency, will not witness a decline in their energy consumption. Worse still, this second group could see its precarious situation getting worse when subsidies for renewables result in higher taxes on electricity. For the energy transition to be successful, it must be inclusive. The fight against energy poverty in Europe must be one of the central objectives of this transition. In section 4.2.3., the extent of energy poverty in Europe will be investigated. It will be followed by an outline of a strategy that puts the energy transition at the service of the fight against energy poverty in Europe.

4.2.1. The energy transition as a public health issue

The energy transition, by promoting "clean energy",[321] should have a positive impact on the health of European citizens. This issue is key if national and European authorities are to win the support and commitment of citizens. Given the breadth of the problem, the following analysis shall restrict itself to two major consequences of the energy transition for public health: its contribution to reducing air pollution (4.2.1.1.) and the benefits of increased energy efficiency for household thermal comfort and indoor air quality (4.2.1.2.). While the first issue affects all citizens, the second concerns especially households living in energy poverty.

321. Clean energy is energy whose output emits a small amount of greenhouse gases and air pollutants (e.g. solar, wind, hydro). Biomass is an exception: although it is considered neutral in terms of greenhouse gas emissions, its combustion fumes contain many regulated compounds (oxides of nitrogen, sulfur dioxide, particles, etc.).

4.2.1.1. The energy transition as a means of reducing air pollution

The World Health Organisation (WHO) underlines the fact that a reduction in air pollution levels leads to better cardiovascular and respiratory health of the population, both in the short and long term.[322] In recent decades, the EU has made considerable strides to improve air quality: since 1990, sulfur oxide emissions have dropped by almost 90% and nitrogen oxide emissions by more than 50%. Emissions of fine particulate matter have been reduced by almost 20% since 2000.

BOX 7 ► Overview of EU action to improve air quality

In 2013, the EU adopted a policy package entitled "Clean Air for Europe", which delineates the problem and the measures needed to achieve the new intermediate targets for reducing the effects of pollution on health by 2030. It also contains a proposal for the ratification of the amendment to the Gothenburg Protocol to the UN Economic Commission for Europe's (UNECE) Convention on Long-range Transboundary Air Pollution to reduce the acidification, eutrophication and ground-level ozone.

The EU has three legal mechanisms to address air pollution:

- defining general air quality standards for ambient air content of air pollutants. Directive 2008/50/EC on ambient air quality sets EU air quality standards for tropospheric ozone, particulate matter, nitrogen oxides, hazardous heavy metals and a number of other pollutants.
- imposing (national) limits on total pollutant emissions; The National Emission Ceilings Directive (adopted in 2001 and revised in 2016) limits the overall emissions of five pollutants: sulfur dioxide, nitrogen oxides, non-methane volatile organic compounds, ammonia and particulate matter fines.
- adopting legislative measures for the various sources of pollution, for example, by controlling industrial emissions or setting standards for vehicle emissions, fuel efficiency or fuel quality.
    - in order to limit pollution from road transport, a number of directives have been adopted to set emission performance standards for various categories of vehicles and to regulate the quality of fuels.
    - to reduce air pollution generated by ships, Directive 2012/33/EU limits the sulfur content of marine bunker fuels in European seas.
    - the Industrial Emissions Directive (Directive 2010/75/EU, the so-called FDI Directive) lays down obligations for highly polluting industrial installations and is the basis for licensing and operating permits for these installations. It consolidates and brings together all applicable directives (waste incineration, volatile chemical compounds, large combustion plants, integrated pollution prevention and control, etc.) into a single text in order to facilitate their application and to minimize pollution from various industrial sources.

Source: European Parliament, Air and noise pollution, fact sheet, December 2016.

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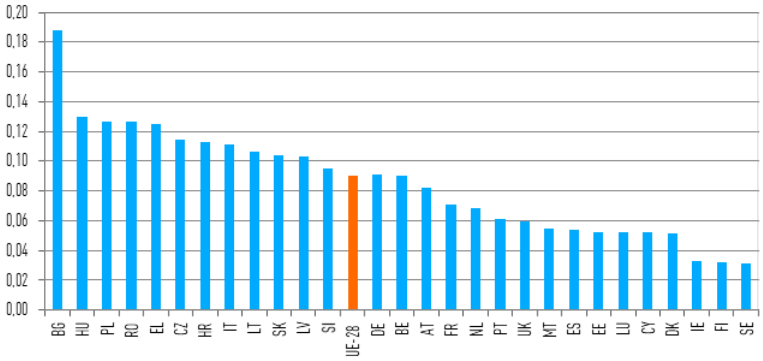
322. World Health Organisation, *Ambient (outdoor) air quality and health*, Fact sheet, no 313, September 2016

Despite these improvements, air pollution in the EU remains one of the main environmental dangers to public health. The European Environment Agency estimates that in 2013, there were more than 430,000 premature deaths due to air pollution in the EU.[323] The International Energy Agency (IEA) has a lower figure of 340,000 for 2015 but indicates that about half of the EU's 510 million people are exposed to fine particle concentration levels that are above the recommended limits by the WHO.[324] As illustrated in figure 6, the countries most affected by premature mortality due to air pollution are the Eastern European countries (except Estonia) and the South (Greece and Italy).

FIGURE 6 ► Premature mortality due to exposure to fine particulate matter (PM2.5) as a percentage of the total population in 2013



Source: Data available in European Environment Agency, *Air quality in Europe—report 2016*, n° 28/2016.

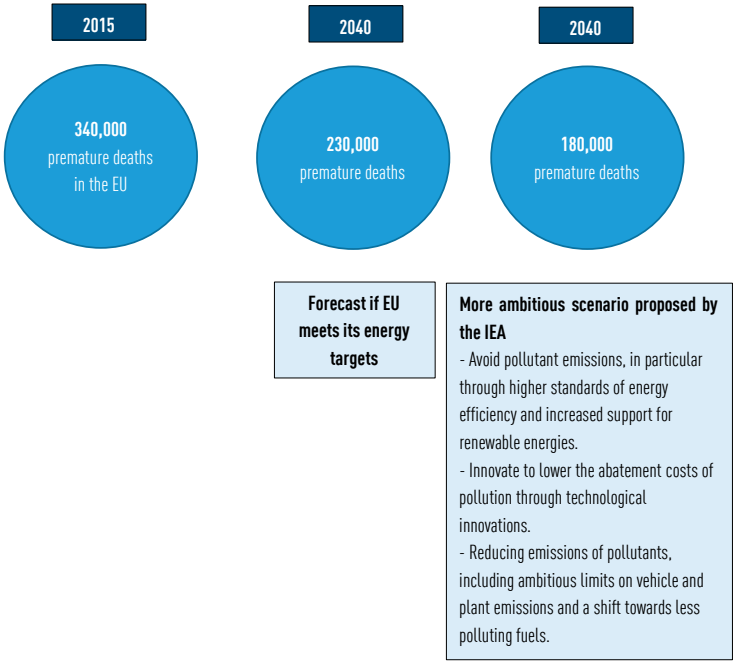
Whereas the production and use of energy is the most important source of air pollution from human activity, progress towards accomplishing the objectives of the European energy strategy (reduction of greenhouse gas emissions, improved energy efficiency and the development of renewable energies) have significant co-benefits, particularly in reducing air pollution.[325] The IEA esti-

323. European Environment Agency, *Air quality in Europe—2016 report*, November 2016
324. International Energy Agency, *Energy and Air Pollution: WEO 2016 Special Report*, 2016, p153
325. Ibid.

mates that the number of premature deaths linked to pollution will be reduced to 230,000 per year by 2040 if the EU meets its energy targets.

EU countries are moving in the right direction but the IEA urges them to be more ambitious, proposing an alternative scenario in which countries would adopt stricter pollution control standards, further enhance the energy efficiency of buildings and increase the share of renewables in energy production (see box 7). In this scenario, the number of premature deaths would be reduced to less than 180,000 per year by 2040 and the number of Europeans exposed to fine particle pollution above the levels recommended by the WHO would be less than 10% (compared to 50% today).

BOX 8 ► Reducing air pollution in Europe—IEA guidelines for a more ambitious strategy



Source: International Energy Agency, *Energy and Air Pollution: WEO 2016 Special Report*, 2016

Working towards a more ambitious scenario of reducing air pollution naturally comes at a price. Still, the IEA believes that, in addition to its positive impact on health, pursuing this path would also bring economic benefits that would far exceed the costs. An impact study by the European Commission corroborates this hypothesis, concluding that the economic benefits of the new EU air quality policies can be twenty times higher than the costs of implementing them.[326] What hampers more determined action by the public authorities is the fact that the costs are immediate, whereas the benefits will only be visible in the medium to long term.

Similarly, the costs and benefits of the energy transition are not evenly distributed across member states. If all EU countries stand to gain in terms of public health, the IEA evinces that the Eastern European Countries, which are currently heavily dependent on traditional solid fuels for their heating needs, would derive the greatest relative benefits from an accelerated energy transition. According to the IEA scenario, they could gradually replace their existing heating system with less polluting boiler systems.[327]

In this context, the idea of a "social pact" for the energy transition is particularly salient. As we have already seen, the Eastern European countries also need to address major challenges for they are more affected than other member states by job losses and employment redefinitions. A package is required to develop a systematic approach to the costs and benefits of the energy transition. The social pact would enable the EU to have a better grasp of the social challenges and opportunities the energy transition brings, whether for the EU as a whole or for individual countries.

