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 379 billion euros 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.

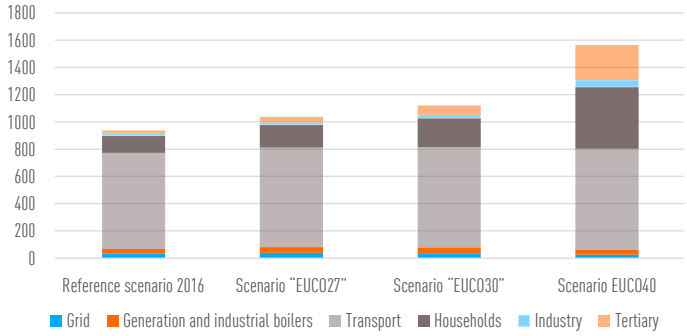
CAPEX can be of two types:

- 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[223].

FIGURE 1 ► Energy-related investments needs between 2020 and 2030 in different scenarios (annual average, in billions of euros 2010)



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

223. 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.

TABLE 1 ► Investment needs and gaps in the energy sector (annual average, in billions of euros)

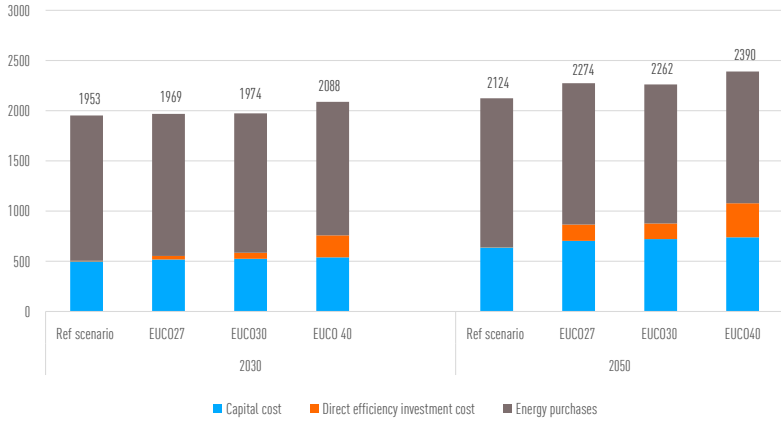
	REQUIRED[1]	CURRENT (ANNUAL INVESTMENT, AVG. 2001-2015)[2]	GAP
Power generation	53	41	12
Energy networks (gas and electricity)	64	47	18
Energy efficiency	112	42	70
Total	230	130	100

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

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 232 billion euros/year (if we include only the energy sector) or 937 billion euros/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 100 billion euros/year, most of it related to investments in energy efficiency (table 1).

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.

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)[224]. 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

224. 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)[225].

Another element 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[226]. 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 when 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

225. 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
226. 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[227].

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[228]. 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)[229]. 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 their 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

227. 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.
228. http://climateaction.unfccc.int/companies
229. 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 businesses 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[230]. Besides, in some sectors such as energy efficiency, the effort in low-carbon investment is still largely based on self-financing[231]**.** 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[232]. 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[233]. In addition to that, the new Investment Plan for Europe

230. Hsu, Angel, "4 charts that explain climate action from cities and companies", *The Huffington Post*, blog, 22 April 2016
231. 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).
232. European Commission, Winter Economic Forecast 2017, Institutional Paper 048, February 2017
233. 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[234]. 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.

234. For a more detailed explanation of the Juncker Plan see Eulalia Rubio, David Rinaldi and Thomas Pellerin-Carlin, "Investment in Europe: making the best of the Juncker Plan", Report, Jacques Delors Institute, March 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 efficient, 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[235]. 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[236]. 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

235. 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
236. 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 of CO_2 quotas, 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[237], 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 "Clean Energy Union Deal" (see chapter 1. for more details).

