

ROADMAP			
TITLE OF THE INITIATIVE	Energy Union Integrated Strategy on Research, Innovation and Competitiveness		
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ADDITIONAL INFORMATION			
<p>This indicative roadmap is provided for information purposes only and can be subject to change. It does not prejudice the final decision of the Commission on whether this initiative will be pursued or on its final content and structure.</p>			

A. Context, Subsidiarity Check and Objectives
<p>Context</p> <p>Context:</p> <p>Research, innovation (R&I) and competitiveness are paramount to address the climate challenge, to accelerate the EU energy transition, and to reap benefits in terms of jobs and growth that the Energy Union can bring.</p> <p>The transition and disruptions our economy is undergoing to meet climate and energy challenges will require major technological advances, different social organisation, -new business models, optimised processes and better alignment between the research, innovation and industrial policy priorities.</p> <p>The March 2014 European Council¹ stressed "the role of cleantech as a cross-cutting element for enhancing the competitiveness of EU industry". These new technology and other innovative solutions will contribute to make Europe the world's number one in renewables as well as to maintain and reinforce a strong and high-performing industrial base for our internal market and to contribute to Europe being a global player.</p> <p>Research and innovation cut across all elements of the Energy Union strategy adopted in February 2015. Heating and cooling in homes and workplaces² and transport – people and freight, public and private – do benefit from research and innovation just as much as industry in general and electricity markets. New technology and innovation entering quickly into the market through new business models are key to achieving the transformation of the EU's energy system and broader competitiveness and growth objectives. With the right overall strategy it will be possible to support EU leadership in competitive low-emissions solutions, improve our quality of life and create jobs and growth.</p> <p>The Energy Union strategy provides a framework to achieve EU energy and climate goals based on five interlocking dimensions. Its fifth dimension foresees an integrated strategy for research and innovation and competitiveness to deliver on its overarching objectives of decarbonisation, energy efficiency and independence.</p> <p>In its State of the Energy Union 2015 report³, the Commission stipulated that this integrated strategy should reflect the findings of the consultation which the Commission will launch with the Member States and stakeholders on three interconnected strands: energy technologies, transport and global competitiveness. It should increase public and private investment in research and innovation, remove</p>

¹ European Council 20/21 March 2014 Conclusions

² Share of final energy consumption: heating and cooling = 46%; transport = 33% and power =21%.

³ COM (2015)572

disincentives for innovation, and overcome barriers to private investment.

This Strategy should address the relationships with all energy-related sectors in order to identify the links, synergies and trade-offs, so as to ensure that actions under the Energy Union do not negatively impact EU objectives in other areas.

This Strategy should address actions that will have an impact on the mid- to long-term radical transformation of the energy system (broadly considered, including the energy users and major CO₂-emitting sectors) as part of a future low-carbon, resource-efficient, sustainable economy. It should address the technology developments (including system integration aspects), the pathways and the solutions needed, taking into account the need to keep at the same time energy security, energy and mobility affordability for the EU citizens and businesses, and the competitiveness of the EU industry, and looking at how to foster the creation of economic growth and jobs.

Building on the Low Carbon Roadmap 2050⁴, an approach using updated scenarios and back-casting (from where we know that we would need to be in 2050) can better couple longer-term objectives with policy options. It would help to guide long-term R&I programming in a more integrated fashion, addressing the interlinked questions in a more holistic manner, and to cooperate with industry in addressing common challenges thereby seizing the opportunities for jobs and growth. In that sense, the strategy could provide an overarching framework within which they would be linked and developed further.

Relation with past and possible future initiatives

1. The following elements feed directly into the Strategy:

- a) The **Integrated Strategic Energy Technology Plan**.⁵ The recently adopted Communication for an Integrated SET Plan highlights 10 priority areas of action which are in line with the new political priorities defined in the research & innovation pillar of the Energy Union. It is foreseen that the Commission services will agree with the Member States and the research and industry stakeholders on the strategic objectives and targets in each technology area and will define implementation plans.
- b) A **Strategic Transport Research and Innovation Agenda**. In the transport area, a Communication on "Research and innovation for Europe's future mobility" (Strategic Transport Technology Plan)⁶ described in 2012 issues related to transport R&I and presented ideas on how innovation could better serve the transport and mobility needs of European citizens and businesses whilst addressing larger societal challenges such as climate change and dependence on oil. However, there is now a need to determine how the transport system should adapt to the decarbonisation challenge while ensuring that increasing mobility needs are met. To this end, a Strategic Transport Research and Innovation Agenda would need to be developed and agreed.
- c) **Global Technology and Innovation Leadership**. Global technology and innovation leadership is crucial for Europe's future, particularly in terms of competitiveness and hence jobs and growth. First mover advantages will be considered by many countries with a focus on incentivising and developing new technologies and services in the broader climate and energy areas. A new global competition has already commenced to position economies around the world in terms of opportunities for jobs and growth in the forthcoming decades. The EU's industrial leadership in many areas is at stake and it needs to be determined what public policy action is needed to improve the position of our industry in the global