4.2.1.2. Energy transition and energy efficiency measures for improved thermal comfort and better indoor air quality

The benefits of the energy transition for public health are not limited to the reduction of external air pollution. Indeed, one of the three objectives of the energy transition is to improve energy efficiency (in particular for housing), which requires better thermal insulation.

326. Thomas Verheye, Head of Unit on Industrial Emissions, Air Quality & Noise, Directorate-General for Environment, European Commission, *EU Air quality and the EU energy system*, PowerPoint presentation, March 2016
327. In the more ambitious scenario proposed by the IEA, by 2040, the average loss of life expectancy would be reduced by about 30% in Poland, Romania and Hungary (compared to the scenario based on the continuation of current policies). The same trend would hold for the decline in the number of premature deaths due to exposure to fine particles.

While the first objective of the energy transition for public health concerns all citizens, the second is aimed at those living in dilapidated, poorly insulated and/or humid housing (and concerns more than 15% of European citizens, see table 4) and/or lack the financial means to adequately heat their homes (almost 10% of the European population is concerned). Overall, these problems affect between 50 and 125 million Europeans. Individuals already living under conditions of energy poverty are particularly vulnerable (see 4.2.3).

Numerous studies have established a link between temperature / indoor air quality and the health of the inhabitants. The WHO has conducted a study (LARES – Large Analysis and Review of European Housing and Health Status) that examined the relationship between the energy efficiency of more than 3,000 housing units in eight European cities and the health of their occupants. After adjusting for the characteristics of individuals, reports of poor health (with specific symptoms and pathologies such as hypertension, asthma attacks, allergies, headaches, colds and sore throats) appeared to be significantly associated with poor thermal comfort, waterproofing problems and moisture and/or mould.[328]

328. Study cited in Host S., Grange D., Mettetal L, Dubois U. *Précarité énergétique et santé : état des connaissances et situation en Île-de-France*, Regional Health Observatory Île-de-France, 2014, p8

TABLE 4 ► EU-27 Excess Winter Mortality Index (1980-2013) in %

COUNTRY	EXCESS WINTER MORTALITY INDEX
MT	29,4
PT	28
CY	23,6
ES	20,6
IE	19,7
UK	18,6
EL	17,9
BG	17,8
RO	17,5
IT	16
FR	13,8
BE	13,6
SE	13,3
AT	13,2
SI	13,2
HU	12,3
DK	12,2
NL	11,8
DE	11,7
PL	11,7
LV	11,5
LT	11,5
LU	11,2
EE	10,9
CZ	10,8
FI	9,5
SK	8,2

Source: Data from Liddell, C. et al, "Excess winter deaths in 32 European countries: a critical review of methods", *Journal of Public Health* (2015).

The data used for the excess winter mortality index[329] also shows that this indicator is not climate dependent but strongly related to poor housing conditions and the inability to adequately heat one's home.[330] Indeed, the excess winter mortality was highest in countries with milder winters: Malta (29.4), Portugal (28), Cyprus (23.6) and Spain (20.6). In an article published in 2003, J. D. Healy has accentuated this "paradox of winter excess mortality": there is a greater risk of death during the winter for those living in southern Europe, where the climate is temperate and winters mild, than for those living in countries further north, such as the Baltic countries (index between 10 and 12) or Finland (9.5), where winters are severe.[331] These differences can be accounted for by divergent levels of health spending and dissimilar socio-economic conditions but above all by differences in indoor temperatures (well-heated housing is imperative in countries with severe winters). The study cited reveals that countries with higher energy efficiency in housing have a lower winter mortality index.[332]

The objective of improving energy efficiency, particularly by means of thermal insulation measures, should therefore heighten the thermal comfort and indoor air quality of homes, which in turn will have a positive impact on consumer health (while also lowering health care costs). But this requires that special attention be given to households living in fuel poverty (see 4.2.3.)

BOX 9 ► The cost of housing rehabilitation vs. the cost of poor housing conditions

In 2004, the United Kingdom launched a housing health and safety rating system (HHSRS). The entire housing stock has been classified according to criteria of safety and degradation. 29 potential hazards and the average probability of their occurrence were assessed. These calculations help estimate the average financial costs to the healthcare system (other measures that could be taken into account are: number of days off work, loss of income, insurance indemnities, etc.). At the same time, the direct financial expenditure required for a large-scale rehabilitation of dilapidated homes has been evaluated. The conclusion is that energy poverty costs the British healthcare system an estimated 5.3 million pounds

329. The accepted EU-wide definition of Excess Winter Mortality is: "the surplus number of deaths occurring during the winter season (December to March inclusive) compared with the average of the non-winter seasons". Angela Tod and Harriet Thomson, "Health impacts of cold housing and energy poverty" in Katalin Csiba (ed.), *Energy poverty handbook*, Les Verts/Alliance Libre Européenne du Parlement européen, October 2016, p40.
330. Sian Jones, "Social causes and consequences of energy poverty", in Katalin Csiba (ed.), *Energy poverty handbook*, p32.
331. J. D. Healy, "Excess winter mortality in Europe: a cross-country analysis identifying key risk factors", *Epidemiol Community Health*, n°57 (2003), p784-789.
332. Study cited in Angela Tod and Harriet Thomson, "Health impacts of cold housing and energy poverty", in Katalin Csiba (ed.), *Energy poverty handbook*, p41.

(6.5 million euros) per 100,000 housing units, whereas rehabilitation measures would amount to 1.5 million pounds (just over 1.8 million euros).

Source : Host S., Grange D., Mettetal L, Dubois U. *Précarité énergétique et santé : état des connaissances et situation en Île-de-France*, Regional Health Observatory Île-de-France, Paris, 2014, 14.

4.2.2. "Consumactors" and "prosumers"- ensuring that citizens benefit fully from the advantages of the energy transition

The liberalisation of energy markets, by exposing monopolies to competition and enabling customers to choose their energy provider or switch rates, was a necessary step for the "activation" of consumers in the energy sector.

With the energy transition, the role of "active consumers" takes on a new dimension: the success of the transition process depends in part on the participation and commitment of consumers.

Above all, to achieve the goal of improving energy efficiency by at least 27% by 2030, households—which account for about 26% of the EU's energy consumption—must play their part. This involves reducing energy consumption through better insulation of homes or the adoption of new behaviours, services and technologies. In return, in addition to the overall benefits of the energy transition, households will see their energy bills slashed and their purchasing power increased.

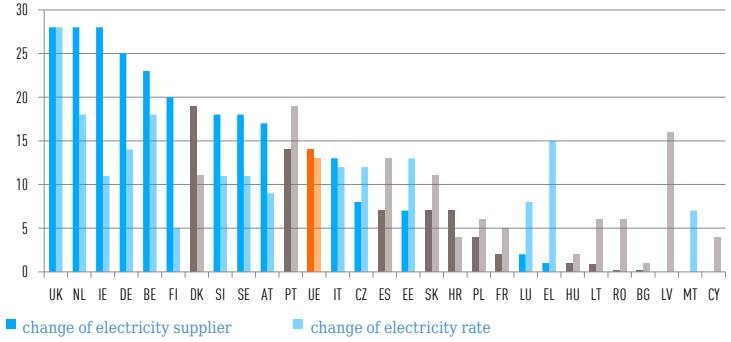
Moreover, consumer behaviour will increasingly affect the development of renewable energies. Indeed, since renewables are often variable energies, their development beyond a certain threshold will require consumers to align their consumption to peak production times.[333] Last but not least, active consumers and prosumers are helping to raise public awareness, highlighting the need for and the importance of the energy transition and thus encouraging people to take greater ownership of the energy transition, which is essential if it is to be successful.

Yet although the energy transition must be centred on consumer-actors, a gap remains between consumers and the energy market. As the European Consumers' Organisation (BEUC) argues, the majority of consumers simply want to use energy services without having to get too involved in understanding a complex market.[334]

333. Wind power and photovoltaics are the two fastest growing forms of renewable energy. They depend on sunlight or wind and are not necessarily available when consumers most need them.
334. BEUC, *Building a consumer-centric Energy Union*, position paper, July 2015, p16

This judgement needs to be qualified. To be sure, at the EU level less than 15% of consumers have switched electricity suppliers during 2012 to 2015 (see figure 7). But this average conceals large national disparities, with figures varying from 0% to almost 30% depending on the country, which seems to suggest that consumers are not inherently passive. Rather, certain national policies maintain them in a state of passivity, while others succeed in activating them.

FIGURE 7 ► Consumers who reported having changed their electricity supplier/rate at least once in the last three years (spring 2012 to spring 2015)



Countries without regulated prices for households appear in blue; those with regulated prices in grey.
Source: Data from a Consumer Survey conducted by Ipsos, London Economics and Deloitte between February and June 2015. The information is available in European Commission, *Second consumer market study on the functioning of the electricity market for consumers in the EU—Country fiches*, 2016.

One of the objectives of the social pact for the Energy Union should be to ensure that consumers are able to take full advantage of the energy transition. In order to do so, consumers must be made aware of the "why"—individual benefits such lower energy bills, a greater sense of control over their energy consumption as well as collective advantages such as the sense of having made a contribution to the energy transition and better air quality—and "how" of becoming an active energy consumer.