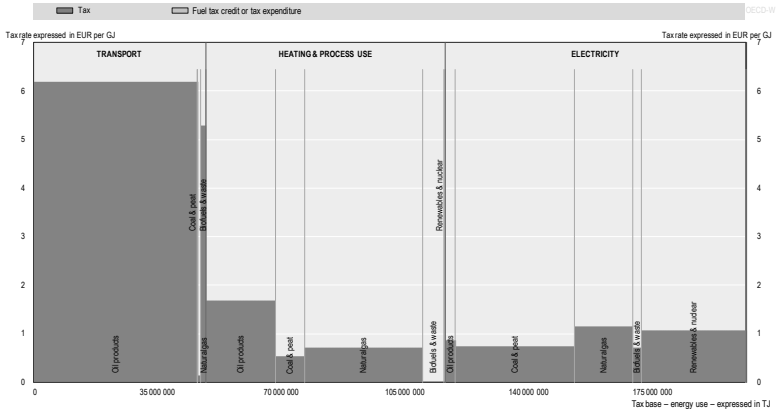
Even if the ETS system is improved, one should not forget that it covers less than half of total EU GHG emissions. The rest of the emissions are either not priced at

237. 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*.

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.

Figure 3 shows the different tax treatment of fuel use across sectors in OECD countries. As it 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 CO_2 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 CO_2 emissions (20 per tonne of CO_2) 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[238] and has been recently evoked in the report by the High-Level Group on Own Resources published in January 2016[239].

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[240].

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 17.2 billion euros in 2012 and fossil fuel subsidies in transport were estimated at 24.7 billion euros[241]. An 2014 ECOFYS study reaches similar conclusions: according to this study, support to the supply of fossil fuel energy amounted to 16.3 billion euros in 2012, representing more than 16% of total public support to energy[242]. Besides, 27 billion euros 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

238. 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
239. High Level Group on Own Resources, *Future financing of the EU. Final report and recommendations*, December 2016
240. OECD, Aligning policies for the transition to a low-carbon economy, 2015
241. European Commission, *Energy prices and costs in Europe*, Brussels, 30.11.2016 COM(2016) 769 final
242. ECOFYS (2014a), *Subsidies and costs of EU energy-Final report*, 2014. Study commissioned by DG Energy

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 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 157 billion euros between 2008-2012[243]. 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[244], 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[245].

243. ECOFYS (2014a), op.cit.
244. 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).
245. 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	37.4 billion euros allocated to low-carbon energy projects between 2014-2020, of which 16.5 billions to sustainable transport, 13.2 billions to energy efficiency, 4.8 billions to RES and 2.9 billions 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	5.4 billion euros allocated to pan-European energy infrastructures, 24 billion to transport infrastructures between 2014-2020 (2)
Horizon 2020	X	X	X	X	Grants, financial instruments and technical assistance (ELENA and MLEI)	6 billion euros 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)	864 million euros to co-finance small climate mitigation and adaptation projects between 2014 and 2020 (of which 80 millions to support PF4EE, a financial instrument for energy efficiency projects) (5)
EIB lending	X	X	X	X	Direct and intermediate loans	15 billion euros/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	2.2 billion euros 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	117 million euros 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 27 billion dollars in 2004 to more than 120 billion dollars in 2011, and while it has declined since then (it was at around 55 billion dollars in 2015), it remains nonetheless high in comparison to other regions of the world and represents over 85% of total EU's investment in energy generation[246].

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 157 billion euros between 2008-2012[247]. While the significance of this figure has to be relativized in historical perspective[248], 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[249]. In schemes fixing the volume, renewable producers are more exposed to market prices. However, such

246. IEA, 2016, *op.cit.*
247. ECOFYS (2014a), *op.cit.*
248. 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.
249. 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, see chapter 4, box 10).

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)[250].

