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Draft Energy Challenge WP 2014-2015

Focus area

I) Focus area: Energy Efficiency

Energy efficiency is a no-regret option for Europe, addressed by both short-term (2020 targets, EU legislation[1]) and long-term (2050 roadmap) EU policies.

The objectives of EU action in the field of energy efficiency are:

(1) to hold **2020** energy consumption down to no more than 1474 Mtoe of primary energy consumption and 1078 Mtoe of final energy consumption[2]; and

(2) to hold **2030** energy consumption down to an appropriate level (which may be set as a function of the EU's economic performance).

In 2009, it was forecast that the policies and measures then in force at European and national level would still leave EU primary energy consumption at about 1680 Mtoe in 2020. Since then, Member States have committed to energy efficiency as a key element in their energy policies and energy efficiency measures have started to function on a significant scale. It is now projected that primary energy consumption will be no higher than 1550 Mtoe in 2020 and 1290 Mtoe in 2030. This is encouraging progress; but it should be noted that the poor performance of Europe's economy has also made a significant contribution, and that these projections still leave a gap in relation to the EU target for 2020. Moreover, it is clear that more ambitious action in energy efficiency will be needed to achieve EU objectives for 2030.

The **overall challenge** for EU action in the field of energy efficiency is therefore to close this gap ensuring that the energy efficiency target for 2020 is achieved and that the necessary framework is put in place to enable the achievement of a sufficient and cost-effective level of energy efficiency for 2030.

A package of activities is therefore needed, supporting 1) actions to remove market and governance barriers (citizen engagement, improving skills and knowledge, regulatory and financing frameworks); and 2) the development and demonstration of more energy-efficient technologies and solutions.

Research and demonstration activities will focus on buildings, SMEs and industry including energy-related products while uptake measures will address market failures and governance gaps across all sectors.

The work programme covers the following topics:

A Increasing energy efficiency in buildings

B Increasing energy efficiency in combination with renewable energy use in heating and cooling

C Increasing energy efficiency in industry and SMEs

D Increasing energy efficiency of energy-related products

[1] Namely Energy Efficiency Directive, Ecodesign and labelling legislation, Energy Performance of Buildings Directive

[2] EU27; 20% less than the energy consumption projected for 2020 at the time the objective was set

E Innovative financing for energy efficiency

F Citizen engagement, capacity building, governance and communication for energy efficiency

A – Increasing energy efficiency in buildings

***Specific Challenge*:** Buildings account for 40% of EU final energy demand and most of them will still be in place in 20 years' time while the rate of new construction will remain generally low. The refurbishment of existing buildings represents more than 17% of the saving potential that could be achieved in EU[3]. An ambitious refurbishment of the building sector could lead to 1300 billion EUR[4] in energy savings by 2050 and create millions of jobs. The biggest challenge to reduce energy use in the buildings sector is therefore to increase the rate and depth of building renovation (currently only at 1.2%/a[5]) and increase its speed to minimise disturbance for occupiers. To achieve an ambitious increase of the renovation rate (up to 2%/a), one necessary step is for innovative technological solutions to be widely demonstrated.

Further, the large contribution expected from the building sector to the 2020 energy objectives is a major challenge for the construction industry which needs to be ready to deliver renovations offering high energy performance as well as new, nearly zero-energy buildings using innovative technologies. There is a need to train architects, engineers and building managers. By promoting integrated design and good operational management practices, these professions can help closing the gap between energy performance at design stage and operational performance. They can help the uptake of new products and services for both new and refurbished buildings. In addition, a large share of craftsmen and on-site building workers also need up-skilling (between 3.9 and 4.6 million workers6). Existing qualification schemes, accreditation structures and training incentives are far from sufficient to deliver training on energy efficiency and renewable energy at a large scale and to attract building workers (especially from SMEs) into trainings.

Finally, the recast of the Energy Performance Building Directive and the new Energy Efficiency Directive contain provisions to increase renovation rates, especially for public buildings. However a number of non-technological barriers hamper the implementation of these Directives and also prevent other market actors in the residential and private sectors from following the example that the public sector is supposed to set. The heterogeneity of the construction industry, the large number of companies and the relative lack of quality standards and inspection mechanisms, especially when compared to other sectors, hinder the achievement of ambitious energy savings and the effective integration of renewable energies. In addition, many buildings are not commissioned or operated properly and Energy Performance Certificates have not yet gained full public acceptance. Thus, to respond to the pressure to build and renovate towards Nearly Zero Energy Buildings by 2018 and 2020, respectively, the construction sector needs to significantly upgrade its working practices.

[3] http://www.isi.fraunhofer.de/isi-media/docs/e/de/publikationen/BMU_Policy_Paper_20121022.pdf

[4] BPIE (2013) A guide to developing strategies for building renovation
http://www.bpie.eu/documents/BPIE/Developing_Building_Renovation_Strategies.pdf

[5] Renovate Europe Campaign

[6] Based on draft BUILD UP Skills EU overview report – data to be confirmed (www.buildupskills.eu).

A1: Innovative solutions for increasing the rate, depth and applicability of building renovation techniques in existing buildings

***Scope*:** Project proposals will focus on bringing down the cost and improving the applicability (speed, compatibility and user-friendliness) of innovative building renovation technologies and solutions, including insulation materials and systems, building control systems and renovation techniques.

Further, project proposals should include development of innovative design tools for refurbishment at building and district levels, mass manufacturing of pre-fabricated modules for refurbishment, development of new self-inspection techniques and quality check measures for efficient construction processes.

Further, project proposals should focus on development and application of new tools and methodologies to reduce gap between predicted and actual energy performance at the level of buildings and blocks of buildings. As well, actions will be undertaken to develop, test and roll-out adaptable envelopes integrated in building refurbishment projects, including multi-functional solar-thermal facade elements. Finally, activities will validate the integrated approach to retrofitting of residential buildings.

This topic will be implemented through the PPP on Energy efficiency in buildings (EeB PPP).

Impact: RTD G to add: renovation cost reduction, increased scale of solutions, improved applicability

Instrument: *CP through EeB PPP,*

A2: Addressing the gap in knowledge and skills in the construction sector

Scope: Regarding craftsmen and on-site workers, proposals should build on the results of the recent BUILD UP Skills initiative and may focus on upgrading or establishing large-scale qualification and training schemes for the continuing education of building workers. They may also address coordination and accompanying measures (e.g. voluntary certification schemes, accreditation, mutual recognition, incentives to encourage the participation of craftsmen). Regarding other practitioners, proposals should focus on improving the qualification and skills of middle and senior level building professionals, in particular architects, engineers, contractors and building managers in energy efficiency and renewable energy technology in buildings. The consistency with the Action Plan "Construction 2020" needs to be ensured. For support to trainees, proposals should link to other sources of funding such as the European Social Fund, including Youth Guarantee Scheme.

Expected impact: Raising the managerial capacity to support innovation and sustainable energy use in buildings through new leadership and work practices. Reduced skills mismatch. More concretely, every million Euro of EU support is expected to increase the skills of at least 2000 craftsmen[7], or 500 construction sector managers[8], resulting in savings of more than 30 GWh per year, and increasing the employability of the building workforce. Evidence of sustainable energy investments should be provided. Organisational and financial mechanisms should be established to sustain training activities for at least 3 years after the projects' end.

Instrument: CSA

[7] Conservative estimate based on the FEEBAT scheme (see BUILD UP Skills France status quo analysis).

[8] EUREM.NET and IDES-EDU projects.

A3: Increasing energy performance of existing buildings through process and organisation innovations

Scope: The focus should be on renovations of existing buildings. Project proposals should focus on removing market barriers, in particular technical and regulatory, targeting wide spectrum of stakeholders (public and private buildings sector, businesses, construction and buildings professionals, housing associations, academia, etc.). In essence, they should address the following type of activities or their combinations:

- *Organisation and process innovations for large scale pools of buildings*: Enable large building owners and operators (e.g. defence sector; insurance groups; social housing sector; public authorities) to achieve higher energy performance of their buildings.

- *Methods and tools for comparing and benchmarking of the energy performance* of building areas or (architectural) building designs or building systems, and move toward integrated design including ICT solutions.

- *Development, testing and implementation of quality standards*, reliable inspection and monitoring mechanisms for building renovation.

- Support the *cluster activities* of EeB PPP projects

Expected impact: within the duration of the projects, activities should trigger the renovation of existing buildings towards Nearly Zero Energy Buildings, resulting in savings of at least 2.200 toe/year (25 GWh/year) per million EUR of EU support.

Further, activities should support the replication of best practices to raise quality and compliance in the construction, renovation and operation of buildings, resulting in savings of at least 5.000 toe/year (~57 GWh/year) per million EUR of EU support.

Activities should contribute to achieving the level of energy consumption in new buildings of 20-50 kWh/m^2/year in 2020

Instrument: CSA

Other types of activities:

- Establishment and running of EU voluntary certification scheme for non- residential buildings
- Guidance on compliance and reporting on the monitoring of the independent control systems
- Development of an EU Building stock observatory
- Impact assessment of the review of the EPBD
- Impact assessment of the Build up Skills initiative
- Technical assessment of national energy performance calculation methodologies and tools and the link with revised CEN standards
- Consumers uptake of (Energy audits)/EPCs/Inspections of technical building systems
- Communication activities

Instrument: Tenders (studies)

B – Increasing energy efficiency in combination with renewable energy use in heating and cooling

Challenge: Technologies supporting the heating/cooling supply for either centralised or de-centralised purposes need to be improved in order to gain in efficiency performances as well as to reduce their costs. Due to the huge potential to increase the share of district heating/cooling in the EU, it is necessary to develop intelligent systems exploiting local resources, with waste heat recovery and renewable energy integration as well as roll-out solutions for integration into intelligent electricity grids.