In this context, the European Commission's awareness campaign, which will be launched in 2017, aiming to encourage more consumers to participate in energy market developments, stressing the benefits of energy efficiency and the possibility of switching one's energy provider is certainly a step in the right direction.[335] As

335. European Commission, *Second Report on the State of the Energy Union*, COM (2017) 53 final, 1st February 2017, p10

a follow-up, the Commission could encourage member states to set up educational programmes for primary and secondary school pupils in order to raise awareness of green energy and energy efficiency, as Claude Turmes has propounded.[336] The goal is not only to educate children but also to raise awareness among their parents.

By itself, greater awareness is of course insufficient to induce behavioural changes and to empower consumers so that they can reap the gains of the energy transition. In the energy market, there are still obstacles and impediments to be overcome. Policy-makers must ensure that consumers intent on reducing their energy consumption, renovating and isolating their homes, or becoming a producer of photovoltaic or wind energy are emboldened to do so.

4.2.2.1. Removing barriers to an active role for energy consumers

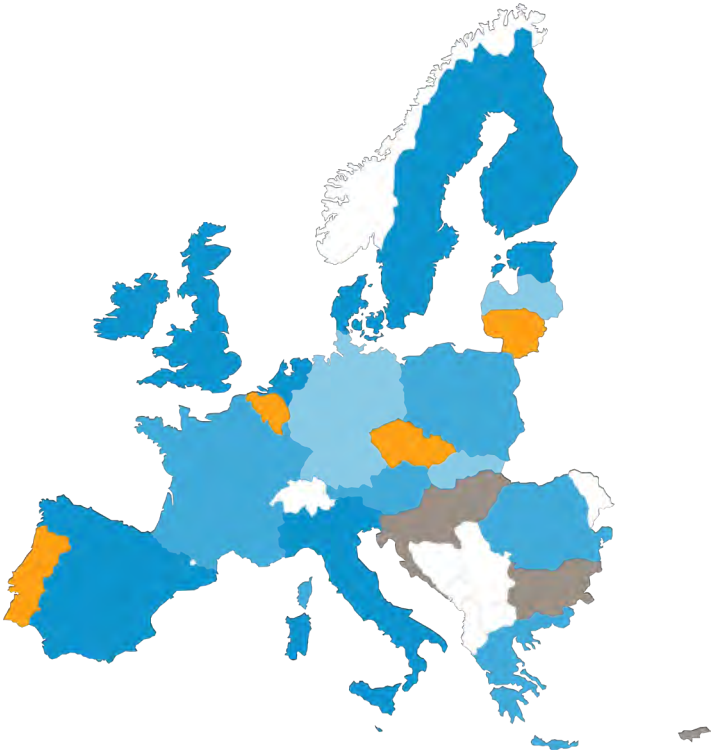
One of the major obstacles to greater involvement of consumers is the fact that today the majority of Europeans receive up-to-date information about their energy bill only once or twice a year. Consumers will find it difficult to change their consumption patterns and save energy unless they receive more comprehensive information about their energy consumption and costs and have easy access to their consumption data in real time.

A necessary step to remedy this situation is the replacement of conventional meters by so-called "smart" meters, which will provide consumers with free and frequent access to precise consumption data.

As part of third energy package of 2009, EU member states committed themselves to implementing smart meters wherever they are cost-effective, with the aim of replacing 80% of electricity meters with smart meters by 2020. As of now, installing smart meters proceeds at different paces across member states. 17 out of 28 countries have committed themselves to a large-scale roll-out of smart meters (i.e. more than 80%) by 2020 (see map 1). Other member states are still awaiting the profitability analysis of this measure or, in thoses case where it has already been carried out, remain as yet unconvinced about the profitability of a large-scale roll-out. In 2015, Germany, which was committed to the measure, declined to stage a mass roll-out after an unfavourable cost-benefit analysis.[337]

336. Claude Turmes, *Transition énergétique—une chance pour l'Europe*, Les petits matins, Paris, 2017, p449
337. A 2013 study by Ernst & Young estimated that the costs for a mass roll-out in Germany would amount to between 15 and 20 billion euros. The country cannot rely on economies of scale, unlike France for example, where ERDF regularly stages large-scale roll-outs of new meters, thus reducing costs (five billion euros).

MAP 1 ► Expected level of smart meter use by 2020 in EU member states



total deployment (more than 99%) by 2020
wide deployment (more than 80%) by 2020
selective deployment by 2020
no wide deployment by 2020
no available date

Source: Data from the Joint Research Center for Smart Electricity Systems and Interoperability (consulted in January 2017)

The mass deployment of smart meters will not automatically save energy. Energy saving will depend on the use each consumer makes of this new device. For example, a report by the French *Conseil Général de l'Environnement et du Développement* concluded that in France, using smart meters for energy control is not very widespread:

only 0.3% of customers having a smart meter installed in their home have chosen a secure account enabling them to track their consumption.[338] It is crucial to change this situation, in particular by linking the deployment of smart meters to programmes and/or apps that enable consumers to have access to their consumption in real time and by alerting them to the possibilities their new meter offers.

Studies have shown that providing consumers with information about their consumption enables them to reduce their energy consumption. For example, the European Commission has undertaken a study which shows that tenants, once they are furnished with information about their energy use, are able to reduce their consumption by around 8% simply by changing their heating habits.[339]

Taking an interest in one's energy consumption can be facilitated by a playful approach. Five years ago, no one would have thought that consumers would be attracted to apps/smart watches allowing them to count their steps on a daily basis. And some years from now, it could well be possible that consumers will be interested in how much energy their home appliances consume, tracking the energy costs of their everyday activities, just as they currently count their steps or measure their calory intake. It is also up to the European authorities to come up with original solutions.

The deployment of smart meters is a first step that must be accompanied by the creation of regulatory and incentive frameworks for consumers. In November 2016, the European Commission proposed a revision of the regulatory framework for the electricity market in order to enable a more active role of consumers. The proposal contains new provisions to improve and clarify the information on electricity bills and demands that each state put in place electricity price comparing tools to provide independent information to all consumers, that consumers can switch energy suppliers more easily, at short notice (three weeks) and without incurring cancellation fees.[340] Another important project for the Commission is to promote consumer access to dynamic electricity pricing in order to bring about a modulation of demand (with spikes in consumption when energy prices are low and a drop in consumption when they are high). This will allow consumers to pay less if their energy use occurs at certain times.

338. Bernard Flüry-Hérard and Jean-Pierre Dufay, *Le déploiement du compteur Linky*, Conseil général de l'environment et du développement durable, report n° 010655-01, January 2017
339. European Commission, *Delivering a New Deal for energy consumers*, COM (2015) 339, SWD (2015) 141, 15 July 2015, p3
340. It is crucial to ensure the independence of this tool for power suppliers could support non-independent price comparisons whose algorithm favours one supplier over others.

4.2.2.2. Creating a European regulatory framework for prosumers

The development of renewable energies offers consumers the opportunity to generate their own energy and to resell the energy they do not consume.

At this stage there is no common regulatory framework and no common definition of "prosumers" at EU level. Significant disparities exist between member states regarding the opportunities for citizens to become prosumers. According to a report commissioned by Greenpeace on the rights of prosumers, in Germany about half of the renewables are held by citizens (individual or group prosumers via cooperatives). Conversely, in Poland, by the end of 2015 there were only 4,700 micro-installations that produced electricity from renewable energy (with an installed capacity of about 35 MW).[341]

While the issue of prosumers currently for the most part hinges on national responses, once the European Commission asserts that citizens are at the heart of the Energy Union, it should also guarantee some form of equity between consumers so that they can make the most of the energy transition, irrespective of the country they live in.

The Commission should therefore undertake to define a European regulatory framework for prosumers which would include a common definition of the term and answers to the main obstacles to be overcome.

Three issues in particular must be addressed at European level.

- Lack of support or access to reliable information on the various technological options on the market in a context where the quality of the offers available varies widely. BEUC has identified certain trends that may become major problems if a response is not forthcoming quickly: lack of independent advice during sale, problems during the installation process, or consumer dissatisfaction regarding the performance of the device or the service offered by the installers. The definition of a common framework would therefore make it possible to define specific provisions for informing and protecting prosumers that would be valid in all EU countries.
- Lack of clarity of the regulatory framework for prosumers, which stems from the fluctuations in renewable development support programmes in many member states. This includes, among other things, the introduction of network costs, the inability to receive fair remuneration for excess

341. Josh Roberts, *Prosumer rights: options for a legal framework post-2020*, ClientEarth, May 2016, p12

electricity that is exported to the grid, or the retroactive introduction of changes to support mechanisms for renewables.

- Difficulties in accessing the network in certain member states where administrative barriers, including long and complex authorisation procedures, discourage consumers and increase investment costs. For example, the current proposal by the European Commission suggests ensuring priority access to the electricity grid for renewable energy furnished by small producers (installations below 500kW), which protects small prosumers. Nevertheless, addressing the question of prosumers also requires an in-depth analysis of how network costs are shared between consumers and prosumers, as BEUC points out, in order to find the right compromise between "autonomy of production and consumption on the one side and solidarity in one's contribution, via distribution and transport networks, to the balance of the system on the other".[342]

Defining this common framework is not an ancillary issue, since cases of abuse, fraud, mismanagement, etc. will prevent people from taking ownership of the energy transition (especially since prosumers are meant to have a positive impact on the political sustainability of this transition). Spain provides an instructive example, with national policy on renewables having disastrous consequences for consumers (see box 10).