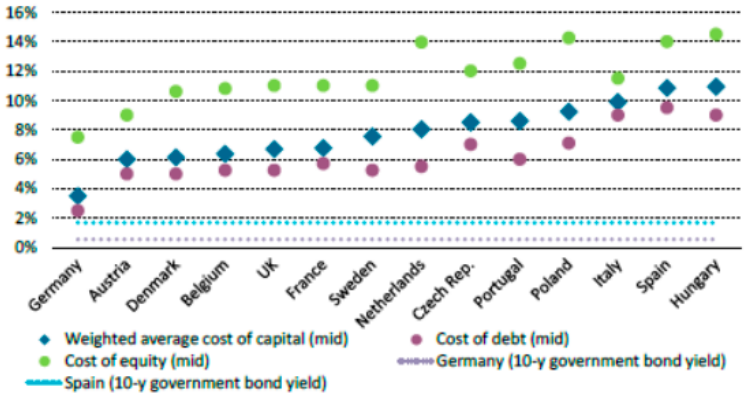
In addition to reforms to national support schemes, it is important to foster a more optimal distribution of renewable energy generation throughout Europe. In effect, the existence of different national schemes with little coordination is in itself a major source of inefficiency, as it prevents the exploitation 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 remain 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. Out of the 29,3 GW of PV installed capacity built in Europe in 2010, 17,4 GW were built in 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%[251].

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 to reduce the difference in costs of capital for renewable projects in Europe. The relative under-deployment of renewable production in certain eastern and

250. Thilo Grau (2014), "Comparison of Feed-in Tariffs and Tenders to Remunerate Solar Power Generation", DIW Berlin, Discussion Paper 1363
251. 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*

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 demand thanks to more diverse energy behaviours by consumers, and, by increasing the size of the market, reduce the need for capacity mechanisms and carbon intensive back up capacities.

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 European Commission set a target for Member States : increasing their 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[252].

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[253] 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[254]**.** The problem mostly lies on the lack or weak implementation of existing EU regulations' dispositions[255]**.**

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 disincentives potential private promoters to take clear financial engagements for these projects[256].

Third, whereas the total expected investment cost of the 109 energy PCIs is 52.5 billion euros[257], EU budget for energy PCIs is very small. The CEF budget for energy PCIs amounts to only 5.4 billion euros 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[258]. Recently, additional EU funding has come from the new

252. ENTSO-E, *2016 Ten Year Network Development Plan—Executive report*
253. European Union, Regulation (EU) No 347/2013 of 17 April 2013 on guidelines for trans-European energy infrastructure
254. ACER, *Consolidated report on the progress of electricity and gas projects of common interest for the year 2015*, July 2016
255. 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)
256. ACER, *ibid.*
257. ACER, *op.cit.*
258. The original budget for CEF energy was 5.85 billion euros but in November 2015 CEF budget was cut in order to liberate funds to finance the new EU guarantee fund supporting EFSI.

European Fund for Strategic Investment (EFSI). Indeed, the Fund has invested 290 million on energy infrastructures in the first year of functioning, mobilising 2.8 billion euros of total public and private investment[259]. 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[260].

As regards CEF, one should also highlight that an important part of the funding disbursed so far has gone to gas networks[261], despite the fact that the CEF regulation[262] 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[263]. 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 overestimated gas demand … and needs to restore the credibility of the forecasts it uses."[264] Fixing this problem requires projections to be done by an independent body with relevant expertise, such as a European Energy Information Service (see chapter 1. for more details).

259. European Commission, "The Investment Plan for Europe and Energy: making the Energy Union a reality", Fact Sheet, June 2016
260. EY, *Ad-hoc audit of the application of the Regulation 2015/1017 (the EFSI Regulation)*, Report commissioned by the European Commission, 14 November 2016
261. By the end of 2016, 75 actions have received funding from CEF energy, amounting to a total of 1.2 billion. Almost 70% of the funding (824 millions) has gone to gas projects. See CEF Energy, key figures.
262. European Union, Regulation No. 1316/2013 of 11 December 2013 establishing the CEF
263. 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.
264. 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 European 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[265], "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. 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