Another important area of development concerns the efficient industrial heat management. In the EU, about 2/3 of total industrial heat demand is concentrated on temperatures below 400 °C and this can mainly be generated by fossil fuels. Few renewable technologies, such as biomass based combustion or co-combustion could currently provide heat at temperatures above 250 ºC at costs competitive with fossil fuels. Further R&D is therefore needed to develop renewable alternatives for high temperature heat, such as heat pumps or solar thermal technologies.

In the same time, actions are needed to set the market conditions right, enabling to use the full potential of district heating/cooling and address the major bottlenecks. This involves the integrated planning and integration of heating/cooling into the territorial context, adaptation to low energy building standards, inclusion of heating/cooling into building renovation strategies and empowerment of consumers through innovative metering, billing and compliant handling processes.

B1: Development and demonstration of innovative highly energy efficient heating and cooling solutions

Scope: Project proposals in this area should be addressing the following areas, or their combinations. :

- *Increase market uptake of high-efficiency cogeneration* in the residential and services sector by bringing down the cost of equipment especially in small and medium size capacities and for not yet widely used or emerging technologies (e.g. fuel cell, Stirling engine, internal combustion engines, Organic Rankin Cycle)

- *For individual heating*: speed up the replacement of old, inefficient fossil fired space heaters with products having A+++ to A+ energy labels. In this view, it is necessary to develop high efficiency, very low emission and cost effective biomass heating systems. The objective is to close the gap between steady state testing and real life performance of residential biomass systems with cost reduction up to 50% by 2020. This is to increase system efficiency to >85% and to reduce real life emissions (CO, OGC and dust) by 50% by 2020.

- *For District Heating* (DH)/cooling, develop, demonstrate and deploy new generation of highly efficient low-temperature DH systems (prioritizing the waste heat recovery). Such systems might be combining hybrid technologies to improve overall efficiency and utilize surplus electricity from the grid, including the best use of solar energy, biomass, heat pumps and large-scale storage.

- For *centralised, residential heating sector*, activities should deliver the innovation in the area of solar thermal technologies, materials and systems and heat pumps (including for nearly-

zero energy buildings e.g. small-capacity, reversible heat pumps), increasing the seasonal performance factor > 5.

- *For heat storage,* activities should lead to increased storage density using phase change materials (PCM) and thermochemical materials TCM). The objective is to develop next generation of Thermal Energy Storage systems based on PCM or TCM in order to enable the implementation of TES in applications with less available volumes and to enable the cost-effective long-term storage of renewable heat.

- Develop cost-competitive advanced *metering solutions* for the direct measurement of heat output and heat consumption for households, services and industry

- Bring down the cost of district heating and cooling systems through heat losses reduction by developing new, cheaper, easy to deploy and more conductive pipes and new insulation materials for the *heat distribution*.

Impact:

- Achieve the level of energy consumption of space and water heating of 30 to 50% less than today

- Achieve the level of energy consumption of air conditioning of 50% less than today

- Contribute to wider use of intelligent DH/cooling systems and integration of waste heat into heating/cooling networks

Instrument: CP

B2: Uptake of effective heating and cooling solutions by removing the existing barriers

Scope: Activities should:

- *For individual heating:* Promote and achieve the replacement of old, inefficient fossil fired space heaters with products having A+++ to A+ energy labels.

- *For industrial heating/cooling*: Promote effective heating/cooling solutions in industry, ensure exchange of information and knowledge.

- *For process and organisational innovation in DH:* Enhance public planning techniques and procedures to tackle in an integrated way the refurbishment of old buildings and the deployment of new buildings to a low- or nearly zero energy standard with the deployment of efficient district heating and cooling. Ensure exchange of information and knowledge.

- *For DH industry:* develop good practice, licensing criteria and efficiency benchmarks.

Impact: to add

Instrument: CSA

Other activities:

I. JRC's assistance, through Administrative Arrangement , to implement the relevant provisions of Directive 2012/27/EU, such as:

1. Technical assistance to implement the heat, cooling, CHP, DHC and cogeneration related provisions of the EED
2. Evaluation of national comprehensive assessments and cost-benefit analyses implementation under Article 14 of EED
3. Templates for the comprehensive assessment under Article 14 of the EED
4. Support on issues related to cogeneration

II. Other tenders (tbd)

Instrument: Tenders

C – Increasing energy efficiency in industry and SMEs

Challenge: Between 2000 and 2010, energy efficiency in industry has on average improved by 1.3% per year[9]. However only by using existing cost-effective energy solutions, the industry sector could further reduce its consumption by at least 13%[10], thus gaining in competitiveness and saving potentially nearly 40 Mtoe a year. Among other actions, obtaining larger savings in industry also requires introducing new affordable intelligent energy solutions that are reliable enough to not unduly interrupt production chains.

The new Energy Efficiency Directive will facilitate the market uptake of energy efficiency solutions by i.a. asking large companies to undergo an energy audit every 4 years. However there remain important market failures in particular for SME's which often lack energy expertise, internal resources and access to financing.

C1: Increasing energy efficiency in industry and SMEs through development and demonstration of innovative solutions

Scope: Activities should focus on:

- *Energy management in SMEs:* Innovative monitoring, analysis, control and planning tools including ICT, business solutions such as software and energy management solutions, real-time control and automation, on up-scaled across SMEs.
- *Demand response measures in industry and SMEs*: Integrated solutions for industrial demand response. Creation of Innovation hubs (EIT linked with national clusters).
- *Bringing down the costs of best available technologies* in heating/cooling, water heating, ventilation, insulation, lighting and motors in industry and SMEs. This should include technologies for highly efficient industrial CHP, upgrading the waste heat to process heat and heat recovery and technological innovation in the area of industrial solar thermal applications for production processes.

Impact: Reduced costs and increased competitiveness of industry. Increased energy and resource efficiency. To add, inputs from SPIRE PPP

Instrument: CP, including through the SPIRE PPP

[9] Odyssee-MURE project (http://www.odyssee-indicators.org/)

[10] http://www.isi.fraunhofer.de/isi-media/docs/e/de/publikationen/BMU_Policy_Paper_20121022.pdf

C2: Increasing energy efficiency in industry and SMEs through organisational and process innovation

Scope: Activities should focus on removing key market barriers, in particular the lack of expertise and information on energy management. Proposals should primarily address the uptake of cross-cutting technologies such as electric motor driven systems and steam/hot water generation because they represent 75% of the potential savings in industry[11]. Actions should be targeted at the manufacturing industry and involve large multipliers. They should consider the fact that energy-intensive industries are the most relevant actors - accounting for 70% of industrial energy use – and that SME's today are facing the biggest challenges. Therefore the proposals should address the following areas or their combination:

- *Territorial Integration of industry/SMEs:* Development of tools for planning and designing of industrial sites to minimize the energy demand. Industry clustering and pairing with urban zones to optimise the energy use.
- *Industrial systems efficiency benchmarking*: Devise methods and tools including ICT to compare and benchmark the energy performance of industrial systems and processes and develop guidelines for tailored measures.
- *Energy management in SMEs and industry*: Improve the availability of trained energy auditors and energy managers and the diffusion of energy management systems and best practices. Develop instruments to ensure availability of updated, comprehensive and usable information on energy efficiency relevant for industries

Expected impact: every million Euro of EU support is expected to increase the skills of hundreds of people working in the sector. These actions should trigger energy conservation measures in at least as many companies; resulting in savings of more than 50 GWh per year. In addition each proposal should put in place mechanisms guaranteeing that, for at least 3 years after the project's end, additional companies follow suit, giving extra savings and further competitive edge to EU industry.

Instrument: CSA

[11] Although this might depend on the industrial sector. Electric motors, for example, might be embedded in process-specific machines.

D – Increasing energy efficiency of energy-related products

Specific challenge:

Challenges on technology development…to add

Further, correct implementation of the EU Ecodesign Directive would yield yearly savings of up to 600 TWh of electricity and 600 TWh of heat in 2020, as well as net savings for European consumers and businesses of €90 billion per year – 1% of EU's current GDP – in year 2020 (meaning net savings of €280 per household per year)[12]. Previous initiatives have illustrated the need and relevance of market surveillance activities, e.g. by testing the pan-EU compliance of refrigerators and freezers (ATLETE[13]), washing machines (ATLETE II), TV and monitors (ComplianTV[14]) or other products (ECOPLIANT[15], MarketWatch[16]) to the legal requirements. It was estimated that globally, around 200 TWh/year could be lost due to non-compliance with standards and labelling programmes[17]. In view of the revision of the labelling directive in 2014 and the possibility of a new legislative framework from 2015, specific actions supporting products policy implementation are also needed.

D1: Development and demonstration of very efficienct energy-related products

Scope: Activities should address the following areas or their combinations:

- Further development of energy-related products with cross-cutting impacts (e.g. heat pumps or industrial technologies) including their demand response-readiness.
- Develop solutions that enable and encourage customers buy more intelligent and efficient products without any technological hurdles. (LEDs incompatibility with standard advanced lighting luminaires). Plug-an play solutions should be prioritized.
- Develop e-labelling for product energy performance

Impact:

- Energy consumption of air conditioning – 50% less than today
- Energy consumption of lighting – 80% less than today
- To add

Instrument: CP

[12] Molenbroek, E. Cuijpers, M. & Blok, K. (2012) Economic benefits of the EU Ecodesign Directive. Improving European economies.

[13] http://www.atlete.eu

[14] http://www.eaci-projects.eu/iee/page/Page.jsp?op=project_detail&prid=2613

[15] http://www.ecopliant.eu

[16] http://www.eaci-projects.eu/iee/page/Page.jsp?op=project_detail&prid=2644

[17] Waide, P. (2010) How much energy could we save through compliance? Presentation at the IEA conference, London, September 2010.