It would also be useful to share experiences (in order to encourage the exchange of good practices) and to ensure a better visibility of prosumers within the EU as part of the annual report on the state of the Energy Union. In this respect, the European Economic and Social Committee (EESC) recommends, in an own-initiative opinion on this subject, that the Commission "monitor the development of prosumerism in the member states as part of the annual Energy Union reporting".[343]

Lastly, the development of "prosumerism" raises questions of social equity: public authorities must put in place the necessary mechanisms to ensure that, given the high cost of entry, there is no polarisation between wealthier households who could become prosumers and poorer households who do not have this option but would nonetheless contribute to funding financial incentive programs for renewables (see 4.2.3.).

342. Claude Turmes, *Transition énergétique — une chance pour l'Europe*, p442
343. EESC, *Prosumer Energy and Prosumer Power Cooperatives: Opportunities and challenges in the EU countries*, own-initiative opinion, 19 October 2016, p5

BOX 10 ► Learning the lessons from Spain's system of support for renewable energy development

In the 2000s, there was a push to develop renewable energies in Spain. In 2007, the government set up a very generous system of premiums and feed-in tariffs for green energy. The price it paid for photovoltaic electricity was twelve times higher than the market price for electricity. To some extent, the initiative was a success because the capacity of photovoltaic solar panels increased five-fold in one year (from 690MW in 2007 to 3.5GW in 2008). At the same time, the cost of the system of premiums and feed-in tariffs also exploded from 190 million euros in 2007 to 3.5 billion euros in 2012. As the government did not want to pass this increase in costs entirely on to consumers, the cumulative energy deficit (the difference between the costs and the regulated revenues of the electricity system) reached 26 billion euros (or almost 3% of GDP). In order to cope with this deficit, in 2009 the government for the first time cut the premiums introduced in 2007. From then on, about ten legislative changes (with retroactive effect) gradually eroded the profitability of the installations and led to financial difficulties for producers. Small producers (individual producers or cooperatives) were hit particularly hard. This naturally fueled consumer distrust of investment in renewable energy, which has collapsed in recent years. Spain, which at the end of 2000 was one of the ten most attractive countries in the World for investment in renewable energies, ranks only 28th in 2016.

Source: "Les sacrifiés de la bulle verte espagnole", *Les Échos*, 12 May 2014; "Spain solar power clouded by government U-Turn", *EUObserver*, 27 October 2015, "The cost del sol", *The Economist*, 20 July 2013; Ernst&Young, Renewable Energy Country Attractiveness Index, October 2016

4.2.2.3. Making sure consumers and their personal data are protected

Protecting consumers means above all protecting them from unfair, deceptive and/or aggressive commercial practices. Since consumers are often unfamiliar with the energy market, which often changes due to the provision of new goods and services, allows the above-mentioned business practices to take hold.

In addition to existing consumer legislation in energy sector, the third energy package has introduced a specific set of rights for energy consumers.[344] It must be ensured that these rights are respected and enforced in each member state (see chapter 1.).

Protecting energy consumers also means protecting their personal data. Indeed, with the deployment of smart meters, it is crucial to tackle the risk of user profiling via energy consumption data (which would make it possible to gain information about time spent at home and away from home, lifestyle choices, heating type, etc.). As we have seen in France, the deployment of the Linky smart meter has

344. Working Group Consumers as Energy Market Actors, *Draft Report*, p11

provoked many questions from privacy advocates, despite rather stringent recommendations on the collection of data from the National Commission on Informatics and Liberty (CNIL) (see box 11). The BEUC, insisting on the basic principle of individual freedom of choice, argued that the decision of consumers who have certain reservations and do not wish to be equipped with a smart meter must be respected.[345] No additional fees should be imposed upon them. Alternatively, it may be necessary to offer consumers the possibility to have all their data stored on a hard drive in their home that only they would be able to access.

BOX 11 ► Protecting consumer privacy in France

The CNIL has specified the modalities for reading the load curve of customers so as to protect their personal data:

- Linky meters must be set up to record on site (i.e. at the customer's home) the load curve at hourly intervals for a maximum of one year;
- the customer's consent must be requested for the load curve to be fed into the ENEDIS information system and for passing the information on to third parties;
- the user has the right to oppose even this local form of data storage; without having to give reasons for this decision, it suffices to tick the relevant box;
- the user can deactivate the local storage at any time and delete the data (especially in the event of moving house).

Source: Commission nationale de l'informatique et des libertés, Délibération n° 2012-404 portant sur la recommandation relative aux traitements des données de consommation détaillées collectées par les compteurs communicants, 15 November 2012

4.2.3. For an energy transition that aims to eradicate energy poverty

There are more than 50 million people in the EU who are at risk of energy poverty—they are unable to heat their homes adequately and/or to pay their energy bills. While the energy transition brings tangible benefits to consumers, there is a risk that vulnerable consumers will not be able to take full advantage of the benefits of the energy transition. Without public support policies, the energy transition could even exacerbate social polarisation.

On the basis of an overview of the problem of energy poverty in the EU (4.2.3.1.), the impact of the energy transition on energy poverty (4.2.3.2.) is analysed. While it is essential to ensure that the energy transition does not have a negative

345. BEUC, *Protecting and empowering consumers in future smart energy markets*, February 2013, p3

impact on consumers living in or at risk of energy poverty, more needs to be done. The social pact of the Energy Union must ensure that the energy transition aims for the eradication of energy poverty throughout Europe (4.2.3.3.). It is above all a question of social justice but also a political issue, because—similarly to the situation of workers—if there are consumers who lose out from the energy transition, it will prove more difficult to attract the citizen support that is essential to the success of the energy transition.

4.2.3.1. Energy poverty in the EU

The problem of energy poverty has been publicly acknowledged in the United Kingdom, and since the late 2000s it has gained increasing political attention throughout the EU. Although there is no common European definition of energy poverty, it is commonly accepted that this situation concerns "a situation in which individuals or households are unable to properly heat their housing or to use other energy services needed at an affordable price".[346]

With the third package of legislative proposals for common rules for the internal markets for electricity and gas which was adopted in 2009, the problem of energy poverty has been explicitly recognised in EU legislation. The package states the following: "Member states shall take appropriate measures to protect final customers, and shall, in particular, ensure that there are adequate safeguards to protect vulnerable customers. In this context, each member state shall define the concept of vulnerable customers which may refer to energy poverty and, inter alia, to the prohibition of disconnection of electricity to such customers in critical times.… Member states shall take appropriate measures, such as formulating national energy action plans, providing benefits in social security systems to ensure the necessary electricity supply to vulnerable customers, or providing for support for energy efficiency improvements, to address energy poverty where identified, including in the broader context of poverty".[347]

346. Steve Pye et Audrey Dobbins, "Energy poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures", Policy report Insight_E, May 2015, p2
347. Articles 3.7 and 3.8 of the Directive 2009/72/EC concerning common rules for the internal market in electricity, 13 July 2009

BOX 12 ► Defining and measuring energy poverty

The approach commonly used to quantify energy poverty at the national level explores the ratio of household income to energy expenditure. According to this approach, an energy poor household is one which needs to spend more than a certain share of disposable income on energy (for example 10% in Northern Ireland, Scotland and Wales). Similarly, in 2010, the Commission proposed that households allocating more than twice the national average of their total consumption expenditure to energy products should be considered energy poor. Although this expenditure approach has the advantage of being relatively straightforward, it is not without shortcomings. On the one hand, it excludes households that restrict their energy consumption in order to limit their spending. But it might, on the other hand, include more affluent households that use an excessive amount of energy.

OFFICIAL DEFINITIONS OF ENERGY POVERTY IN THE EU		
Great Britain	Northern Ireland, Scotland and Wales (since 2001)	"Defined as having to spend more than 10% of income (including housing benefit) on all household fuel use to maintain a satisfactory heating regime."
	England (since 2013)	"A household where i) their income is below the poverty line (taking into account energy costs); and ii) their energy costs are higher than is typical for their household type."
France (since 2010)		"Is considered in a situation of energy poverty "a person who encounters in his/her accommodation particular difficulties to have enough energy supply to satisfy his/her elementary needs, this being due to the inadequacy of resources or housing conditions."
Ireland (since 2016)		"Energy poverty is a situation whereby a household is unable to attain an acceptable level of energy services (including heating, lighting, etc.) in the home due to an inability to meet these requirements at an affordable cost."
Slovakia (since 2015)		"Defined as a condition when average monthly household expenditures for the consumption of electricity, gas and heat, represent a significant share of the average monthly household income."
Cyprus		"Energy poverty may relate to the situation of consumers who may be in a difficult position because of their low income [...] in conjunction with their professional status, marital status and specific health conditions and therefore, are unable to respond to the costs for the reasonable needs of the supply of electricity, as these costs represent a significant proportion of their disposable income."

Source: Katalin Csiba (ed.), *Energy Poverty Handbook*, The Greens/EFA group of the EP, 2016, p137-138

The problem of energy poverty is certainly linked to the larger fight against poverty, but it must be treated as a challenge in its own right because it has its own causes and solutions (see 4.2.3.2 and 4.2.3.3.). Moreover, recognising this challenge in European legislation and addressing it in the context of energy policy is particularly relevant given that the EU has more competences in the field of energy (which is a shared competence of the EU) than in the fight against poverty (where essentially the EU can only coordinate the action of the member states).