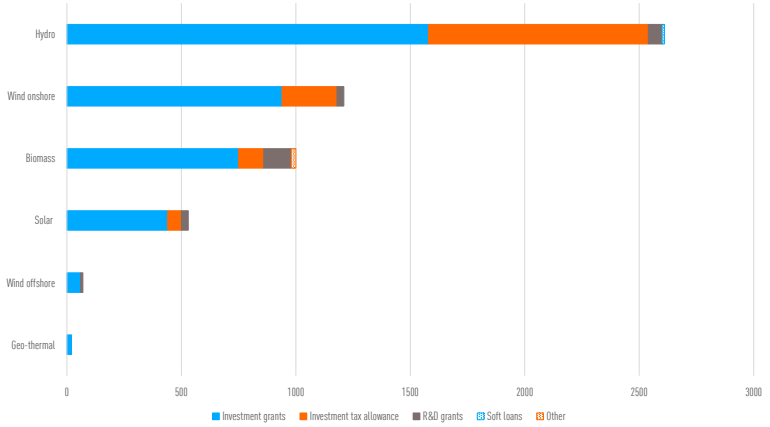
In addition to the support provided to renewables through market schemes (feed in tariffs, feed in premiums, auctions and tenders), public authorities support investment in renewables through direct funds, be in form of grants, soft loans, tax exemptions or other type of financial support.

According to a 2014 ECOFYS study[266], the financial support to renewables through grants, soft loans and tax exemptions amounted to 5.4 billion euros 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 3.3 billion euros in 2015 (EIB

265. Milleu Ltd, Study on climate mainstreaming in the programming of centrally managed EU funds, Final report produced on behalf of DG CLIMA, 2015.
266. ECOFYS (2014a), op.cit.

2016)[267] and KfW's support to renewables was estimated at 7.93 billion euros in 2012 (Cochran et al 2014)[268]. 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)[269].

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



Source: ECOFYS 2014[270]

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.

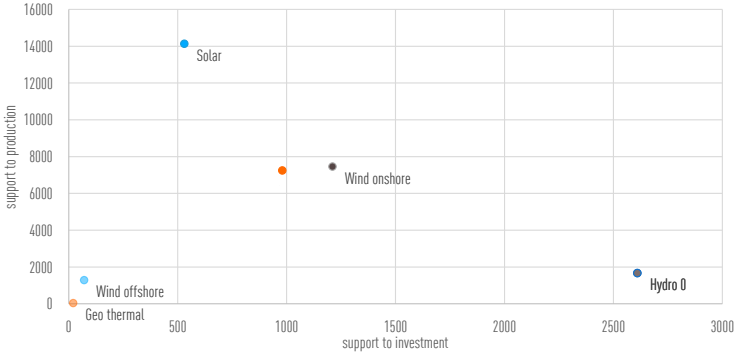
A first important point is the need to ensure complementarity between policy measures in support to renewables. As seen in section 3.5.2., Member States already provide significant support to the deployment of renewables through market-based schemes that guarantee a minimum revenue for their production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

267. European Investment Bank, *EIB Activity Report 2015*, 2016
268. 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
269. European Investment Bank, Evaluation financing of Climate Action (mitigation) within the EU 2010-2014. Synthesis report, September 2015
270. ECOFYS (2014a), op.cit.

immature RES technologies or on projects confronted to some particular 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 in 2012, some RES technologies (wind offshore and geothermal) received much lower public support than others (solar, hydro and wind onshore)[271]. 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[272], 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 millions of euros)



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

271. The picture changes if we look at support in relative terms (that is, per MWh 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.
272. 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[273]. 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, the level of investment in energy efficiency in Europe is still below its economic potential[274]. There is also growing recognition on that more ambitious energy efficiency targets for 2030 would be beneficial in that they would help attain EU´s long-term

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

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 6.1 billion euros in 2007-2013 to 18.4 billion euros in 2014-2020) and there have been improvements in their use and geographical allocation. The EIB has also defined energy efficiency as a priority[275], and the creation of the European Fund for Strategic Investment (EFSI) has allowed the Bank to triple its lending to energy efficiency projects (from 1.29 billion euros in 2012 to 3.62 billion euros in 2016)[276]. 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[277].