D2: Driving the market change dynamics towards highly efficient energy-related products.

Scope: Proposals should focus on monitoring, verification and enforcement activities of the EU energy-related products policy, in particular for those products that represent the highest energy saving potential (e.g. electric motors, water and space heating & cooling equipment, lighting). Projects should support higher level of surveillance activities by clarifying how much energy savings would be lost by low levels of compliance, and go beyond product testing activities. Actions must involve the relevant market surveillance authorities and consumers' associations as appropriate. In

- Identify products that are likely to contribute an increasing share of energy consumption in future, and identify the scope for dynamic-BAT performance for key energy using products
- Develop mechanisms and datasets for regular semi-automatic update of existing product requirements based on clear criteria
- Provide consumers with historical information on the energy consumption of their appliances

Expected impact: every million Euro of EU support is expected to generate savings around 15 GWh/year of energy losses avoided from non-compliance[18]. In addition, projects should result in an increase of confidence among purchasers, manufacturers and retailers.

Instrument: CSA

Other type of actions

I. Framework contracts:

1. Preparatory studies which precede the legislative work and
2. Impact assessment studies
3. Review studies and related technical assistance on ecodesign and energy labelling implementing measures
4. Technical assistance to support the regulatory process
5. Technical support to the Commission on standardisation work on energy related products
6. Technical support to support to stakeholders on standardisation work on energy related products
7. Technical assistance for market surveillance activities
8. Communication on product policies

II. Open calls for tender:

9. Preparatory studies which precede the legislative work (2nd quarter 2015)
10. Impact assessment studies (1st quarter 2014)

[18] Conservative estimate based on the study from Paul Waide (Navigant), quoted above.

11. Review studies and related technical assistance on ecodesign and energy labelling implementing measures (2nd quarter 2015)
12. Technical assistance to support the regulatory process ((1st quarter 2014)
13. Technical support to the Commission on standardisation work on energy related products (3rd quarter 2015)
14. Technical support to support to stakeholders on standardisation work on energy related products (3rd quarter 2015)
15. Technical assistance for market surveillance activities (1st quarter 2014)
16. Communication activities on Energy Efficiency policies (1st quarter 2014)

Instrument: Tenders

E: Innovative financing for EE

Challenge: 50 EUR on the pavement. Market failures, suboptimal investments and lack of capacity both in businesses and public sector. Lack of trust of investors and financiers towards energy efficiency market.

The energy services industry needs to develop new business models and grow beyond its traditional core if it wants to reach its estimated potential turnover of some EUR 25 bn per year[19]. There is for instance a need for this industry to engage and expand to non-traditional market segments, to respond to the debt constraints in the public sector or to better monetise energy savings. Investors and financiers need to be involved, new financing products and services need to be developed and applied. It is also necessary to increase public acceptance and turn consumers into active market players, with proper access to information and financing.

The public sector has an exemplary role to play and should address the energy efficiency of public assets[20]. However, sustainable energy investment projects require significant efforts to carry out inventories, mobilisation of stakeholders, feasibility studies, financial engineering, legal assistance and procurement. These efforts combined with a lack of necessary skills often prevent both public and private sectors to invest into sustainable energy projects that would be economically viable and bring about a number of other environmental and social benefits for the wider community. It is necessary to further support market actors in these activities through dedicated project development assistance (PDA) facilities (building on the experience of IEE2 with MLEI and ELENA), thus facilitating the development of innovative and replicable organisational and financing solutions.

E1: Increasing energy efficiency through improving the financeability and risk profile of energy efficiency investments across sectors

Scope:

Dialogue with financial market actors, standardisation and valuation entities. Development of new business models and financial products, ensuring synergies of public and private finance. Development of robust monitoring and evaluation system for standardisation and benchmarking.

Activities should:

- Reduce the high risk perception of investors on energy efficiency investments and develop reliable valuation techniques.
- Offer investors and service providers reliable standardised descriptions of EE investments/measures/contracts , as well as trustworthy measurement and verification protocols.
- Identify mechanisms to make investments in energy efficiency in the public sector compatible with the rules for public debt and deficit.

Expected impact:

[19] Bertoldi 2007, EEP

[20] Energy Efficiency Plan, 2011 (COM(2011)109 final) and Energy Efficiency Directive 2012/27/EU

Instruments:

E2: Development of credible pipeline of innovative EE investment projects

Scope: Project development assistance support (ELENA +). Eventually direct contribution to EU financing instruments on EE (EEE F, Deep green?).

- Pilot and replicate innovative financing and business solutions and monitor their impacts, develop a credible project pipeline improving the investors' confidence Provide project development assistance support.

Expected impact:

Every million EUR of H2020 support invested into selected projects is expected to trigger investments worth at least EUR 15 million; or increase the skills of more than 200 public procurers; or trigger energy conservation measures in at least 75-100 public authorities.

Instrument: *CSA*

E3: Development and market roll-out of innovative energy services

Scope: Enable roll-out of EPC.

- Build capacity of public authorities and SMEs to deal with non-grant financial support
- Identify models for supporting energy efficiency investments among vulnerable consumers
- Engage in development of enabling environment for fully operational energy services market.

Expected impacts: Every million Euro of EU support invested into the relevant activities is expected to: deliver savings of at least 25 GWh/year

Instruments: CP, CSA

Other type of activities:

- Enable to leverage of EU support through appropriate financial mechanisms.
- PDA facility with IFI(s)

Instrument: tbd

[This topic will have to be co-financed by all focus areas as cross-cutting by nature.]

F: Citizen engagement, capacity building, governance and communication for EE

Challenge: in the EU, residential use of energy is responsible for the emissions of 1 ton of CO_2 equivalent per person and per year[21]. While the barriers to consumer energy conservation are known for more than 30 years[22], most of them still hold, in particular split incentives (e.g. tenants vs. landlords), lack of information, initial investment in energy-efficient equipment or habits of the energy users. Consumers should be at the centre of EU energy policy and be guided to make informed choices when buying energy-efficient products and equipment.

Further, while Member States produce and implement National Energy Efficiency Action Plans (NEEAPs), local and regional authorities are also developing their plans at their own level. Whichever level, these plans are in principle powerful tools to address issues in an integrated manner, identify and prioritise cost-effective measures, and have them endorsed by elected representatives. However there is insufficient collaboration between cities, regions and national governments in drawing and implementing these plans, which results in a lack of synergies and therefore missed opportunities in terms of energy savings and economies of scale. Therefore there is a need to better link the preparation and implementation of these plans between the different governance levels.

F1: Consumer engagement for energy efficiency

Scope: proposals should focus on changing the behaviour of consumers in their everyday life (e.g. at home, at work, at school), using market segmentation and focussing on "action", the last step of the AIDA (Awareness – Interest – Desire – Action) framework. The equipment responsible for the main energy consumption should be addressed in priority (e.g. heating and cooling, lighting, domestic appliances, consumer electronics)[23]. Some training or educational activities may also be necessary, e.g. to help consumers read and understand their energy bills or the labels. Actions should involve manufacturers, retailers and consumer associations. The specificities of vulnerable consumers should also be taken into account when appropriate, as fuel poverty is growing in many countries[24]. The use of social innovations and innovative technologies (e.g. smart meters/appliances) should also be considered when it brings added value.

- Better understand consumers' and other stakeholders' perception, motivation and behaviour, e.g. understanding of product labels and building certificates
- Develop tools (such as comparative ones) to induce stronger energy saving behaviour of households
- Change consumers' behaviour (including without price signals)

[21] Ballu, M. & Toulouse, E. (2010) Energy savings in practice. Potential and delivery of EU ecodesign measures.

[22] Crossley, D. J. (1983) Identifying barriers to the success of consumer energy conservation policies. *Energy*, 8, 533-546.

[23] Bertoldi, P., Hirl, B. & Labanca, N. (2012) Electricity consumption and efficiency trends in the EU-27.

[24] Boardman, B. (2012) Fuel poverty synthesis: lessons learnt, actions needed. *Energy Policy*, 49, 143-148.

- Ensure a proper functioning of the market to stimulate a demand response in households, including capacity building on the applicable electronic and ICT devices, their capacity to monitor and analyse the energy use information.

- Improve customers' knowledge on energy saving opportunities in households, , with particular attention to electronic and ICT devices, their capacity to monitor and analyse the energy use information. Provide consumers with feedback and on the energy consumption of their appliances.

Expected impact: Within three years, every million Euro of EU support is expected to pull the market towards a bigger market share of the most energy-efficient products (from the highest energy class), and to deliver annual energy savings of around 10% for at least 5,000 households[25] (around 8 GWh/year of savings[26]).

[Appropriateness of this topic to be further revised]

F2: Higher energy efficiency through improved governance

Scope: Proposals should support public authorities in better linking up local, regional and national levels for delivering integrated sustainable energy action planning and projects within given territories to achieve economies of scale. Public actors should be encouraged to look at sectors that are better dealt with at inter-municipal or regional level such as mobility management, sustainable energy supply and development of bankable energy efficiency or renewable energy projects. Further, activities should:

- Buildings renovation planning: Build better national, regional and local planning capacity (e.g. in developing and implementing building renovation strategies).

- Build better national, regional and local planning capacity (e.g. in developing and implementing heating and cooling plans) and encourage cooperation between public and private sector, while involving consumers.

- Development of sector-specific technology pathways towards 2050 to target the most energy-intensive industrial sectors.
- Ensure better enforcement of legislation (e.g. building codes, building inspection regimes, construction products regulation)

- Enable continuation of the Concerted action on EPBD

- Develop better tools for implementation of EU legislation (e.g. for energy efficient public procurement, cost-benefit and life-cycle-cost analysis)

[25] Energy savings in this order have been achieved in former IEE projects (e.g. ACHIEVE, EC-LINC, Energy Neighbourhoods, Eco n'Home).