There is no common definition of energy poverty nor is there a common rule for measuring this phenomenon. At the national level, indicators based on the level of energy expenditure as a percentage of income are often used to measure the problem for public policy purposes. However, this expenditure approach has some limitations (see box 12). For this reason, pan-European studies trying to gauge the extent of the problem mostly use three indicators from EU statistics on income and living conditions (EU-SILC): (i) inability to keep the home adequately warm; (ii) having arrears in utility bills; and (iii) living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames or floor.

TABLE 5 ► Energy poverty indicators (2015) in percentage of total population

	INABILITY TO KEEP THE HOME ADEQUATELY WARM	TOTAL POPULATION LIVING IN A DWELLING WITH A LEAKING ROOF, DAMP WALLS, FLOORS OR FOUNDATION, OR ROT IN WINDOW FRAMES OR FLOOR	ENERGY ARREARS
EU-28	9,4	15,2	9,0
BE	5,2	18,2	5,1
BG	39,2	12,9	31,4
CZ	5,0	8,9	3,0
DK	3,6	16,1	3,4
DE	4,1	12,8	4,0
EE	2,0	13,4	7,9
IE	8,9	14,5	18,2
EL	29,2	15,1	42,0
ES	10,6	15,2	8,8
FR	5,5	12,6	5,9
HR	10,0	10,9	28,5
IT	17,0	24,1	12,6
CY	28,3	26,5	20,1
LV	14,5	24,4	16,7
LT	31,1	17,0	8,4
LU	0,9	14,4	2,4
HU	9,6	25,4	19,4
MT	13,9	10,2	10,2
NL	2,8	15,7	2,7
AT	2,6	11,7	3,5
PL	7,5	11,9	9,2
PT	23,8	28,1	7,8
RO	13,1	12,8	17,4
SL	5,6	26,9	17,5
SK	5,8	6,3	5,7
FI	1,7	4,4	7,5
SE	0,9	7,5	2,7
UK	7,8	14,8	7,0

Source: Eurostat EU-SILC, data for Ireland is from 2014.

According to Eurostat data, in 2015, 9.4% of the European population could not maintain an adequate temperature in their home in 2015, i. e. about 50 million people in the EU, with a similar number of Europeans in arrears with their energy bills.

Underlying these figures are very heterogeneous national realities (see table 5). A central-periphery asymmetry is noticeable: with a few exceptions (Spain, Poland, Czech Republic, Slovakia, Estonia and Malta), the countries of Southern and Eastern Europe have a larger share of the population at risk of fuel poverty than the countries of the centre and the North of the EU. This has led some authors to speak of a geographical and social "energy fracture" running through the EU, which results in a higher proportion of households in the least developed member states being unable to meet their basic energy needs.[348]

Greece and Bulgaria have the highest percentage of energy arrears. In Greece this concerns more than 40% of the population, which is obviously linked to the economic crisis that the country has been experiencing since the beginning of the decade. By contrast, the problem is rather more limited in Sweden, Denmark, Austria, Germany, the Netherlands, Luxembourg and the Czech Republic.

In six European countries—all of them in Eastern and Southern Europe—about one in four inhabitants live in houses with water infiltration, humidity or mould (Italy, Cyprus, Latvia, Hungary, Portugal and Slovenia).

Bulgaria, Lithuania, Greece, Portugal and Cyprus are the countries with the highest share of the population having difficulty maintaining an adequate temperature in the home. Given their location in the south or in the Mediterranean basin, which promises milder winters, this may seem surprising for the Mediterranean countries, which have milder winters. Indeed, countries with very cold winters (Sweden, Finland, the Netherlands and Denmark) are much less affected by this problem. But the countries of the South are suffering from the consequences of a poorly insulated housing stock and the lack of adequate heating systems in most of the houses. Since the beginning of the decade, the problem of fuel poverty in some countries of the South is also linked to the austerity policies pursued in these countries which have led to a fall in household income.

348. Stefan Bouzarovski and Sergio Tirado Herrero, "Understanding the core-periphery divide in the geographies of European Energy Poverty", in *Energy Poverty Handbook*

As far as the Eastern European countries are concerned, Bouzarovski and Herrera argue that in the former Soviet bloc the "number of inadequately heated homes has seen a dramatic expansion during the past two decades due to the combination of, inter alia, rapid price rises, inadequate social protection and low residential energy efficiency".[349]

4.2.3.2. What impact does the energy transition have on energy poverty?

Energy poverty is caused by three main factors: i) low household income; ii) high energy prices; and iii) poor energy efficiency in the home. To understand the impact of the energy transition on energy poverty, it is necessary to understand its impact on these three main causes of the problem. While the energy transition does not have a direct impact on household income levels, it has a direct impact on energy prices and household energy efficiency. These two issues shall be analysed in this section.

The impact of the energy transition on energy prices

According to a report by the Agency for the Cooperation of Energy Regulators (ACER) and the Council of European Energy Regulators (CEER), electricity prices for households increased by 28 % between 2008 and 2015, while the price of gas increased by 15%.[350]

Figures 8a and 8b show two indicators illustrating two drivers of energy poverty: low incomes (measured by the at-risk-of-poverty rate, i.e. the share of people with an equivalent disposable income below 60 % of the national median equivalised disposable income after social transfers) and the price of energy (as measured by the price of electricity and gas at purchasing power parity).

349. Stefan Bouzarowski and Tirado Herrero, "The energy divide: integrating energy transitions, regional inequalities and poverty trends in the European Union", *European Urban and Regional Studies* 24, no 1 (2017): p72
350. ACER/CEER, "2015 electricity and gas market monitoring report—retail markets", November 2016, p9

FIGURE 8A ► Average electricity prices for households in PPS (per 100 kWh) and at-risk-of-poverty rate in the EU-28 in 2015 (in percent)

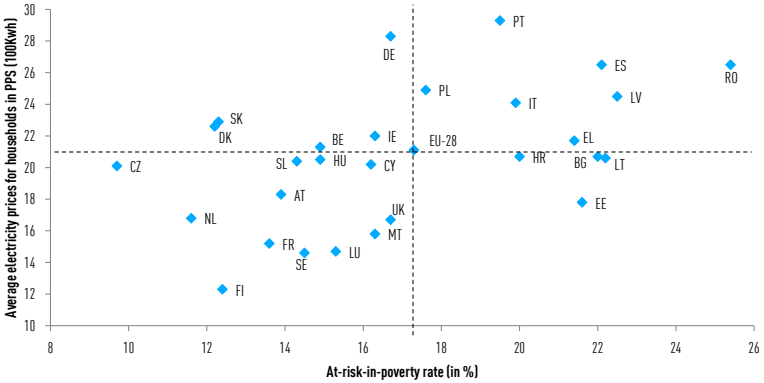


FIGURE 8B ► Average price of gas for households in PPS (per 100 kWh) and at-risk-of-poverty rate in the EU-28 in 2015

Source: Author's elaboration on the basis of Eurostat data

All countries suffering from a combination of high electricity/gas prices and an above-average poverty risk are in Southern and Eastern Europe. In five of these countries, the population is particularly at risk of energy poverty,

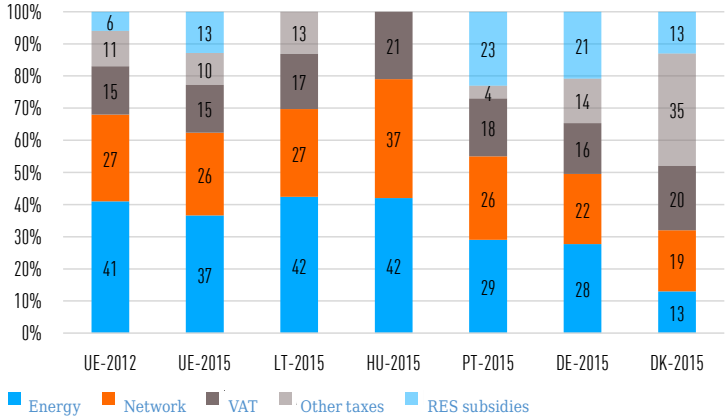
according to table 5: Portugal, Greece, Italy, Bulgaria and Latvia. This data also highlights the fact that energy prices and low incomes are not the only causes of energy poverty. Indeed, in three countries with below average poverty rates and electricity prices there is a significant risk of energy poverty, according to table 5. These are Cyprus, Slovenia and Hungary. As shown in table 5, they are particularly affected by poor housing, which translates into low energy efficiency, another cause of energy poverty.

Will the energy transition lead to lower energy prices, thus making a significant contribution to the fight against energy poverty? It does not look likely, at least not in the short term. Member states' investments in renewable energy are often financed by an increase in electricity taxes. According to the 2015 ACER/CEER report, within the EU these consumer charges doubled between 2012 and 2015, amounting to 13% of the electricity price in 2015 compared to 6% three years earlier. This European average hides very heterogeneous national realities: the renewable energy charges (or RES charges) make up more than 20% of the electricity price in countries such as Portugal and Germany, but less than 1% in other countries, notably Hungary and Latvia (see figure 9).

