



Council of the  
European Union

Brussels, 5 December 2016  
(OR. en)

15176/16  
ADD 1

ENER 423  
CLIMA 173  
AGRI 655  
COMPET 646  
TRANS 482  
ENV 765  
ECOFIN 1157  
RELEX 1021  
TELECOM 272  
CONSOM 304  
RECH 345

#### COVER NOTE

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From:	Secretary-General of the European Commission, signed by Mr Jordi AYET PUIGARNAU, Director
date of receipt:	1 December 2016
To:	Mr Jeppe TRANHOLM-MIKKELSEN, Secretary-General of the Council of the European Union

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No. Cion doc.:	COM(2016) 763 final - ANNEX 1
Subject:	ANNEX to the COMMUNICATION FROM THE EUROPEAN COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE, THE COMMITTEE OF THE REGIONS AND THE EUROPEAN INVESTMENT PLAN Accelerating Clean Energy Innovation

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Delegations will find attached document COM(2016) 763 final - ANNEX 1.

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Encl.: COM(2016) 763 final - ANNEX 1



EUROPEAN  
COMMISSION

Brussels, 30.11.2016  
COM(2016) 763 final

ANNEX 1

**ANNEX**

*to the*

**COMMUNICATION FROM THE EUROPEAN COMMISSION TO THE EUROPEAN  
PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL  
COMMITTEE, THE COMMITTEE OF THE REGIONS AND THE EUROPEAN  
INVESTMENT PLAN**

**Accelerating Clean Energy Innovation**

## ANNEX

### DESCRIPTION OF THE FOUR TECHNOLOGY FOCUS AREAS

The integration of smart, cutting-edge digital technologies into all aspects of the energy system, along with their various applications, is a precondition for remaining at the forefront of the shift to the more consumer-centric products and services model that will drive the next wave of innovation in the renewable-energy sector, in storage solutions, in e-mobility, in advanced housing and in the whole of the energy sector.

a) Decarbonising the EU building stock by 2050: From nearly-zero energy buildings to energy-plus districts

The EU's building stock represents a total floor area of around 25 billion m<sup>2</sup>. Buildings consume 40% of the EU's final energy demand, more than any other sector. But buildings also represent a large energy-savings potential and once renovated and upgraded, they can help to generate surplus power or provide key energy storage capacity. As pointed out in the Commission's European Buildings Initiative,<sup>1</sup> the EU is already a global leader in innovation systems for buildings, but research and innovation must remain a top priority to build and further expand this leadership in future. Transforming the EU's building stock (minimising environmental impacts over the whole life-cycle) will yield a better living environment, create new jobs and growth and help achieve the circular economy's objectives. To reach these goals, there is a pressing need to at least double current building renovation rates (which at only 0.4-1.2% are far too low)<sup>2</sup> and for deeper and more thorough renovations, drawing on forward-looking legislation, standards, innovative technologies and business models, and the development of new skills and competences.

To create significant impact, innovative solutions must go beyond today's nearly-zero-energy designs. They should address all technical aspects (including domestic renewable-power generation, designs for optimised life-cycle use of energy and materials, digital management and control systems, and energy-system integration) as well as regulatory, standard-setting, financing, governance and other socioeconomic issues. They must demonstrate the feasibility of energy-plus districts in different climatic regions and economic contexts, encompassing the integrated management of related environmental issues (such as water and waste).<sup>3</sup>

b) Strengthening EU Leadership on renewables.

Further system integration and developing the next generation of renewable-energy technologies, including potential game-changers, is required for renewables to become the

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<sup>1</sup> COM(2016) 860 Annex I

<sup>2</sup> Around 75% of the EU's building stock is very energy-inefficient. Following current renovation rates, it would take about a century to upgrade it to the latest standards.

<sup>3</sup> Applying Circular Economy principles to assess the environmental performance of buildings; see, [http://susproc.jrc.ec.europa.eu/Efficient\\_Buildings/](http://susproc.jrc.ec.europa.eu/Efficient_Buildings/)

dominant source of primary energy production and power generation. <sup>4</sup> It is also prerequisite for transformation of carbon-intensive sectors, such as transport,<sup>5</sup> where strong incentives to innovate in alternative energies (e.g. electricity from renewable sources, advanced biofuels) are needed. This includes dedicated research and innovation support, in close collaboration with industry, for Europe to maintain its global leadership in renewable-energy technologies.

Support will focus on: (1) Accelerating the development of renewable energy solutions for buildings, such as Building-Integrated Photovoltaics for energy generation and renewable technologies for heating and cooling, to allow the mass-realisation of nearly-zero energy buildings; (2) Research on optimisation and cost reduction of renewable energy generation, in particular for off-shore wind energy systems in order to accelerate the potential for wind deployment; and (3) Intensifying the development of solutions to increase the production and integration of renewables, in particular of variable renewables, into the energy system including the transport sector, through thermal and chemical storage (power-to-gas, power-to-liquids).