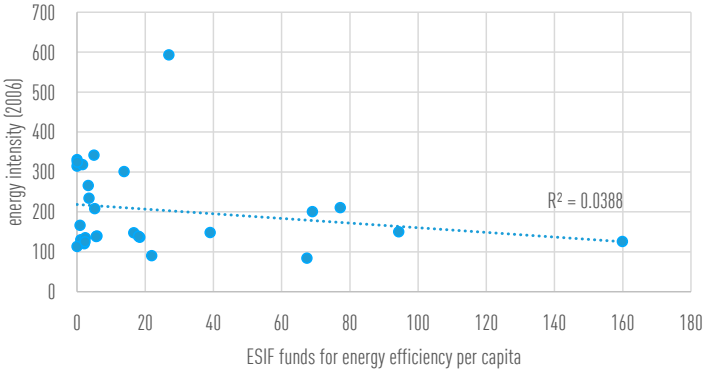
BOX 6 ► Improvements in the geographical distribution of ESI funds for energy efficiency

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 figures 7 and 8, unlike in the previous programming period[278], there is now a clear correlation between amounts of ESI funds allocated

275. European Investment Bank, *EIB Climate Strategy*, 2015
276. 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
277. 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).
278. See Eulalia Rubio, David Rinaldi and Thomas Pellerin-Carlin, "Investment in Europe: making the best of the Juncker Plan", Report, Jacques Delors Institute, March 2016, Chapter 3

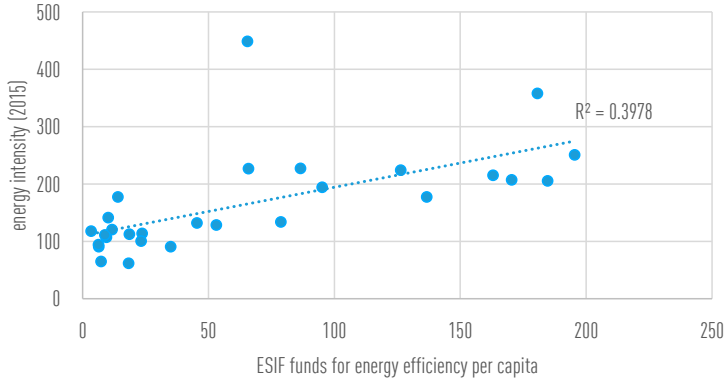
to energy efficiency and Member States' energy intensity (which is a proxy of investment needs in energy efficiency). This better geographical alignment of ESIF funds probably reflects the improvements introduced in the ESIF programming procedures, particularly the obligation by Member States to plan 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 10 billion euros 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[279], 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 (EC) 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 23 millions in 2015 to 38 millions 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.

279. Energy Efficiency Financial Institutions Group, Energy Efficiency – the first fuel for the EU Economy. How to drive new finance for energy efficiency investments, February 2015

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 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 phase out 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[280], 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,

280. European 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 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.

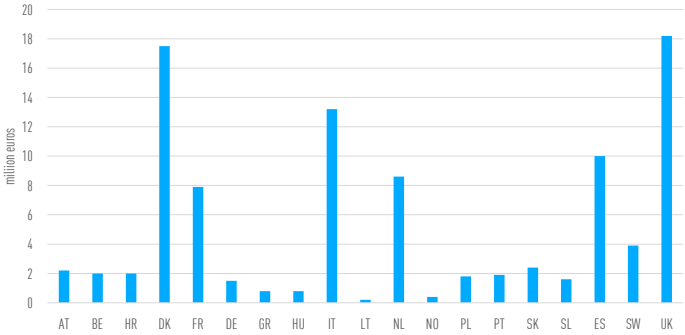
Establishing "one-stop-shops" at national and regional level (as proposed in the "Smart Financing for Smart Buildings" initiative) is essential to reduce risks of overlaps and secure coordination. However, the same effort has to be done at the EU level. In principle, the new European Investment Advisory 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[281]. 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 the whole EU territory 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[282]. To prevent this to happen, the budget of the EIAH should be enhanced. It would be also recommendable to set up a programme to encourage the exchange of staff between NPBs involved in the provision of EIAH services[283].

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 is now more responsive to this logic (see box 7), this is not the case for the provision of other EU-level technical assistance.

281. 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 (..)
282. See Eulalia Rubio, David Rinaldi and Thomas Pellerin-Carlin, "Investment in Europe: Making the best of the Juncker Plan", Studies and Reports No.109, Jacques Delors Institute, March 2016
283. Eulalia Rubio, David Rinaldi and Thomas Pellerin-Carlin, 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)[284].