Experts have warned of the regressive effect of this mode of financing the energy transition, since an increase in energy prices has a negative impact on the income of poor households which is disproportionately greater than the repercussions for wealthier household.[351] This is strictly a national choice. Individual states could have financed renewable subsidies via any other form of tax (for instance income tax, VAT, corporate tax, etc.). Moreover, researchers at the European Parliament add that poor households "face a 'double penalty', since they pay for RES subsidies through their energy bills but cannot benefit from producing renewable energy themselves because of high up-front investment costs."[352] However, it should be pointed out that many member states protect the poorest households from rises in energy prices (thereby dampening the cost impact of financing the development of renewable energies) through social policy interventions: social energy tariffs, energy vouchers, etc.

351. Louise Suderland and Darryl Croft, "Energy poverty—risks, conflicts and opportunities in the development of energy poverty alleviation policy under the umbrella of energy efficiency and climate change", in *Energy efficiency first: The foundation of a low-carbon society*, European Council for an Energy Efficient Economy Summer Study, 2011
352. Nikolina Šajn, "Energy poverty: protecting vulnerable consumers", Briefing, European Parliament Research Service, May 2016, p6

FIGURE 9 ► Distribution of the electricity cost of the standard offers for households made by the incumbent operator in EU capital cities (2012-2015)



Source: Data from the ACER/CEER report, 2015

Impact on the energy efficiency of housing

One of the objectives of the energy transition is to considerably improve energy efficiency (for example by 27% by 2030 at the EU level and by 50% by 2050 in France and Germany). This requires significant improvements in the energy efficiency in housing. Since poor energy efficiency in housing is one of the causes of energy poverty, the energy transition must use energy efficiency improvements to reduce energy poverty in Europe. If energy costs rise but households are able to reduce their energy consumption, lower energy bills are possible.

However, the measures that achieve the best results in terms of improving energy efficiency, such as insulation work or changes in heating mode, often involve high costs. Without public aid, they will remain beyond the reach of the poorest households. Similarly, tenants will find it harder to take advantage of the opportunities offered by improved energy efficiency than homeowners. This calls for targeted measures supporting consumers living in or at risk of energy poverty (point 4.2.3.3.).

To conclude, the energy transition can indeed heighten the risk of energy poverty (if we take into account the two main channels through which the energy

transition has an impact on energy poverty)—unless ambitious measures to increase energy efficiency are put in place.

4.2.3.3. The Energy Union: paying more attention to energy poverty and supporting national initiatives to tackle this challenge

The Energy Union has already put the issue of energy poverty on the agenda. However, this did not yet translate into effective and ambitious actions to combat energy poverty. As Dobyns and Pye explain, this is due to an at most partial understanding of the problem, originating in the deficiencies of the existing indicators and in the willingness of the European Commission to leave this problem to the member states (the subsidiarity principles prevails).[353] In order to ameliorate this situation, the "energy poverty" section of the Energy Union's Social Pact must address two challenges. It should work toward a better understanding and greater visibility of the problem, and it must identify and support the best solutions to this problem (regardless of whether they derive from European legislation, community funds or the coordination of national initiatives).

How to gain a better understanding of the extent and impact of energy poverty and identify the best solutions

The first step to be taken in order to ensure that the Energy Union serves the fight against energy poverty is to gain a better understanding of the challenge and ensure greater visibility. Today, as we saw in section 4.2.3.1., the European approach to the challenge of energy poverty remains fragmented and uneven. There are different definitions, various metrics to measure the problem, and profoundly heterogeneous responses (as outlined below). Although a one-size-fits-all top-down approach to the challenge of energy poverty is not desirable, not least because national particularities need to be taken into consideration—such as the energy performance of buildings, the energy system or the local climate—, stronger EU intervention is needed to ensure that the energy transition will not leave some of the consumers on the margins.

This requires improved data collection methods, which ought to furnish additional information on the extent and impact of energy poverty within the EU, an evaluation of the effectiveness of the counter-strategies, and the promotion of an exchange about good practices. Many reports stress the importance of

353. Audrey Dobbins and Steve Pye, "Member state level regulation related to energy poverty and vulnerable consumers", in *Energy Poverty Handbook*, p119

developing a common European definition of energy poverty, which does not necessarily imply a single metric for calculating it. By way of example, in 2015, the European Parliament has asked the European Commission to propose a definition and indicators of energy poverty and an action plan to defeat it.[354]

The Commission has taken a major step in this direction by announcing the creation of an observatory on energy poverty by the end of 2017, which will produce statistics on energy poverty, disseminate good practices and provide information on energy poverty. Identifying the challenge of energy poverty and providing a better understanding of it is an indispensable but insufficient step towards addressing the problem.

Overcoming energy poverty: from palliative to preventive measures

There are various instruments available to protect those who are in living in or at risk of energy poverty. This includes, first of all, measures to support and inform consumers, protecting them against electricity cuts in particular (the European Commission has proposed to strengthen these protective mechanisms by introducing new procedural safeguards which take effect before a consumer's energy supply is cut), and campaigns to raise awareness of the topic (including tools to compare energy prices, measures to improve energy efficiency, the use of smart meters to track energy consumption, etc.).

While these measures are important, the two main instruments for responding to energy poverty are, on the one hand, financial interventions to reduce energy bills and, on the other, measures to improve energy efficiency.

The former include social tariffs (particularly in the Southern countries, notably in Cyprus, Spain, France, Greece and Portugal, but also in Belgium) or energy subsidies for low-income households.[355] Nonetheless, these are, as it were, passive measures which preserve the status quo and represent a growing and recurrent burden (in view of the fact that energy prices rise faster than the average household income) on public budgets. Moreover, this type of measure often has various shortcomings, as a report on energy poverty published in 2013 by the French Caisse des Dépôts has brought into relief. One problem is how to target households living in or on the cusp of energy poverty. For example, in the United Kingdom, only 12% of the beneficiaries of the "winter fuel payment"

354. European Parliament, *Towards a European Energy Union*. Resolution of 15 December 2015, paragraph 150
355. Steve Pye and Audrey Dobbins, "Energy poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures", Policy report Insight_E, May 2015, p46

(an initiative that makes up 90% of the budget for income support measures to combat energy poverty) are in a precarious energy situation.[356] In addition, non-use rates are often significant due to a lack of knowledge or the insufficient comprehensibility of the measures. For example, in France, the non-use rate for social tariffs hovers around 20%.[357]

Financial interventions to cut energy bills are palliative—not preventive—measures that respond to the effect rather than the cause of the problem without creating any added value or having a leverage effect on private investment or growth. While these short-term initiatives are necessary in order to alleviate the most severe symptoms of energy poverty, they must be considered as transitional measures and need to be coupled with preventive action.

Ambitious measures to renovate and isolate the homes of vulnerable households can provide a structural response to energy poverty, since better energy efficiency will cut energy bills and improve the thermal comfort of homes. This is the most effective and sustainable way forward to lift consumers in Europe out of energy poverty.

Yet in any one year investments in in-depth renovation of homes with poor energy performance potentially cost more than other responses to energy poverty such as social tariffs or energy subsidies. This can impede the development of preventive measures. Yet energy efficiency expenditures in a given year yield gains over several years (and not just in terms of capital development), which is not the case for spending on energy subsidies that has to be renewed each year. In addition to reducing energy poverty, investing in home renovation brings many other benefits:[358]

- In social terms, building renovation programmes, when targeting the poorest, not only help reduce energy poverty but also contribute to improvements in public health (as we saw in section 4.2.1.) and foster social inclusion through the rehabilitation of deprived neighbourhoods;
- In economic terms, these measures increase investment (public investment leads to private investment) and create employment (given the labour

356. The winter fuel payment, ranging from 100 to 300 pounds, is handed out every year before Christmas to retired persons aged 60 or over. This aid is aimed at combating the excess winter mortality of elderly people. See the Association for the Conservation of Energy, *National fuel poverty budgets*, Briefing, May 2012, p4.
357. Johan Tyszler, Cécile Bordier and Alexia Leseur, "Combating fuel poverty. Policies in France and in the United Kingdom", Climate Report, n°41, Caisse des dépôts et Consignations, September 2013, p24
358. Bogdan Atanasiu (ed.), *Alleviating fuel poverty in the EU—investing in home renovation, a sustainable and inclusive solution*, Buildings Performance Institute Europe, May 2014, p8

required renovation activities have considerable potential for job creation in the construction sector), which has a positive impact on growth;

- In budgetary terms, improvements in public health resulting from greater thermal comfort and better indoor air quality should lead to lower public expenditure on health and social protection (for example less sick leave), as illustrated in box 8;
- In environmental and energy terms, improving the energy efficiency of buildings contributes to achieving the objectives of the European energy strategy (i.e. improving energy efficiency by 27% by 2030 or cutting CO2 emissions through lower energy use).

A report funded by the European Commission, after having analysed the measures adopted by EU countries to combat energy poverty, comes to the conclusion that 30% of the national measures are dedicated first and foremost to improving energy efficiency, compared with 40% which are used for financial aid and 20% to avoid energy supply disconnections[359].