Greater synergies between renewable-energy production, distribution and consumption will empower consumers – citizens, communities and businesses – and encourage the deployment of novel services that cater to their changing needs and preferences, while at the same time increasing the flexibility of the system so as to incorporate large volumes of distributed, variable renewable energy.

In particular, this concerns market replication and efficient system integration of more mature technologies (e.g. wind energy, photovoltaics and bioenergy), in combination with energy storage or other advanced solutions, such as digital integration with electro-mobility and smart networks, to accommodate the progressive deployment of fluctuating renewable-energy sources. Cost-competitiveness and efficiency improvements of less mature, dispatchable renewable-energy technologies (e.g. flexible hydropower, ocean and geothermal energy, concentrated solar power or advanced, sustainable bioenergy), as a means to provide low carbon base-load and backup power, also need to be accelerated.

c) Developing affordable and integrated energy storage solutions.

To facilitate and enable the transition to a low-carbon energy system (including transport) based largely on renewables, the EU needs to accelerate the full integration of storage devices into the energy system, at domestic, commercial and utility scale.<sup>6</sup> Batteries, hydrogen and other storage applications – both mobile and stationary – are crucial for e-mobility in the short-term but play a larger systemic role for RES integration and optimisation of operations. Research in this area will open the way for subsequent industrial production, the promotion of new business models and further cost reductions, yielding large potential benefits for the EU in terms of growth and jobs.

Re-launching the production of battery cells in Europe is essential: it has multiple benefits in terms of industrial competitiveness, know-how in advanced manufacturing, security of supply and Europe's share in global value chains. Cheaper, lighter, safer and higher-performing batteries, together with faster charging solutions, are a key requirement for a shift to full electro-mobility,

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<sup>4</sup> See, High RES scenario, in: [Impact Assessment of Roadmap 2050, SEC\(2011\) 1565/2, Part 1/2](#).

<sup>5</sup> See, [Communication on a European Strategy for Low-Emission Mobility, COM\(2016\) 501 final](#).

<sup>6</sup> Current EU support for storage-related R&I is provided mainly as part of the smart-grids activities of the SET Plan and in the context of the Fuel Cells and Hydrogen Joint Undertaking.

as well as for increasing energy storage capacities in homes (with associated benefits for grid stability and flexibility). The initiative will also include research on materials; hard- and software management, control and integration of storage devices into the energy system; linking smart electricity grids and vehicle batteries and advanced manufacturing techniques. It will improve the performance and reduce the cost of power electronics necessary to keep storage system efficiencies at a competitive level. It will also address the creation of favourable market conditions for increased dissemination of storage solutions at both consumer- and grid level, including building bridges between the electricity grid, natural gas grid and the transport system as a precondition for a fully renewables-based power supply. It will put particular emphasis on new waste streams from energy transition (batteries, solar panels, etc.), in line with circular-economy principles.

d) Electro-mobility and a more integrated urban transport system.

Based on advanced battery designs and new powertrains, next-generation electric vehicles are firmly embedded in innovative re-charging infrastructures and solutions. The development of cheaper, lighter, safer batteries with longer ranges, as well as faster and more customer-friendly technologies and charging solutions, therefore constitute priorities for research and innovation in the transport area, as well as potential competitive advantages for the EU's transport industry. Digitisation to enable connected and automated transport and smart mobility services, currently at the demonstration stage to address technical and legislative challenges, will provide further opportunities.

The Strategic Transport Research and Innovation Agenda has developed a first long-term strategic approach to prepare the envisaged change of the transport system through research and innovation combining innovative low-carbon technologies, connected and automated transport and smart mobility services, making use of new technologies such as the European global navigation satellite systems (Galileo and European Geostationary Navigation Overlay Service). It also identified the need for enablers and framework conditions, notably infrastructure, public acceptance and greater attention to users' needs. The move towards more autonomous and connected transport, supported by the C-ITS Strategy<sup>7</sup> – particularly in urban areas – and the transformation of mobility into a service and better door-to-door logistics are necessary conditions for achieving greater levels of efficiency and decarbonising the transport system.

Fragmentation in the developing new market of low-emission transport technology must be tackled and the scale-up of deployment of innovation should be supported through different policy levers (e.g., revision of the regulations setting greenhouse gas emission performance standards for cars and vans, review of the Clean Vehicles Directive), financial levers (such as EIB finance) as well as a dedicated platform approach to better share information and align action on investment.

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<sup>7</sup> COM(2016) 766