[26] Considering 1.46 toe of energy consumption per capita and per year and an average household size of 2.4 capita, as indicated in Bertoldi et al. 2012 (quoted above).

- Raise capacity of Member States and national energy regulatory authorities to address demand issues (e.g. in demand response, tariff design, assessment of generation adequacy assessment)
- Enable the continuation of the Concerted Action on EED
- Focus on removal of barriers to public procurement in the energy efficiency area, in particular lack of practical training, lack of experience with use of innovative procurement concepts, and the use of cost – benefit analysis using the a life-cycle approach.

Expected impact: The projects should result in a better adequacy between the various energy strategies and projects at Member States' level, in more efficient collaborations between local, regional and national levels and in an increasing number of Member States reaching the targets set within their NEEAPs.

In the area of public procurement, every million Euro of EU support is expected to increase the skills of more than 200 public procurers and to trigger the launch of public tenders for the purchase of highly energy efficient products (including vehicles), buildings or services resulting in savings of more than 50 GWh[27] per year. In addition each proposal should put in place mechanisms guaranteeing that, for at least 3 years after the project's end, additional public authorities follow suit, giving extra savings and further stimulating the market for energy efficiency.

Instrument: CSA

Other type of activities:

- Improve the modelling of energy efficiency in partial and general equilibrium models. Improve the microeconomic analysis of market barriers to energy efficiency. Model the trade-offs in the decarbonisation of building heating
- Develop an econometric analysis of the causes/drivers/predictors of national energy consumption by sector.
- Support the assessment of 28 National Energy Efficiency Action Plans

Instrument: Tenders

F3: Capacity building, networking and best practice sharing in sustainable energy

Scope:

Impact:

Instrument: CSA

Networking public procurers for Green Data Centres

[27] Based on results from previous IEE projects such as BUYSMART (IEE/08/488/SI2.528388)

Specific Challenge: Procurement of Green Data Centres technologies involve risk associated to technology and scalability and require tailored (i.e. not off the shelf) solutions by suppliers. PPI (Public Procurement for Innovative solutions) and PCP (Pre-Commercial Procurement) represent a not yet sufficiently exploited opportunity for public administrations to drive innovation in this area.

Scope: harmonizing across different administrative domains and accelerating the adoption of relevant guidance and specifications to procure technologies and systems for higher energy and environmental efficiency of data centres. Special attention should be given to cross-border procurement.

Proposals should demonstrate, as appropriate, sufficient expertise on relevant guidance/standards for the measurement of the energy and environmental footprint of data centres as well as on virtualisation/cloud technology.

Consortia should be compact (no redundant roles for partners from the same country).

Expected Impact:

- Significant improvements in terms of energy consumption and environmental footprint of public data centres when the procurement is implemented; such a development would set new norms and practices on the sustainability performance of data centres in Europe.

- Significant promotion of cloud/virtualisation technology as an energy saving one in data centres in Europe.

- Promotion of standards/metrics in measuring the energy/environmental footprint of the ICT-sector (as data centres form a core part of almost every ICT infrastructure).

Funding scheme: CSA

Other type of activities:

- EUSEW
- Financing portal
- Communication activities

Instrument: Tenders

[this topic will have to be co-financed from all 3 focus areas as it is cross-cutting by nature]

Increasing energy efficiency in electricity supply, transmission and distribution (including demand response) through technological development

Challenge: [presumably to be included in the low-carbon WP]

Scope: Activities should:

- Increase the flexibility and controllability of large-scale cogeneration (10-150 MW) by inter alia allowing the variation of heat-to-power ratios and shortening ramping-up and ramping-down times – to be included topic A2 of the low-carbon WP
- Develop technical solutions for the integration of CHP and micro-CHP into smart grids to allow solutions for electric grid flexibility, peak load and other demand management services – topic B1
- Develop technical solutions for the integration of other types of microgeneration, demand response and storage into the grid – topic B1
- Further push the frontiers of engine and turbines technologies to increase conversion efficiency and reduce their costs – topic A2
- Develop tools and methods enabling accounting for the demand side (demand response, storage, microgeneration) contribution when carrying out generation adequacy assessments through the development of the right methodologies – topic B2
- Diminish the cost of alternative balancing technologies, notably storage and demand response – topic B2 and C
- Develop consumer friendly solutions for demand response – topic B?

Impact:

- power generation from CHP – 20-22% in 2030 compared to 15% today
- share of smart meters – 100% by 2030

Instrument: CP

II) Focus area: Competitive low-carbon energy

One of the major challenges Europe will face in the coming decades is to make its energy system clean, secure and efficient, while ensuring EU industrial leadership in low-carbon energy technologies.

To help achieve such ambitious objectives, this Focus Area aims to develop, and accelerate the time to market of, affordable, cost-effective and resource-efficient technology solutions to decarbonise the energy system in a sustainable way, secure energy supply and complete the energy internal market, in line with the objectives of the Strategic Energy Technologies Plan (SET-Plan).

The scale and ambition of research and innovation needed requires enhanced cooperation between all stakeholders, including the EC, the Member States, the industry and the research community.

The EU is committed to reduce its greenhouse gas emissions 20 % below 1990 levels by 2020, and intends a further reduction to 80-95 % by 2050. In addition, renewables should cover 20 % of final energy consumption in 2020, and a large part of it by 2050, as identified in the Energy roadmap 2050. A reduction of at least 60% of GHGs by 2050 with respect to 1990 is required from the transport sector, while by 2030, the goal for transport will be to reduce GHG emissions to around 20% below their 2008 level.[28]

Time is pressing. The solutions that will be developed and rolled out to the market in the next ten years will form the backbone of the energy system for the many years ahead. Besides, the energy system needs to evolve to accommodate, among others, much higher levels of integration of renewable energy. It is essential that the society understand the existing challenges and the implications of their possible solutions, so as to ensure sustained public acceptance.

A – Development and demonstration of competitive renewable electricity and heating/cooling

A1 – Close-to-market demonstration of competitive renewable electricity and heating/cooling

Specific Challenge: Renewables should cover 20% of the final energy consumption in 2020. In this context, Europe has been witnessing a significant growth in the contribution of renewable energy sources to the overall energy mix, fostered through the Renewable Energy Directive, the internal market and the infrastructure package. However, to sustain this growth and achieve the EU targets for renewable energy, and to ensure EU industrial leadership in low-carbon energy technologies, thereby contributing to (i) growth and jobs in Europe, (ii) energy security and affordability, and (iii) global GHG emissions reduction, a number of important sub-challenges need to be solved:

a) Levelized cost of renewable energy production needs to decrease while technology performance needs to increase, in order to ease the introduction of renewable energy into the market.

b) The ease of integration of variable output renewable energy into the energy system needs to be enhanced to ensure continuity of supply.[29]

c) Renewable energy technology supply chains and manufacturing processes able to compete globally need to be developed and consolidated.

[28] White Paper 'Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system' COM(2011) 144 final.

[29] Proposals shall address only grid integration solutions that need to be integrated with or adapted to the particular renewable energy conversion device or system. Other grid integration issues are addressed under Specific challenge B.

d) A better understanding of the implications of an increase in the use of RES needs to be achieved, while ensuring sustained public acceptance.

e) Market uptake barriers (e.g. regulatory issues, capacity building and access to finance) need to be removed.

Scope:

When addressing the present specific challenge, proposals should consider the energy system as a whole and the possible implications upon it of the technology solutions being proposed. In the case of technology solutions covered by Industrial Initiatives of the SET-Plan, the proposals should address the key innovation challenges for the technologies in question, in line with the priorities laid down in the Implementation Plans of the respective Industrial Initiatives.

Regarding the specific above-mentioned sub-challenges, proposals have to address them as follows:

- Sub-challenge a) has to be addressed by all proposals.
- Sub-challenge b) has to be addressed by all proposals related to variable output renewable energy sources.
- Sub-challenge c) may be addressed either within the context of the Leadership in Enabling and Industrial Technologies Work Programme, or as a work package of a proposal in the present specific challenge, in the case of technology solutions for which the development of such supply chains and manufacturing process is essential for the global competitiveness, and thus long-term economic viability, of the solutions in question.
- Regarding sub-challenges d) and e), all proposals have to include a work package on 'the business case' of the close-to-market technology solution being addressed. That 'business case' work package, has to demonstrate, the business case of the technology solution in question, and has to identify potential issues of public acceptance, market and regulatory barriers, including standardisation needs. The 'business case' work package should also address, where appropriate, synergies between technologies (including those for storage), regional approaches and other socio-economic and environmental aspects from a life-cycle perspective (e.g. pollution and recycling).

The proposals should bring the proposed technology solutions to a higher TRL level, aiming at "demonstration" of those solutions, accompanied, where appropriate, by support research activities and activities targeting market uptake. The proposals should bring the proposed technology solutions from TRL 5 to TRL 6-8 (see annex).

Expected impact:

[A table of target reduction of levelized cost of renewable energy production per technology.]

Bring costs of renewable electricity down to grid parity by increasing efficiencies and decreasing costs. Making renewable electricity generation more predictable and grid friendly. Increase the use of the renewable energy sources for electricity and heating and cooling. Reduce renewable energy technologies installation time and costs. Increasing the reliability and lifetime while decreasing of operation and maintenance costs. Reducing the environmental footprint and the energy payback time. Strengthening the European industrial technology base, thereby creating growth and jobs in Europe.

Instruments: CP, CSA, ERA-NET

Additional information: In order to ensure that a balanced portfolio of technologies covering different renewable energy sources will be supported, the share of the EU contribution benefitting one single technology area[30] shall not exceed [25%] of the budget for the present topic.