For example, in the United Kingdom, in 2013/2014, the public budget spent on fighting energy poverty was just over three billion euros, of which about 2.6 billion euros were spent on income support programmes or measures aimed at dampening the impact of energy price hikes, compared with only 500 million (around 15%) for energy efficiency measures. Between 2010 and 2014, public spending to counter energy poverty was significantly cut (-30%) but spending on energy efficiency fell even more sharply than the overall government budget spent on fighting energy poverty (-50%).[360]

Within the framework of the Energy Union, the European Commission should take the initiative and encourage member states to gradually move from price control mechanisms and energy subsidies to more effective public spending on renovating residential buildings in order to eradicate energy poverty in the EU in the medium term. In this respect, it could use European governance instruments, both existing ones (for example the European Semester because it concerns the budgets of member states) and those under construction (for example

359. Steve Pye and Audrey Dobbins, "Energy poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures—appendices to main report", Policy report Insight E, May 2015, p50

360. Total expenditure rose from 4.4 billion euros in 2010/2011 to 3.1 billion euros in 2013/2014. Investment in energy efficiency over the same period fell from almost 1.1 billion euros to about 500 million euros, according to data available in Bogdan Atanasiu (ed.), *Alleviating fuel poverty in the EU—investing in home renovation, a sustainable and inclusive solution*, Buildings Performance Institute Europe, May 2014, p32

in the context of the current negotiations about the governance structures of the Energy Union, see chapter on governance).

Targeting energy-poor households more effectively in initiatives to improve the energy efficiency of buildings

National programmes to improve the energy efficiency of buildings are often aimed at very different households not all of which are living in energy poverty. The European Commission's requirement in this regard is that a part—and not all—of the energy efficiency measures should be implemented as a matter of priority in energy-poor households or social housing.

Given the economic and environmental/energy benefits of energy efficiency programmes in buildings, financial aid should not be restricted exclusively to households living in energy poverty. However, in order to maintain the social and budgetary benefits of these programmes (reducing energy poverty, improving public health/lower health costs and greater social inclusion), it is essential to target energy poverty more effectively in these national programmes.

In order to ensure better targeting, member states must first have access to indicators that facilitate the identification of households living in or at risk of energy poverty. While it is necessary to identify households in energy poverty, it is equally important to know about their specific characteristics, for instance whether they are owners or tenants of their dwelling.

When energy-poor households are owner-occupied, furnishing information on the benefits of energy efficiency improvements and providing adequate financial incentives is often enough to induce them to undertake building work to improve the energy efficiency of their dwelling. For tenants, on the other hand, financial incentives should be accompanied by compulsory rules for landlords, who are often reluctant to improve the energy efficiency of their property from which, they often think, they stand to gain little. Great Britain is an encouraging example. The government, since April 2016, has banned owners from refusing requests for energy efficiency improvements from their tenants when financial support is available. From April 2018, it will be illegal to let housing with very poor energy efficiency (rating lower than "E") when public co-financing for energy efficiency improvements would be available (see box 13).[361] In a similar

361. Bogdan Atanasiu (ed.), *Alleviating fuel poverty in the EU—investing in home renovation, a sustainable and inclusive solution*, Buildings Performance Institute Europe, May 2014, p36

vein, Claude Turmes, hoping to accelerate the renovation of the European housing stock, proposes "to establish a level of performance below which a building cannot be sold or let. On a scale from A to G, one would begin with category D, and then gradually move upwards."[362]

BOX 13 ► Energy efficiency of housing in the United Kingdom. The Green Deal and the Energy Company Obligation

The "Green Deal" launched in 2013 (and replacing all existing energy efficiency programmes) is an insulation improvement programme for the housing stock which is based on the principle of third-party investment. This programme allows individuals to have their energy renovation financed by a third-party investor (a group of certified power suppliers and specialised industrial companies). The occupant then repays the loan through the energy savings (the mechanism is ongoing even in the event of a change of owner). The mechanism aims to combine insulation improvement and net savings for the owner after repaying the loan. The Green Deal is based on two principles: the monthly repayments for the works scheduled on the bills must be lower than or equal to the forecast energy savings; the repayment period must not exceed the expected useful life of the improvements performed. These principles place a de facto limit of around 10,000 pounds on the amount of the loans. Where the improvement projects are too costly (for example on the external insulation of solid walls), an obligation, known as the Energy Company Obligation, has been introduced for the country's six main power suppliers, has been introduced as a measure to support the Green Deal. For the period between 2013 and 2015, power suppliers committed themselves to allocate 760 million pounds annually to renovation projects deemed too expensive to meet the Green Deal criteria. The ECO also requires 540 million pounds to be allocated to insulation improvement works for low-income and remote households, particularly in rural areas, as well as for vulnerable households that are at risk of fuel poverty. The ex-ante impact study of the British government estimates that the Green Deal and the ECO will help lift between 125,000 and 250,000 households out of fuel poverty by 2023.

Source: Johan Tyszler, Cécile Bordier and Alexia Leseur, "Combating fuel poverty. Policies in France and in the United Kingdom", Climate Report, n°41, Caisse des dépôts et Consignations, September 2013, 25-26.

The priorities of national renovation programmes for buildings should be the following: i) the renovation of social housing; ii) the granting of subsidies or loans without interest or at very low rates for households living in energy poverty; iii) tackling the challenge of renovating tenants' living in energy poverty. In its May 2016 resolution "A New Deal for Energy Consumers", the European Parliament has underscored these priorities, suggesting "that an objective of reducing the

362. Claude Turmes, *Transition énergétique—une chance pour l'Europe*, p283

number of energy-inefficient homes by 2030 should be considered, with a focus on rental properties and social housing".[363]

Numerous studies furnish examples of good practices in national energy efficiency programmes aimed at vulnerable consumers or consumers living in/at risk of energy poverty (see box 14). One of the tasks of the future European Observatory on Energy Poverty will be precisely to draw up an overview of these good practices and to outline recommendations to the member states, thus allowing for better targeting of households living in energy poverty within the framework of housing renovation programmes.

BOX 14 ► Energy efficiency programmess targeting low-income households in France: "Habiter Mieux" and "Chèque énergie"

The "Habiter Mieux" Programme

The "Habiter Mieux" (Live Better) programme, launched in 2010, is an energy renovation programme for low-income households. The programme is managed by the Agence nationale de l'habitat (Anah) and co-financed by public funds (83%) and operators (17%) which contribute to a budget of 1.45 billion euros.

It was originally intended only for owner-occupiers under certain income conditions. The small number of renovations undertaken in the first three years of the programme (less than 50 million for a target of 300 million by 2017) led, in 2013, to significant changes in its provisions. The scope of beneficiaries was extended to include landlords and joint owners, and the eligibility threshold was broadened from the first decile up to the median income. This change has made 46% of homeowners eligible, leading to a reallocation of funds to middle-class households at the expense of those with lower incomes.

Still, it should be stressed that these changes have also reduced the residual amount that households are required to finance (which initially often exceeded 5,000 euros) by increasing the initial ANAH grants and the state premium. The programme is based on the following principles:

1. The procedure of identifying households thanks to the initiatives implemented by local authorities, the power networks, local social organisations, power suppliers and construction specialists.
2. Guidance of these households by approved social, technical and financial engineering organisations. In this matter, homeowners benefit from a complete project manager assistance that is technical (energy assessment and definition of the project assistance), administrative and social (help with setting up a project, support in assembling, and completion of the project).
3. The implementation of local procedures to collect energy savings certificates (CEE), which enables the three major liable parties, namely EDF, GDF SUEZ and Total, to increase the share of energy savings certificates obtained in exchange for the financial contribution to the Habiter Mieux programme;

363. Resolution of the European Parlament, *A New Deal for energy consumers*, 26 May 2016, paragraph 38

4. The mechanism for financing works through:
a. the basic ANAH subsidies for owner occupiers, under income conditions, which are intended to finance 35% or 50% of the amount of the works undertaken;
b. A government grant financed by the French Insulation Improvement Assistance Fund (FART), in the form of a fixed-rate grant amounting to 3,000 euros, which can be combined with the previous ANAH grant;
c. The potential involvement of the social departments of socially beneficial cooperative companies for home ownership (SACICAP) for households that have no equity and need to access a bank loan. SACICAP organisations grant interest-free loans with no management fees up to a maximum amount of 20,000 euros and with a repayment period of up to 10 years.
d. Additional grants may be provided by regional authorities. From an energy efficiency point of view, the programme performs well with average recorded energy savings of 38% after renovation, which are well above the minimum of 25% required for each renovation project.

"Chèque énergie"

The energy check, launched in 2016, is gradually replacing social energy tariffs. It has been introduced on an experimental basis in several departments (Ardèche, Aveyron, Côtes d'Armor and Pas-de-Calais) and will be extended to the whole country in 2018. The energy cheque is a financial aid allocated to beneficiaries, under income conditions, that can be used to pay their energy bills (the advantage over social tariffs is that they can be used to finance any energy source, whereas social tariffs concern only electricity and gas) or to finance renovation work. This is a step towards an integrated (i.e. curative and preventive) approach to combating energy poverty.

Source: Johan Tyszler, Cécile Bordier and Alexia Leseur, „Combating fuel poverty. Policies in France and in the United Kingdom", Climate Report, No. 41, Caisse des Dépôts et Consignations, September 2013; Steve Pye and Audrey Dobbins, "Energy poverty and vulnerability in the energy sector in the EU: analysis of policies and measures", Policy report Insight_E, May 2015; And www.chequeenergie.gouv.fr/.

European funds for the improvement of the energy performance of dwellings

Between 2007 and 2013, of 347 billion euros provided by cohesion policy, 10 billion euros were allocated to sustainable energy projects (5.1 billion euros for energy efficiency measures and 4.9 billion euros for renewable energy development in existing housing).