⁴ COM (2011)112

⁵ (C(2015) 6317 final).

⁶ COM(2012) 501 final

marketplace.

2. Other related initiatives closely linked include the work under the Investment Plan for Europe, Single Market, Capital Markets Union, Digital Single Market, Circular Economy package, Communication on decarbonising the transport sector, work underway under Key Enabling Technologies (KETs), and various other Horizon 2020 elements on Climate action, Energy, Transport, Industrial processes, the Bioeconomy, and the reformed EU Cohesion Policy and Smart Specialization Platform on Energy. The future electricity market reform should enhance long-term price signals which should lead to more investments through the market taking advantage of new and innovative climate and energy solutions to address the EU's long-term objectives.

Issues

Issues the initiative will address:

Addressing climate change and energy challenges will be helped once the technologies would be sufficiently competitive and available on the market or the social innovation will make the socio-economic changes possible.

Deployment of technologies (hence bringing them from the research to the market) is very important as it helps the industry to commercialise its efforts.

However, energy and climate change are areas with significant market failures.

Apart from the relatively low public financial support to energy research and innovation, there is a worrying shortage of private investment in the area. The decline in overall investment in Europe since the financial crisis has also affected investment in clean energy. Private investment in R&D in the energy sector is 4 to 5 times lower than 20 years⁷ ago. R&D spending as percentage of revenue in Europe⁸ is lowest in the energy and chemicals clusters at 0.75% (2013) while in computing and electronics it is 15 times higher than that at 11.3%, in aerospace and defence 10 times higher at 8%, and in the automotive sector 5-6 times higher at 4.2%. Reports from the IEA⁹ and by prominent scientists¹⁰ have been vocal in stressing that R&D investments in energy are far too low. Main reasons include: a low general level of investment in comparison to the level which existed before the financial and economic crisis; a lack of certainty for investors regarding the stability of regulatory frameworks at EU and at national levels; lack of awareness of a large number of companies, in particular SMEs, of the potential benefits of the uptake of energy and climate related solutions; a high perceived risk on the return on investment for demonstration activities; and insufficient market-based incentives to invest in the whole supply chain.

Risk is inherent to research and innovation, where multiple solutions need to be brought to bear on overall progress, requiring experimentation and often large scale, high capital costs for demonstrators and scientific infrastructures.

Deployment policies are often evaluated by the short-term cost per deployed unit of low carbon technology. From the innovation standpoint this is only of a secondary importance because the aim is to bring down the cost of future generations of the supported technologies.¹¹

There is also need to focus on the right incentives, while removing the wrong ones. Government

⁷ "World Energy Technology Perspectives", IEA, 2015

⁸ "The Global Innovation 1000: Comparison of R&D spending by regions and industries", PwC, 2015

⁹ "World Energy Technology Perspectives", IEA, 2015

¹⁰ "A Global Apollo Programme to combat Climate Change", 2015, the brainchild of a group of eminent UK scientists, economists and businessmen including Sir David King, currently the UK's climate change envoy, Lord Nicholas Stern, Lord Adair Turner, and ex-BP chief Lord John Browne.

¹¹ Brueghel Policy Brief, Issue 2015/02, Georg Zachmann: Making low-carbon technology support smarter

support to the production and use of fossil fuels in OECD countries and in particular in key emerging economies remains high, at USD 160-200 billion annually over the period 2010-2014, according to a new OECD report¹². As the report recommends, "the reform of measures supporting fossil fuels appears more relevant than ever" and "the time is not one for complacency". Recent research by the International Monetary Fund suggests to do better on internalising external costs, particularly those social costs stemming from environmental damage, health deterioration, traffic congestion, road accidents, and alike. They estimate the overall cost of energy subsidies, when internalising those external costs, at USD 5.3 trillion in 2015, a figure larger than the global expenditure in the health¹³ sector. Such public support schemes seem to be incoherent with the widely shared desire to achieve a low carbon, sustainable economy. Compared to fossil fuel subsidies, financial support for renewable energy is very limited and this combination is unlikely to lead to any larger scale technological breakthrough for clean energy¹⁴.