A2 – Developing the next generation of renewable electricity and heating/cooling technologies

Specific Challenge: Renewables should cover a large part of the final energy consumption by 2050 as identified in the Energy roadmap 2050. To achieve this necessity, a number of important sub-challenges need to be solved:

a) Levelized cost of renewable energy production will need to decrease further while technology performance will need to continue increasing, in order for renewable energy to cover a large part of the final energy consumption by 2050.

b) Resource efficiency[31] needs to be addressed taking a life-cycle perspective.

c) The ease of integration of variable output renewable energy into the energy system needs to be enhanced to ensure continuity of supply.[32]

d) Renewable energy technology supply chains and manufacturing processes able to compete globally need to be developed and consolidated.

Scope: When addressing the present specific challenge, proposals should consider the energy system as a whole and the possible implications upon it of the technology solutions being proposed. In the case of technology solutions covered by industrial initiatives of the SET-Plan, the proposals should address the key innovation challenges for the technologies in question, in line with the priorities laid down in the implementation plans of the respective industrial initiatives.

Regarding the specific above-mentioned sub-challenges, proposals have to address them as follows:

- Sub-challenge a) and b) have to be addressed by all proposals.
- Sub-challenge c) has to be addressed by all proposals related to variable output renewable energy sources.
- Sub-challenge d) may be addressed either within the context of the Leadership in Enabling and Industrial Technologies Work Programme, or as a work package of a proposal in the present specific challenge, in the case of technology solutions for which the development of such supply chains and manufacturing process is essential for the global competitiveness, and thus long-term economic viability, of the solutions in question.

The proposals should bring the proposed technology solutions to a higher TRL level, from TRL3 or above to TRL 5.

[30] For the purpose of this specific challenge, technology areas will be categorised as follows: wind energy, photovoltaics, concentrated solar power, bio-CHP, ocean energy, geothermal energy, hydro energy, renewable heating and cooling.

[31] By resource efficiency we mean efficiency in utilisation of the resources as described by the EC Communication 'A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy' COM(2011) 21: raw materials such as fuels, minerals and metals but also food, soil, water, air, biomass and ecosystems.

[32] Proposals shall address only grid integration solutions that need to be integrated with or adapted to the particular renewable energy conversion device or system. Other grid integration issues are addressed under Specific challenge B.

Issues of grid interface, synergies between technologies (including those for storage), regional approaches, socio-economic and environmental aspects from a life-cycle perspective (including public acceptance, business cases, pre-normative and legal issues, pollution and recycling) need to be appropriately addressed where relevant.

Expected impact: Bring costs of renewable electricity down to grid parity by increasing efficiencies and decreasing costs. Making renewable electricity generation more predictable and grid friendly. Increase the use of the renewable energy sources for electricity and heating and cooling. Reduce renewable energy technologies installation time and costs. Increasing the reliability and lifetime while decreasing of operation and maintenance costs. Reducing the environmental footprint and the energy payback time. Strengthening the European industrial technology base, thereby creating growth and jobs in Europe.

Instruments: CP, CSA, ERA-NET

Additional information: In order to ensure that a balanced portfolio of technologies covering different renewable energy sources will be supported, the share of the EU contribution benefitting one single specific technology area[33] shall not exceed [25%].

A3 – Support to market uptake of renewable electricity, heating and cooling technologies

Specific challenge: Renewables should cover 20% of the final energy consumption in 2020 and even bigger share in the years after. Europe has been witnessing a significant growth in the contribution of renewable energy sources to the overall energy mix, fostered through the Renewable Energy Directive, the internal market and the infrastructure package. However, we are also seeing deceleration of this growth[34], possibly due to the economic crisis, but also because there are a number of market uptake barriers that remain or persist for both established and innovative renewable energy technologies.

Therefore, to ensure a sustained level of growth and to achieve the EU targets for renewable energy, and to create the appropriate business environment for EU industrial leadership in low-carbon energy technologies, in addition to the challenges related to the specific technologies, a number of important cross-cutting market-uptake challenges need to be addressed such as:

- Ensuring sustained public acceptance of renewable energy projects and renewable energy overall, while taking into account of the implications of the substantial increase in RES share in the final energy consumption;
- Renewable energy legislation needs to be implemented in all Member States in a harmonised manner using the best practices of the forerunning Member States;
- All Member States must possess the necessary capacity to enact the EU legislation, while the businesses must make full use of the opportunities, which these new markets creates for them.
- New financing methods for supporting investments in innovative and established renewable energy must be developed.

[33] For the purpose of this specific challenge, technology areas will be categorised as follows: wind energy, photovoltaics, concentrated solar power, bio-CHP, ocean energy, geothermal energy, hydro energy, renewable heating and cooling.

[34] As shown in the last Renewable energy progress report (COM(2013)175).

Scope: Proposals should address one or several of the sub-challenges mentioned above. Regional specificities, socio-economic and environmental aspects from a life-cycle perspective shall be considered.

Expected impact: Increasing the share of renewable electricity, heating and cooling in the final energy consumption. 30% reductions of the time taken to authorise the construction of renewable electricity generators and related grid infrastructures. Substantial and measurable reductions in the transaction costs for project developers as well as for the permitting authorities, whilst still fully addressing the needs for environmental impact assessments and public acceptance. Development of better policy, market support and financial frameworks, including at regional and local level.

B – Electricity grids: enabling an increased flexibility of the European power system, efficiently providing increased transfer capacity and enabling an active participation of users and new market actors

Specific Challenge: The overall reduction of greenhouse gases by at least 80% by 2050 will likely require a much higher fraction of our energy consumption being delivered to its final uses through electricity and a major modernisation of European electricity networks. Future networks will need to integrate new energy resources, technologies and approaches motivated by the EU political and regulatory frameworks, which today promote the internal energy market, renewable energy, alternative fuels for transport, local active consumption and storage, grid-scale storage, micro-generation, electric vehicles, smart metering, smart grids and the exploitation of digital technologies and services.

A first challenge is enabling an increased flexibility of the power system to cope with the growing share of intermittent and decentralised renewable generation, and managing the complex interactions among millions of energy resources. A second challenge is cost-efficiently enhancing available network capacity to deliver energy over longer distances, to support increased flows from renewables and those resulting from the integrated energy market. A third challenge is providing the information, services, market architectures and privacy guarantees to support open markets for energy products and services and to activate the participation of consumers in energy markets. The modernisation of energy networks also needs to maintain or enhance service quality, reliability and security and to mitigate capital and operational costs.

To address these challenges, innovation is needed in system integration, interoperable technologies, services, tools, co-ordination schemes, business processes, market architectures and regulatory regimes to plan, build, monitor, control and safely operate end-to-end networks in an open, competitive, decarbonised, sustainable and climate-change resilient market, under normal and emergency conditions. Potential risk of lock-in effects of early deployment should be taken into account. As the modernisation of electricity grids involves a substantial integration of ICT in electricity grid systems, synergies with IT and telecommunication networks are expected to be exploited in many areas.

B.1 Demonstration and validation of electricity-system integration

Scope: Integrating and validating solutions to grid challenges that reached already TRL 5-6 and bringing them to TRL 6-7, concentrating on field demonstration of system integration, up-scaling and replication at industrial scale and supporting research. Appropriate user and general public acceptance, regulatory, market up-take (e.g. e.g. regulatory issues, capacity building and access to finance), social, environmental and resource efficiency aspects should be included.

Expected impact: Improving flexibility and available capacity of European electricity grids at all voltage levels to integrate new electricity producers and users, while maintaining or enhancing

service quality, reliability and security of the power system. Providing the infrastructures, processes and information to develop the active participation of demand, of new business models and new players in energy markets. Demonstrating advanced grid technologies and system architectures and further developing the competitiveness of European industries. Mitigating capital and operational costs of the grid modernisation required for the energy transition, and minimising environmental impact.

Demonstration projects and related R&D are expected to respond to the priorities identified in the EEGI implementation plan 2014-2016 to address European electricity grids challenges in a timely way and to include measures for up-scaling and replication. Coordination action(s) may further enhance the value of RD&D results with activities such as mapping, up scaling, replication, knowledge and experience sharing.

Instruments: CP, CSA

B.2 Development of the next generation technologies for future electricity grids

Scope: Developing the next generation of technologies, services, tools, system and market architectures by bringing them from TRL 3 or above towards TRL 5. Relevant user acceptance, system integration, regulatory, market, social and environmental aspects should be included.

Expected impact: Further improving the long-term flexibility and available capacity of European electricity grids at all voltage levels, while maintaining or enhancing service quality, reliability and security of the power system. Enabling the full participation of prosumers, new products, services and actors in energy markets. Developing the competitiveness of European industry. Mitigating long-term capital and operational costs of the grid modernisation required for the energy transition.

R&D projects are expected to respond to R&D priorities identified in the EEGI implementation plan or the smart grids platform's SRA 2035. Coordination and support actions will support the coordination of specific stakeholder activities in the area of smart grids.

Instruments: CP, CSA

B.3 Market Uptake Measures for innovative grid technologies

Scope: Driving the implementation of innovative network technologies, services, tools and architectures by helping to bring them from TRL 7 towards TRL 9. Particular aspects include smart metering systems and technologies and processes to improve the hosting capacity for variable renewable electricity.

Expected impact: Accelerating the deployment of innovation in the electricity grids to lower the cost of smart metering and smart grids deployment and to respond in a timely way to the challenges facing grid operators and users in view of the agreed 2020 objectives. Enabling an open market for services deployment.

Instruments: CSA, PCP/PPI

B.4 Market Uptake Measures for integrated energy storage

Scope: Driving a more extensive integration of innovative storage technologies and concepts where the prospect of the business case is positive. The activities should be targeted to usage in Low voltage and Medium voltage electricity distribution systems and bringing energy storage systems from TRL 7 towards TRL 9. Particular aspects include community level storage systems to improve the hosting capacity for variable renewable electricity.