Over the past decade, the European Commission has relaxed the conditions for the use of structural funds for the purpose of housing renovation. A major change in this context was initiated in 2009. Until May 2009, structural funds for investments in housing (mobilised via the ERDF, which could not exceed 2% of the total allocation of this fund) could exclusively be used in collective and social housing

as well as in public buildings and only by new EU member states (which joined the EU in 2004 or 2007). In May 2009, an amendment to regulation 1080/2006:

a) has extended to all member states the possibility of financing expenditure on improving energy efficiency and the use of renewable energy in existing housing;

b) has made all existing housing units (and not exclusively collective, social or public buildings) eligible for financing;

c) has increased to 4% the amount of the ERDF allocation that could be spent on energy efficiency projects and renewable energy use in the existing housing stock.

This reorientation has been continued with the current multiannual financial framework: funds allocated to sustainable energy projects more than doubled between 2007-2013 and 2013-2020 from 10 billion euros to 23 billion euros. Cohesion policy now has a minimum share (12% for the least developed regions, 15% for regions in transition and 20% for the most developed regions) of total ERDF resources which must be allocated at national level to actions supporting the transition to a low-carbon economy. In addition to the ERDF, the Cohesion Fund is also involved in investments in energy efficiency and renewable energy in housing, because a part of the fund's 63.4 billion euros can be allocated to it (see chapter 3.).

As we have seen, public funds mobilised for investment in building renovation have a leverage effect. While it has been estimated that one euro of grant money allocated energy efficiency projects can mobilise 9 to 12.50 euros of private financing, the 23 billion euros (over seven years) of the ERDF for energy projects can raise more than 200 billion euros of private financing.[364] Therefore, in addition to the 23 billion euros programmed for the period 2014-2020, more than 200 billion euros could be invested in energy efficiency programmes thanks to European funds.

To be sure, the European Commission is moving in the right direction but many actors are urging it to go even further, notably by increasing the share of EU funds invested in renovation programmes for vulnerable consumers (including those living in energy poverty).

364. Bogdan Atanasiu (ed.), Alleviating fuel poverty in the EU—investing in home renovation, a sustainable and inclusive solution, Buildings Performance Institute Europe, May 2014, p52

BOX 15 ► Renovation programme of 800,000 social housing units in France thanks to the ERDF

In the Grenelle Law, France has committed 320 million euros from the ERDF to renovate 800,000 social housing units with low energy performance by 2020. Based on the evaluation of the renovation programme, between February 2009 and April 2013, 58,800 households received 233.7 million euros from the ERDF. The measures adopted have reduced the energy consumption of households by an average of 40%. Morever, the 233.7 million euros from the ERDF generated a total investment of 1.22 billion euros in the local economy, providing 17225 additional jobs (mostly in local SMEs).

Source : Bogdan Atanasiu (ed.), Alleviating fuel poverty in the EU—investing in home renovation, a sustainable and inclusive solution, Buildings Performance Institute Europe, May 2014

CONCLUSION

Equiping the Energy Union with "a social pact for the energy transition" would signal that European leaders recognise the imperative to ensure a just and inclusive transition. The social challenges of the energy transition would gain visibility and an integrated approach to the various challenges—as well as effective ways of tackling them—could be put in place. It would provide the basis for more determined actions by European, national, regional and local authorities, in close cooperation with the social partners. This Social Pact would aim at maximising the opportunities the transition offers to citizens, minimising its potential costs, and making sure that vulnerable citizens benefit from it.

In a Europe where, notwithstanding the relative upswing of recent years, unemployment remains too high, the energy transition is synonymous with job creation. About two million Europeans work in renewables or in energy efficiency and, according to the European Commission, an additional 900,000 jobs could be created by 2030. In order to maximise the job-creation potential, it is imperative to boost investment and foster innovation in all relevant sectors, which will enable EU countries to gain a competitive advantage vis-à-vis the rest of the world (see chapter 2., section 1..3). It is also essential to enable workers to acquire the skills required for these new (or redefined) jobs to avoid a skills shortage that would make it harder to meet the needs of companies. It is mandatory to better anticipate the skills needed for "green" jobs (which can be done at the European level, notably within the framework of the "European Skills Panorama") and promote the acquisition of these skills by workers. The creation of a "Green Erasmus Pro" would increase the mobility of apprentices and trainees in the sectors that are relevant to the energy

transition. Moreover, it would lead to a greater appreciation of apprenticeships and encourage young people to prepare for the jobs of the future, thus helping to reduce youth unemployment.

The energy transition is synonymous with an improvement in public health (and, by implication, a decrease in public spending on health and social protection). In 2015, there were more than 430,000 premature deaths linked to air pollution in the EU. Accelerating the energy transition—by imposing more ambitious limits on vehicle emissions, coal-fired power plants and factories—would mean faster improvements in air quality, lower mortality rates and fewer pollution-related diseases. Housing renovation programmes also have a positive impact on public health, including a reduction in winter excess mortality due to better thermal comfort in homes.

The energy transition also has the potential to increase the purchasing power of consumers by cutting their energy bills. To do so, consumers must play a part (by changing their consumption behaviour) and invest in this transition (by favouring more energy efficient or less polluting goods, improving the energy efficiency of their homes or producing their own energy). Public authorities should remove unnecessary obstacles and encourage Europeans to become "consumactors" or even "prosumers". This includes awareness-raising campaigns, making it easier to switch between energy suppliers, the use of smart meters, guaranteed access to dynamic electricity prices, priority access to networks for small producers and the privacy protection to forestall undue user profiling.

Faced with these opportunities, the energy transition also presents two major risks.

The first is that the transition would not be fair, inasmuch as all Europeans would benefit, but only a small part would bear the costs that any transition inevitably entails. Indeed, the energy transition involves employment redefinitions and job losses in the fossil energy sectors and GHG-emitting industries that are exposed to global competition. It is unavoidable to restructure some sectors and regions (especially those relying on coal). The EU must, alongside a close cooperation between national authorities and social partners, anticipate these restructuring processes. This will make it possible to put in place action plans to limit and, where they prove ineluctable, spread over time jobs cuts (for example, by progressively reducing the activity of coal mines). In this

way, the energy transition will not lead to economic decline in the affected regions, a major source of structural unemployment. New sectors of activity must replace those in difficulty. Workers in the sectors "left behind" by the energy transition should have the prospect of securing future employment. It must be ensured that the shift of workers from declining to growing firms will be accompanied by income security and adequate training for new jobs. To this end, a European Energy Transition Adjustment Fund should be set up to finance training, retraining, support and entrepreneurship initiatives for these workers. Lastly, in order to guarantee a fair transition for workers, public authorities and the social partners must ensure the quality of employment, in particular in terms of wages, coverage of collective bargaining and health and safety standards.

The second risk is that the energy transition will not be inclusive and shut out the most vulnerable citizens from the benefits it brings. Without appropriate public action, consumers affected by energy poverty—more than 50 million in the EU—could be worse off, especially when certain countries decide to finance investment in renewable energy by raising electricity taxes. Given the scope of the initial investment required, these same consumers are also likely not to be able to reduce their energy bills by producing their own energy or by improving the insulation/heating of their dwelling. A transition that is inclusive will aim to eradicate energy poverty in Europe. While palliative measures—such as financial aid for the payment of energy bills—are necessary in the short term to combat energy poverty, they should only be temporary, as the only long-term solution to the problem consists in the renovation of residential buildings. As a matter of priority, public subsidies to improve the energy efficiency of housing should be allocated to households in a precarious situation. Greater attention should be paid to the situation of tenants, for example by adopting a renovation obligation for those renting or selling energy-inefficient property. In order to tackle this challenge, the European Commission should help member states gain a better understanding of the extent and impact of energy poverty in the EU, assess the effectiveness of their strategies and promote the exchange of good practice between countries.

An integrated approach to these various social challenges allows us to say that, in social terms, no country in Europe is a looser of the energy transition. Certain countries in Central and Eastern Europe are particularly affected by declining employment due to the energy transition, since their employment

figures in the fossil-fuel sectors and industries with high levels of GHG emission are above the EU average. Nevertheless, in the countries of Central and Eastern Europe (as well as in the countries of the South where unemployment remains very high), renovating the (often poorly insulated) housing stock is particularly important because of its positive impact on employment in the construction sector. In addition, housing renovation programmes not only bring benefits in terms of jobs. They also contribute to the fight against energy poverty (which is relatively widespread in a number of countries in Eastern and Southern Europe), lead to greater social inclusion and a decline in cardiovascular and respiratory diseases (the number of pollution-related deaths reaches the highest levels in Eastern European countries, and excess mortality in the EU's Southern countries).

The social pact for the energy transition, far from being an extra or a luxury, is crucial to its success. It is not just a matter of launching a transition to "decarbonise" the European energy system, but also of using this opportunity to address other major problems affecting people's lives: unemployment, air pollution, poverty. The social pact must become the sixth dimension of the Energy Union to ensure a fair and inclusive transition. The political and social sustainability of the Energy Union and the European Union as a whole may depend on it.

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FROM THE EUROPEAN ENERGY COMMUNITY TO THE ENERGY UNION. A POLICY PROPOSAL FOR THE SHORT TERM AND THE LONG TERM
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Sami Andoura, Leigh Hancher and Marc Van der Woude, Foreword by Jacques Delors, Studies & Research No.70, Notre Europe, March 2010

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