Without a comprehensive strategy for research, innovation and competitiveness which brings together supply, demand and regulatory aspects, the EU risks losing its comparative advantage in low carbon solutions as early mover towards decarbonisation, both in terms of supply and innovation and deployment taking place in Europe. This is already the case with some specific technologies like solar photovoltaics. Other regions are taking far-reaching policy decisions to speed up the development and deployment of low-carbon solutions, and heavily invest in their market uptake and export. In particular the synergies within the R&I strategy for the Energy Union between the SET Plan and STRIA and the funding of projects under the European Structural Investment Funds for the low carbon economy' (more than €40 billion) and for research and innovation (about €41 billion), as well as Strategic Investment Fund, should be exploited.

For the time being, various research and innovation strategies are pursued in different sectors (transport, energy or digital) with no real integration effort.

A much more integrated approach to Energy Union research, innovation and competitiveness could focus in particular on:

1. electric charging infrastructure, storage in batteries & smart grids (building on the Directive on the deployment of alternative fuels infrastructure);
2. generation, provision and use of sustainable low-carbon fuels;
3. ICT in energy, buildings & transport (smart cars, smart homes, smart cities & communities);
4. Financial instruments to promote innovation and de-risk projects suitable to progress EU policy and their deployment; public and private, EU and national funds; the need to align support facilities and leverage the effects of investments
5. New materials, alternatives to fossil feedstock and other raw materials, and industrial design/production processes by cross-sectorial cooperation and industrial symbiosis
6. 'horizontal' legislative barriers and tools to promote innovation;
7. other types of common challenges such as standardisation procedures, making use of public procurement, trade and development action on international level such as on access rules to non-EU markets and cooperation with 3rd countries to enable them to procure low carbon technology.

The Strategy should take into account the results of the climate negotiations in Paris (Conference of Parties, COP21), with its mechanism of periodic revision of the Parties' ambitions, will generate a

¹² "OECD Inventory of Support Measures for Fossil Fuels 2015", OECD, September 2015

¹³ Though the How Large Are Global Energy Subsidies? <https://www.imf.org/external/pubs/ft/wp/2015/wp15105.pdf>

¹⁴ Studies and analysis by reputable institutions are stressing that decisions to commit capital to decarbonisation are increasingly shaped by public policy measures and incentives, rather than by signals from competitive markets. See for example The International Energy Agency's World Energy Investment Outlook 2014, Brueghel Institute's analysis of the EFSI, European Climate Foundation's work on a "Roadmap 2050 for a prosperous, low-carbon Europe

dynamic progression in the decarbonisation of the worldwide economies. In this context, the European Union has to position itself in this worldwide competition for ensuring the leadership in the markets of tomorrow. Research and innovation will be fundamental for that.

Who is affected

All actors relevant to the entire climate and energy domain should be involved in particular the scientific community and the research and innovation actors and businesses from the relevant technology domains but also from socio-economic, legal, finance, and other disciplines, as well as relevant public authorities.

Why is this an EU level issue

The EU provides its Member States with a long-term framework to address sustainability and the cross-border effects of phenomena that cannot be dealt with at the national level alone. Achieving a sustainable and competitive economy at EU level leaves a lot of flexibility in the choice of national pathways, national energy mixes, and national solutions with different timeframes and development paths. However, the total sum of the national solutions needs to be a coherent at EU level and be compatible with EU commitments and legislation, as well as international developments and cooperation. The EU R&I programmes and relevant other instruments will need to be able to support such national and regional developments. EU internal market and external policies and instruments play an important role for the addressed industry sectors.

Subsidiarity check

Article 181 of the TFEU indicates that the Union and the Member States should coordinate their research and technological development activities. Cooperation in research and innovation activities needs to be supported at European level to ensure that the capacities and resources available in all Member States are used in the most cost-efficient way, to promote collaboration between universities, research institutes and companies throughout Europe and to achieve an appropriate scale and impact of research and innovation activities to address the technological challenges in the energy and transport field. The Horizon 2020 framework covers the EU-level R&I activities, but coordination with and among Member States on national R&I actions is missing. Smart specialisation strategies are designed to avoid unnecessary duplication and fragmentation but need to be scaled up at European level through interregional alignment and cluster partnerships.