Expected impact: Accelerating innovation and business models for deployment of storage at local level. Deferred investment for grid reinforcements and lower societal costs associated with high penetration of distributed intermittent renewable energy resources. Timely response to the challenges facing grid operators and users in view of the agreed 2020 objectives. Enabling the development different storage services.

Instruments: CSA, PCP/PPI

C - Providing the energy system with flexibility through enhanced energy storage technologies

Specific Challenge: With the rapid increase of electricity produced by intermittent (centralised or decentralised) renewable sources, there is a need to increase the energy storage capacity significantly on a medium- to long-term basis since other flexibility alternatives for the grids will not be sufficient in an electricity system compliant with energy policy objectives of 2030 or 2050. Present energy storage technologies make limited business sense and suffer from constraints in terms of availability, durability, performance and costs. The joint European Energy Storage Technology Development roadmap towards 2030 identifies the needs[35]. The aim of the RTD&D activities in this challenge will be to develop new technologies or improved technologies with significantly reduced costs, higher efficiency, better durability, wider deployment opportunities and reduced environmental impact. In addition, socioeconomic modelling for use of energy storage technologies need to be enhanced. Generally energy storage has to progress in the innovation chain so that the barriers associated with new storage concepts are reduced. This would include adaptation of new materials and developments for improved safety. Energy storage with bi-directional conversion with electricity or indirect electricity storage through other energy vectors should be pursued. (RTD&D activities addressing enhanced performance of chemical storage in hydrogen will be implemented through the FCH-JU.)

C1 Demonstration and validation of energy storage systems

Scope: Activities should focus on validating and integrating solutions that reached already TRL 5 to TRL 6-7. This would include anticipation of potential market and regulatory issues with due consideration to the socioeconomic aspects and improved models to demonstrate energy storage systems. The activities must take into account grid interfaces and when appropriate use synergies between technologies.

Expected impact: A wider use of storage technologies in the energy system through availability of solutions with reduced cost, increased efficiencies, and lower environmental impact. Increased competitiveness of European industries in the area of energy storage. Significantly reduced barriers for high penetration rates of distributed energy resources and intermittent renewable energy. The impacts are expected to be linked to either:

-large scale energy balancing

or

- improved grid congestion management at local level.

Instruments: CP

[35] http://www.ease-storage.eu/tl_files/ease-documents/Stakeholders/ES%20Roadmap%202030/EASE-EERA%20ES%20Tech%20Dev%20Roadmap%202030%20Final%202013.03.11.pdf

C2 Development of the next generation of energy storage technologies

Scope: Activities should focus on developing the next generation of storage technologies by bringing them from TRL 2 or above towards TRL 5. The activities need to take into account grid interfaces and, when appropriate, use synergies between technologies. Research should also address environmental, economic and public acceptance issues.

Expected impact: An enlarged portfolio of storage technologies with potential for European wide usage. The technologies should enable reduced cost, increased efficiencies, lower environmental impact and fewer location constraints on energy storage systems. Contributions to solutions for high penetration rates of distributed energy resources and intermittent renewable energy.

The impacts are expected to be linked to either:

-large scale energy balancing

or

- improved grid congestion management at local level.

Instruments: CP,

D – Sustainable biofuels and alternative fuels for the European transport fuel mix

D1 - Supporting first market replication of advanced biofuel plants

Specific challenge: Decarbonising the transport sector is a major challenge in the Energy Roadmap 2050. This can be achieved by several means, notably through the electrification of the transport sector, or the use of sustainable alternative, non-fossil fuels.

In the short-term and medium-term perspective, biofuels are expected to be the main contributors to this de-carbonisation. In order to achieve the EU targets regarding renewable energy in transport (set out in the RES and Fuel Quality Directives), and to address concerns regarding indirect and direct environmental impacts of biofuels, new and advanced biofuels using sustainable feedstock need to reach the market. To this end, the following sub-challenges should be addressed:

- Proving that advanced biofuels technologies, as identified in the Roadmap of the European Industrial Bioenergy Initiative (EIBI), are technically and economically feasible, as well as environmentally and socially sustainable, at commercial scale.
- Developing logistic systems for a sound and sustainable feedstock supply.

Access to financing for first-of-its-kind advanced biofuels plants is difficult because banks do not want to take the risk of investing in technologies, which do not have a proven record of operation and costs on one hand, and in a market, which is not fully established yet in view of the on-going revision of the RES Directive, on the other hand. This situation is exacerbated during the economic crisis when availability of capital is reduced overall. The RSFF has been very successful in incentivising banks to invest in riskier projects. these investments to the specific projects of the SET-Plan EIBI.

Scope: Proposals should address the short-term challenges for market penetration of advanced biofuels as presented above. In each case, they should address one of the respective sub-challenges, or a combination of them. They should bring technology solutions to a higher TRL level, in line with the European Industrial Bioenergy Initiative (EIBI) roadmap.

Proposals should aim at moving technologies that reached already TRL 6-7 to TRL 8 (see annex) through first market replication projects – first application in the market of an already demonstrated innovation.

Socio-economic and environmental aspects should be adequately addressed.

Expected impact: The successful construction and operation of the first pre-commercial plants would de-risk subsequent investments in advanced biofuel technology, leading to a massive roll out to the market by industry, in view of reaching the energy targets for 2020 and beyond. A significant social impact is also expected, notably in terms of job creation.

Instruments: Access to risk financing with dedicated budget from the "Energy Challenge"

D2 - Demonstrating advanced biofuel technologies

Specific challenge: Decarbonising the transport sector is a major challenge in the Energy Roadmap 2050. This can be achieved by several means, notably through the electrification of the transport sector, or the use of sustainable alternative, non-fossil fuels.

In the short-term and medium-term perspective, biofuels are expected to be the main contributors to this de-carbonisation. In order to achieve the EU targets regarding renewable energy in transport (set out in the RES and Fuel Quality Directives), and to address concerns regarding indirect and direct environmental impacts of biofuels, new and advanced biofuels using sustainable feedstock need to reach the market. To this end, the following sub-challenges should be addressed:

- Proving that advanced biofuels technologies, as identified in the Roadmap of the European Industrial Bioenergy Initiative (EIBI), are technically and economically feasible, as well as environmentally and socially sustainable, at commercial scale.
- Developing logistic systems for a sound and sustainable feedstock supply.

Scope: Proposals should address the medium-term challenges for market penetration of advanced biofuels as presented above. In each case, they should address one of the respective sub-challenges, or a combination of them. They should bring technology solutions to a higher TRL level, in line with the Implementation Plan of the European Industrial Bioenergy Initiative (EIBI).

Proposals should aim at moving technologies that reached already TRL 5-6 to TRL 7 (see annex) through industrial demonstration projects

Socio-economic and environmental aspects should be appropriately addressed.

Expected impact: Testing advanced biofuel technologies at large industrial scale reduces the technological risk associated to these, paving the way for a subsequent first market replication. For this purpose, the scale of the projects should permit obtaining the data and experience required so that a first market replication can be envisaged as a next step. The industrial concepts demonstrated should have the potential for a significant social and economic impact, notably in terms of job creation, economic growth and safe and affordable energy supply.

Instruments: *CP, [ERANET in 2015, subject to positive feedback from MS]*

Additional information: Some research challenges for biomass feedstocks could better be addressed under the call of Societal Challenge 2: Food security, Sustainable Agriculture, Marine and Maritime Research and the Bioeconomy). Proposers are advised also to consult the work programme of the BRIDGE JTI.

D3 – Developing next generation technologies for biofuels and sustainable alternative fuels

Specific challenge: Decarbonising the transport sector is a major challenge in the Energy Roadmap 2050. This can be achieved by several means, notably through the electrification of the transport sector, or the use of alternative, non-fossil fuels.

In the long-term perspective, electrification or hydrogen and fuel cells can provide solutions to the decarbonisation of the transport sector. However, certain sub-sectors such as aviation, and to lesser extent heavy duty road and maritime transport, will still rely on fuels that should be produced from sustainable, non-fossil feedstock. However, Europe has scarce biomass resources to cope with an increased demand for fuels and other uses. Thus, in the long-term perspective, new technologies of sustainable fuels need to be developed that radically improve the state-of-art, notably in regards to the following sub-challenges:

- Reducing the constraints related to feedstock supply, e.g. through improved resource-efficiency, enlargement of the biomass feedstock basis, or use of new, sustainable feedstock from non-biomass sources;
- Reducing the technical limitations related to the technologies and their competitiveness, e.g., by developing new processes and advancing considerably existing ones in order to increase the efficiency and the effectiveness of the fuel production, or by re-thinking the design of the current technological pathway aiming at substantial investment savings.
- Improving the economic, environmental and social benefits, notably regarding cost reduction, minimisation of demand on natural resources (land and water in particular), GHG abatement and development of rural areas;

Scope: Proposals focusing on the long-term perspective should aim at developing the next wave of alternative and sustainable fuels by moving technologies from TRL 2 or above to TRL 4-5. In each case, they should address one of the respective sub-challenges, or a combination of them.

Socio-economic and environmental aspects should be appropriately addressed.

Expected impact: New technology pathways should permit the use of new feedstock sources, or a more efficient use of the current ones. A significant cost reduction potential is also expected, that would permit these fuels to compete favourably with fossil or older-generation equivalent fuels. New technologies should be developed to a level permitting a robust and reliable assessment of the environmental and social benefits with respect to current technologies, notably in terms of GHG savings, better natural resource use and job creation in rural areas, as well as secure and inexpensive energy to the citizens.