FIGURE 9 ► Geographical distribution of Project Development Assistance (PDA) grants between 2009-2016 (in millions of euros)



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.

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

284. 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

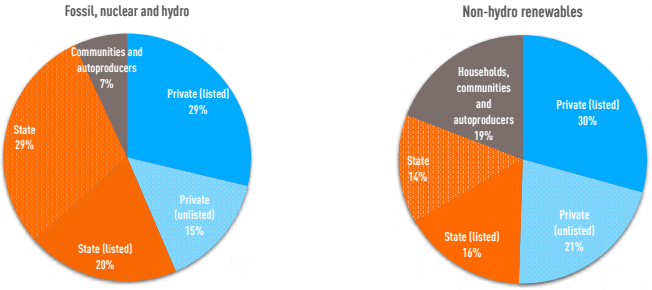
of electric vehicles. This requires strengthening EU regulation and procedures to control vehicles' CO_2 emissions, removing all distortive tax exemptions on fuel and supporting (through regulatory measures and direct financial support) the development of alternative fuels and the deployment of charging 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 is 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 [285]and in countries such as Denmark where local cooperatives financed 83% of the country's wind turbines.[286]

FIGURE 10 ► Ownership of global power generation assets in 2012



Source:International Energy Agency, Special Report. World Energy Investment Outlook, 2014

285. International Energy Agency, Special Report. World Energy Investment Outlook, 2014
286. i24c, *Scaling up innovation in the Energy Union to meet new climate, competitiveness and societal goals*, May 2016

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 consumers/prosumers and give them control, 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 electricity market design which 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) to 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 on the roof, of a wind turbine) 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 to 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 40 billion dollars 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)[287].

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[288]). 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

287. OECD, *Green bonds: Mobilising the debt capital markets for a low-carbon transition*, policy perspectives, December 2015
288. 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.

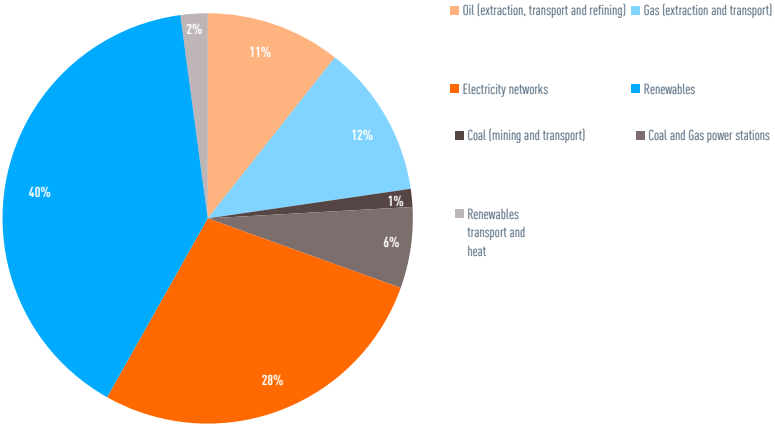
3.6. Incorporate climate considerations in all public and private investment decisions

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[289] 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 (see figure 11). As many energy-related investments typically imply a horizon of decades, continuing to invest in high-carbon projects will lock our economies into the wrong long-term path.

289. 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"[290].

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

290. 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)[291].

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.

291. 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 (see box 11).

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 change mitigation 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 power-generation projects and excludes those where the emissions are likely to reach 550gCO_2/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. The 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 do 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 too short-term focus may render eligible a project which is at odds with the long-term decarbonisation strategy (e.g. 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 transition 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 (see box 13).

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, CO_2, 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 include them in public bidding processes unless it is explicitly required. In addition to that, public administrations are also important purchasers of services and equipment. By changing their patterns of consumption they can support low-carbon objectives, generate new markets and provide examples of good practices for business and consumers.

According to the OECD[292], 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 (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 chapter analyses the magnitude of both challenges for Europe—the "investment" and the "cost" challenge—and offers some general reflections on how to tackle them. A key message is the need to adopt a holistic and integrated

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

approach. A holistic vision implies looking beyond core climate policy 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.