In addition, there is a risk that different Member States could support new technologies or standards in way that is not fully compatible with the sought objectives, thereby fragmenting the Energy Union with a negative impact on the functioning of the internal market: an overarching Strategy should address this, including the need for coordination among Member States.

A harmonised framework for wider deployment of competitive innovative products and solutions can only be achieved on EU-level, in particular in view of increasing competition from 3rd countries.

Main policy objectives

The initiative should contribute to the following objectives:

- Improve the efficiency of the EU's energy and transport systems for citizens, EU businesses and society at large (reduce GHG and other emissions and dependence on fossil fuels (decarbonisation), increase safety and security);
- Maintain and expand the EU's global industrial leadership for low carbon solutions in all economic activities (energy -including energy generation, transport, distribution and use-,

transport, industry and agriculture). Create markets within and beyond the EU for the relevant innovative goods and services.

- Improve the competitiveness of the EU industrial base and contribute to the EU industrial transformation towards smarter and cleaner processes, goods and services.
- Provide innovative low-carbon technologies and non-technological solutions to enable future ambitious energy, transport and climate policies
- Maximise public investment in Energy Union related research and innovation, exploiting the impact of Horizon 2020 and national funding in energy, transport and climate and synergies between Horizon 2020, European Structural and Investment Funds and European Fund for Strategic Investments.
- Address dysfunctional or counterproductive investments for innovation in current public subsidies
- Address bottlenecks for private investment in energy and climate research and innovation,
- Contribute to an innovation ecosystem that enables bottom-up experimentation in Energy, involving new players (including SMEs), innovation in services and business processes and user innovation, aligning smart specialisation strategies to achieve common priorities
- Create synergies between the Energy Union innovation strategy, capital markets union, digital agenda

The Strategy should provide input to the review of Horizon 2020 and the development of a research & innovation framework programme post-2020. It should also provide extensively evidence-based advice that could feed into future policy orientations and regulatory action in the Energy Union context, and will rely on the identification and the design of credible and feasible decarbonisation pathways to 2050 and beyond.

The integrated research and innovation approach should be reflected in future Horizon 2020 Work Programmes (WPs), the next opportunity being the 2018-2019 Work Programmes.

B. Option Mapping

Option 1:

A Communication on an R&I strategy for the Energy Union, comprising all relevant areas (energy - including energy generation, transport, distribution and use-, transport, industry and agriculture, including bioeconomy) and general competitiveness elements. The Communication will be developed along the following principles:

- a) The focus should be how to best seize the opportunity in the fast developing area of the Energy Union, namely solutions that address both the core sustainability issues and provide technologies and innovation that European companies can bring to the global market, contributing to jobs and growth in the EU. This could be done among others through cluster partnerships for smart specialisation investments
- b) Consider stepping up public investment in sustainable energy, transport and climate research and innovation, maximising impact of Horizon 2020 funding in these areas and improving coordination, collaboration and ambition of national support schemes;
- c) Address dysfunctional or counterproductive investments for sustainable innovation in current public subsidies, namely by raising the knowledge and profile of this matter – including the issue of fossil fuel subsidies -, carry out recommendations to Member States and strategic use of EC instruments;
- d) Address bottlenecks for private investment in research and innovation in the Energy Union

space, by effective use of InnovFin, EFSI, development aid and structural funds and contributing towards the better regulation agenda and the third pillar of the Investment Plan (creating an investment friendly environment);

- e) Contribute to an innovation ecosystem that enables bottom-up experimentation, involving new players (including SMEs), innovation in services and business processes, and innovation for the benefit of the user/consumer.

Further supporting elements and details might be addressed specifically focussing on STRIA, global technology leadership, and the SET-Plan respectively, possibly in the form of Staff Working Papers.

Option2:

Three distinctive Communications could be developed: on R&I strategy for the transport activity (STRIA), on global technology and innovation leadership and competitiveness, in addition to the already adopted Communication on an Integrated SET-Plan.

This option would not trigger coordination and synergies among activities that could mutually benefit from R&I efforts in complementary areas. These three initiatives cover different but inter-related areas. The lack of an integrated approach would result in business as usual and may not be sufficient to tackle the broader issue of sustainability. This in turn would limit the expected impact of innovative solutions and their penetration into the market. Overarching regulatory and behavioural issues would also be under-estimated.