Instruments: CP, ERA-NET

D4 – Partnering with Brazil on advanced biofuels [topic to be opened in 2015]

Specific challenge: Decarbonising the transport sector is a major challenge in the global fight against climate change. As such, it is a crucial element in the EU Energy Roadmap 2050 and [to be completed with reference to Brazilian regulations / policy initiatives].

In the short-term and medium-term perspective, biofuels are expected to be the main contributors to this de-carbonisation. In order to achieve the EU [and Brazil] policy targets in this domain, and to address concerns regarding indirect and direct environmental impacts of biofuels, new and advanced biofuels using sustainable feedstock need to reach the market.

Brazil is an essential partner in this sector: it has outstanding expertise, a well-established and highly competitive first-generation industry, as well as optimal conditions for the development of an advanced biofuel industry.

Hence in the framework of the EU-Brazil S&T Cooperation Agreement, the European Commission representing the European Union (EC) and the Ministry of Science and Technology (MCT) of the Government of Brazil, are working together to benefit from the complementarities in research and innovation, in order to foster the development of advanced biofuels and accelerate their commercialisation both in Brazil and in Europe.

To this end, the following sub-challenges should be addressed:

- Exploiting synergies between Brazil and Europe in terms of scientific expertise, industrial capacity and resources.
- Proving that advanced biofuels technologies are technically and environmentally feasible, cost competitive and environmentally and socio-economically sustainable at commercial scale.
- Developing or improving logistic systems for a sound and sustainable feedstock supply.

Scope: Proposals should address the first sub-challenge presented above, and at least one of the other two. They should bring technology solutions to a higher TRL level.

Proposals should aim at moving technologies that reached already TRL 5-6 to TRL 7 (see annex) through industrial demonstration projects, which may include supporting R&D activities if needed.

Socio-economic and environmental aspects should be appropriately addressed.

Additional eligibility criterion: Proposals which do not include coordination with a Brazilian project will be considered ineligible. Therefore, the EC proposals must unambiguously identify the coordinated Brazilian proposal to be submitted to the Brazilian authorities, and include a detailed description of this proposal.

Additional selection criterion: Proposals will be only selected under the condition that the corresponding coordinated project is also selected for funding by the Brazilian authorities.

Expected impact: Testing advanced biofuel technologies at pre-commercial industrial scale reduces the technological risk associated to these, paving the way for a subsequent market replication. For this purpose, the scale of the projects should permit obtaining the data and experience required so that a first market replication can be envisaged as a next step. The industrial concepts demonstrated should have the potential for a significant social and economic impact, notably in terms of job opportunities and wealth creation in rural areas of Brazil or Europe. Clear environmental benefits should also be obtained.

Projects should appropriately exploit the complementarities between the EU and Brazil, and pave the way for significant enhancement in the cooperation between key researchers, institutions and industries that are active in biofuel research and innovation in the EU and Brazil.

Instruments: ***Coordinated call with Brazil***

Additional information

This topic has been defined on the basis of i) the confirmation by Brazilian authorities of their will to continue cooperation on advanced biofuels, and ii) RTD.K preliminary ideas on the principles and contents of coordinated action with Brazil in Horizon 2020 (i.e. building upon past cooperation activities, moving towards closer-to-market activities, increasing the level of ambition in terms of impact).

However the contents of this topic need to be further discussed with the Brazilian authorities beginning of July 2013. A modified version of the topic will be drafted to take account of these discussions, which would be incorporated shortly after in the Work Programme before it is formally endorsed.

In past cooperation relationships with the EU, Brazil opted for coordinated calls with equal resources on both sides, rather than for the EU unilateral instruments (e.g. targeted opening, SICA). It is assumed that such preference will be maintained in Horizon 2020, hence the option for a coordinated call, which it is the instrument adapting best to this type of cooperation.

D5 - Support to market uptake of low ILUC biofuels and sustainable alternative fuels

Specific challenge: Decarbonising the transport sector is a major challenge in the Energy Roadmap 2050. This can be achieved by several means, notably through the electrification of the transport sector, or the use of sustainable alternative, non-fossil fuels.

In the short-term and medium-term perspective, biofuels are expected to be the main contributors to this de-carbonisation. In order to achieve the EU targets regarding renewable energy in transport (set out in the RES and Fuel Quality Directives), and to address concerns regarding indirect and direct environmental impacts of biofuels, new and advanced biofuels using sustainable feedstock need to reach the market. To this end, the following market uptake sub-challenges should be addressed:

- Ensuring sustainable local biomass supply chains complying with sustainability criteria and quality standards;
- Ensuring development of quality and sustainability standards for biofuels and sustainable alternative fuels;
- Creating a bioenergy market for intermediate bioenergy carriers to enabling better technology competitiveness through economies of scale;
- Development of methodologies for the traceability of biomass from which biofuels are derived to distinguish the 1st from the 2nd and next generation biofuels;
- Removing barriers to widespread production and use of biogas/biomethane as one of the most sustainable fuels available today;
- Ensuring sustained public acceptance of sustainable advanced biofuels;
- Legislation specific to biofuels needs to be implemented in all Member States in a harmonised manner using the best practices of the forerunning Member States;
- All Member States must possess the necessary capacity to enact the EU legislation, while the businesses must make full use of the opportunities, which these new markets creates for them.
- New financing methods for supporting investments in innovative and established biofuel technologies must be developed.

Scope: Proposals should address one or several of the sub-challenges mentioned above. Regional specificities, socio-economic and environmental aspects from a life-cycle perspective shall be considered.

Expected impact: Increasing the share of low ILUC biofuels in the final energy consumption. Substantial and measurable reductions in the transaction costs for project developers as well as for the permitting authorities, whilst still fully addressing the needs for environmental impact assessments and public acceptance. Development of better policy, market support and financial frameworks, including at regional and local level.

E - Enabling decarbonisation of the fossil fuel-based power sector and energy intensive industry through CCS

Specific challenge: The EU is committed to an overall reduction of greenhouse gas emissions of at least 80% by 2050. Nonetheless, fossil fuels will continue to be used in Europe's power generation as

well as in other industrial processes for decades to come. Therefore, the 2050 target can only be achieved if the emissions from fossil fuel combustion are eliminated from the system. This will require the application of Carbon Capture and Storage (CCS). The assessments made in the context of the EU's Roadmap for the transition to a competitive low carbon economy in 2050 and the Energy Roadmap 2050 see CCS as an important technology contributing to decarbonisation scenarios in the EU, with 7% to 32% of power generation using CCS by 2050. The application of CCS to industrial sectors other than power (e.g. steel, cement, refining) is expected to deliver half of the global emissions reduction from CCS by 2050. In the near future, these industrial applications will open up new opportunities and avenues for CCS that can accelerate its deployment. For all applications, the demonstration of CO2 storage is of major importance. Therefore, two key challenges in the short-term for driving CCS to deployment are geological storage and the industrial application of CCS.

Scope: Proposals should address one of the respective key challenges as presented above, or a combination of them. For geological storage, focus should be on progressing technologies that already reached TRL 4-5 to TRL 6-7. Projects should enable, under real testing conditions, development and demonstration of best practices for the entire storage cycle, from site characterisation to operation, monitoring and mitigation/remediation of leakage, and including education and training. Knowledge sharing as well as early and sustained engagement of the local community is essential. Collaboration activities between EU project(s) under this topic and selected Australian project(s) endorsed by the Australian government will be encouraged. For industrial applications, focus should be either on progressing solutions that already reached TRL 4-5 to TRL 6-7, or developing next generation technologies by bringing them from TRL 2 or above to TRL 5. Knowledge sharing as well as early and sustained engagement of the local community is essential.

Expected impact: Demonstration of safe and environmentally sound CO2 storage will play a key role in optimising the safe operation of storage sites and in fine-tuning regulatory issues, in promoting confidence in CO2 storage and building public awareness of CCS. Projects should contribute to accelerating the development and deployment of CCS through an enhanced and effective cooperation in research and innovation between various stakeholders and Member States, thereby allowing a more efficient use of existing financial resources and promoting knowledge sharing. The cost- and resource-effective application of CCS in industrial processes, including bio-CCS and CO2 re-use, will expand the available options for CCS and provide a stepping stone to its wider deployment.

Instruments:

- CP, ERA-NET for pilot/demonstration projects (ERANET possibly in 2015, subject to positive feedback from MS)
- CP for projects aiming at developing next generation technologies

F – New knowledge and technologies

Specific challenge: Most of the technologies that will form the backbone of the future energy system are still under development. Several promising technologies have been developed at laboratory scale that would need to be scaled up in order to demonstrate their potential value in our future energy system. In addition, the current energy system needs to adapt to changing climatic conditions. Therefore, new knowledge and more efficient and cost-competitive energy technologies, including their supply chains, will be required for the long term. It is crucial that these new technologies show evidence of promising developments and do not represent a risk to society.

Scope: Activities will focus on accelerating the development of transformative energy technologies or enabling technologies that have meanwhile reached TRL2, and which are not covered by the other topics in this work programme. Innovative solutions and their supply chains such as materials and advanced manufacturing will also be supported as long as the application is clearly energy. In addition, activities can also focus on the early identification and clarification of those technologies

and phenomena that could lead to potential problems (for example environmental and resource efficiency aspects), or concerns to society.

Expected impact: Improved scientific understanding and guidance that enables actors concerned (e.g. policy makers, regulatory authorities, industry, interest groups representing civil society) to frame strategic choices concerning future energy technologies.

Instruments: CP, CSA

G – Supporting the development of a European Research Area in the field of Energy

(to be developed)

H – Social, environmental and economic aspects of the energy system

Specific challenge: Managing the transition to a more sustainable energy system is a challenging task, going beyond mere technological aspects. Consumer's and other actor's awareness, attitudes, risk perception, consumption behaviour and investment decisions have a strong influence on the development of our energy system and are a crucial factor in the dissemination of energy relevant technologies. We need to explore the factors triggering the behaviour of the different stakeholders, in particular the consumers. Furthermore we need to develop appropriate means to facilitate and actively stimulate the public engagement in transforming our energy system and to foster the dialogue with the public on this matter.