Proportionality check

The option of issuing a Commission Communication respects the proportionality principle.

C. Data collection and Better Regulation instruments

Data collection

Data collection could be based on the analysis of reports and work prepared already, which should be brought together in a scientific way

1. The SET Plan Information System (SETIS) will be the basic monitoring and reporting hub to ensure a more diligent and intelligent use of available information, data and reporting practices by stakeholders and the Member States by creating an inventory of indicators. Additionally using the experience of evaluation of projects under NER 300, the Innovation Fund will extend its scope to low carbon innovation projects in industrial sectors.
2. Information on transport technology, transport system developments, user expectations and strategies and scenarios for the future is partially already available, resulting from EU projects (funded by the EU R&I framework programmes over the years) and other sources. In addition, Member States and industry representatives in the innovation roadmap development process should provide specific expertise and information as needed.
3. Information on the competitiveness of renewable energy industry is already available¹⁵. The impact assessment to be carried out for the revision of the EU ETS could also be used, in particular the conclusions concerning the new Innovation Fund and any other options to foster the uptake of technologies (i.e. investment based free-allocation).
4. The Commission's Joint Research Centre (JRC) could provide comprehensive data on biomass supply and demand for all end uses.

In addition, the Commission will consult existing fora and expert groups, and set up new ones as

¹⁵ European Commission (2014): Study on the competitiveness of the EU Renewable Energy Industry (both products and services).

deemed necessary bearing in mind the integrated approach. The existing ones include:

- a) SET-Plan: SET-Plan Steering Group (running since 2011) and the new management structure under the Integrated SET-Plan, in particular the European Technology and Innovation Platforms – ETIPs.
- b) Global technology and innovation leadership: High Level Group on energy intensive industries (established and running since 2013)
- c) STRIA: expert group to be set-up in order to identify critical R&I issues for a transition towards a low carbon transport
- d) Smart Specialisation Platform Energy: mapping activities are foreseen on actors and assets that are relevant for the explored new value chains.

In addition the Commission services should engage with "expert groups" to take forward concrete work on priority topics (including experts, stakeholder, Member States). A number of stakeholder consultation arrangements already exist (in transport: e.g. on ITS and on sustainable transport, European Technology Platforms; in Energy: ETPs, EIIs). But in order to challenge the status quo and enable new ideas, it could be necessary to bring stakeholders together in new, more integrated configurations and add new actors.

- a) Integrated SET-Plan: establish European Technology Innovation Platforms (ETIP) which gather all stakeholders
- b) Global technology and innovation leadership: specific expert groups would need to be set-up
- c) STRIA: specific expert (sub-) groups would need to be set up by the end of 2015

A study will be launched, building on the 2050 Roadmap, in order to assess the decarbonisation pathways to 2050 and beyond in the light of the Energy Union Strategy. Pathways need to be credible, feasible, technologically and socio-economically, and be co-designed with the stakeholders on the basis of scientific evidence, looking at the challenge from a point of view of complete value chains rather than from the angle of existing sectorial representation.

A study to identify the levers to unlock clean industry should be launched. It should in particular identify priority sectors or activities that should be the focus of a policy aiming at fostering clean industry in the EU. For these priority sectors/activities, the opportunities and risks will be assessed and possible policy actions for addressing the barriers and reach the full potential will be analysed.

Consultation approach

The Commission will launch a public consultation and engage with Member States and stakeholders on these three interconnected strands. This would provide important inputs on the basis of which the Commission can provide a political response, as part of the Strategy.

This Public Consultation could also include elements of global technology and innovation leadership. The consultation should address specific as well as common issues concerning the innovation processes and the industrial development in the Energy Union sectors, barriers to effective deployment of successful research and innovation, what factors impede competitiveness in the EU market and in global markets, and seeking views on where European level intervention is appropriate and the processes for such intervention.

In addition the stakeholder fora and expert groups used for data collection could act as a key engagement point with Stakeholder.

Will an Implementation plan be established?

Yes No

Will an impact assessment be carried out for this initiative and/or possible follow-up initiatives?

- No

An impact assessment will not be necessary for the development of the new integrated strategy for research and innovation and competitiveness given that it will not lead to any direct impacts and will have no budgetary or legislative implications. Any follow-up measure contained in the strategy will be subject to the Commission's better regulation requirements.