In order to enable rational policy decisions, the complex links, interactions and interdependencies between the different actors, the available technologies, the legal and financial instruments, and the impact of the different interventions on all levels from the individual to the whole energy system need to be better understood. Furthermore, due to the central role of energy for our societies, the choice of a particular portfolio of energy technologies, as well as the legal and financial framework conditions have far reaching impacts not only on the energy system, but also on the environment (including climate), the economy and the society. E.g. low and zero-carbon technology options for tackling climate change have an impact on land use, food security and water availability. By analysing different options and its consequences, modelling and scenario-building can contribute to provide reliable data for policy shaping.

The ambitious goals of the SET-Plan require the mobilisation of appropriate resources. This applies in particular to the availability of skilled workforce. In line with the SET-Plan Education and Training Roadmap we need to foster European cooperation in this area by building European networks, both in the university based education sector and in the vocational education and training sector.

H.1 The human factor in the energy system

This topic will be open in 2014.

Scope: Proposals should cover one or several of the following aspects:

- Awareness, perceptions, attitudes to energy relevant technologies (including nuclear) and to transition pathways to a low carbon economy of actors in the energy system, including perception of risks and benefits

- Behaviour of consumers and other actors of the energy system and factors triggering it

- Public engagement in the transformation process to a more efficient, low carbon energy system. Development of measures to launch and stimulate a dialogue with the public on energy policy and energy innovation on European level

- Development and support of a) vocational education and training networks in domains with potential shortages/domains needing new or upgrade of existing competences or b) networks of universities to address knowledge, skills and competences needs and gaps. These networks need to be in line with the scope described in the SET-Plan Education and Training Roadmap and need to involve the relevant stakeholders along the technology value chain.

Expected Impact: Support to the implementation of the SET-Plan by better understanding the complex links, interdependencies and interactions of the various actors in the energy system, their motivation, attitudes, perceptions and behaviour. Development of options and strategies to address these factors with a view to facilitate and support the transition towards a sustainable energy system.

Development of strategies and measures to enhance public engagement in this transformation process and to establish a structured dialogue with the public on this matter including Europeanization of existing national energy dialogues.

Support the provision of appropriately skilled workforce to implement the SET-Plan by identification of needs and gaps, and by improving and accelerating the existing education and training activities in the vocational and in the university sector.

Instruments: CP, CSA

H.2 Modelling the energy system, its transformation and impacts

This topic will be open in 2015.

Scope: Proposals should cover one or several of the following aspects:

- Life cycle analysis and comparative assessment of the impacts and the sustainability performance of energy technologies. Comparative assessment of transformation paths towards a sustainable energy system and the related impacts on environment (including climate), society and economy.

- Development of tools and methodologies for integrating agriculture, forestry, climate change impacts and adaptation with climate-energy-economic models and land-use models, using a multi-disciplinary approach. In particular, to investigate the potential role, contribution and limits of mitigation options, such as bioenergy technologies, bioenergy with CCS and energy and resource efficiency in future mitigation pathways

- Analysis of policies, policy instruments, priority setting processes and governance models to promote the transition towards a sustainable energy system, including analysis of social, environmental and economic impacts of energy (technology) policy decisions.

Expected Impact: Support to the scientific underpinning for the implementation of the Energy 2050 Roadmap and the SET-Plan by strengthening the knowledge base for decision-making concerning feasibility, effectiveness, costs and impacts of energy policy measures and options as well as climate change response measures. Development of new or refinement of existing modelling tools to assist policy makers in identifying and analysing strategies for a transition to an efficient low carbon energy system.

Instruments: CP, CSA

Input from Challenge 5 – still to be discussed how best to be integrated in topic H.2

The economics of climate change mitigation

[Topic to be opened in 2014]

Specific challenge: To respond effectively to climate change, radical transformations are needed to enable the transition to a low-carbon society, at the national, regional and global levels. The EU intends to reduce greenhouse gas emissions by 20 % below 1990 levels by 2020, with a further reduction to 80-95 % by 2050, and the transformation of the energy sector is going to play an important role to meet these objectives. Decision-making processes require robust estimates of the costs and benefits, as well as risks and opportunities associated with different mitigation pathways against a background of uncertainty about the future climate and its impacts. In order to be effective and socially accepted, mitigation policies will have to carefully consider short-term and long-term impacts on economic growth and social cohesion.

Scope: Research will promote a comprehensive, state-of-the-art economic assessment of climate change impacts and response strategies aimed at quantifying more accurately the costs, benefits and risks of different transitional changes in the energy sector and beyond, including impacts on economic growth, job creation and social cohesion. Research will be applied at global scale with a focus on Europe. Issues related to governance and mainstreaming of climate change mitigation options across multiple scales and sectors will also be investigated. In addition, actions will generate tools and methodologies in support of evidence-based decision making and will facilitate technological, institutional and socio-economic innovation by improving the links between research and application and between entrepreneurs, end-users, researchers and knowledge institutions.

Expected impact: Support the achievement of the Europe 2020 strategy for a smart, sustainable and inclusive growth and provide the scientific underpinning for the implementation and review of the Roadmap for moving to a low-carbon economy by 2050. Create a framework for supporting high-impact research aimed at identifying, analysing and demonstrating effective, low-emission strategies that are required to facilitate EU's transition to a competitive, resource efficient and climate change

resilient economy by 2050. Contribute to major international scientific assessments (e.g. IPCC) and inform international climate change negotiations (e.g. UNFCCC).

III Focus area Smart Cities and Communities

Draft by DG ENER – to be consulted

The proposed actions in this focus area will run for two years

80% of Europe final energy is consumed in and around cities .....

The European Innovation Partnership on Smart Cities and Communities (SCC) aims at accelerating the deployment of innovative technologies, organisational and economic solutions to significantly increase resource and energy efficiency, improve the sustainability of urban transport and drastically reduce greenhouse gas emissions in urban areas. The SCC is an industry-led initiative that is tailor-made to correspond to the intended intervention at the level of cities and communities, and to the complexity of action at the interface of the three sectors.

The first step to implement the SCC is the development of a Strategic Implementation Plan expected to be finalised by autumn 2013. The Plan is developed together with the SCC High Level Group and their sherpa's formed mainly by industries and cities. It identifies the priority areas of actions and the common levers across them, indicators and target-setting and a supportive framework for the subsequent full-scale roll-out of innovative systems and solutions in Europe's cities and communities (Figure 1)

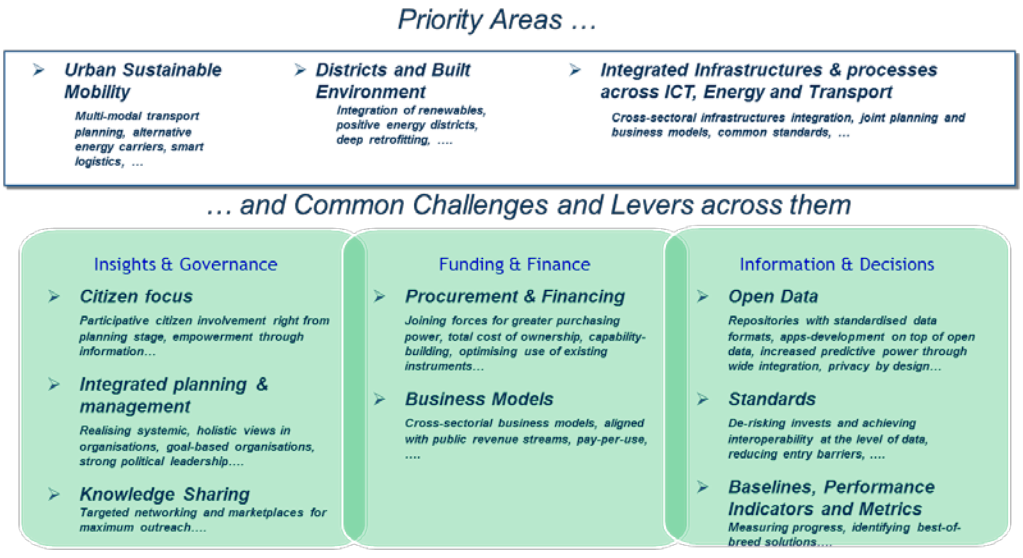

Figure 1: Main priority areas for Smart Cities and Communities and common challenges and levers

A- Initialising the process for deploying replicable solutions for Smart Cities and Communities at the intersection of energy , transport, ICT through lighthouse projects

Specific Challenge:

80% of Europe final energy is consumed in and around cities. The EU policy and regulatory framework in the energy, transport and ICT supports the development of sectoral solutions. However their implementation in real environments such as urban ones should be accelerated while taking into account local specificities. The key challenges for Smart Cities and Communities are to significantly increase energy efficiency of districts of buildings and resource efficiency especially through the use of renewables, improve the sustainability of urban transport and drastically reduce greenhouse gas emissions in urban areas within economically acceptable conditions while ensuring for citizens better life conditions: lower energy bills, swifter transport, jobs creation etc.

Scope:

To identify, develop and deploy replicable solutions at the intersection of energy, transport, and ICT through partnerships between municipalities and industries with industrial .

These solutions at the intersection of the three sectors will have a system approach and are still facing first mover risk. These will be the lighthouse projects as identified by the Communication on Smart Cities and Communities.

These projects will target primarily large scale demonstration of SCC concepts in city context where existing technologies or very near to market technologies (TRL 7 and more) will be integrated in an innovative way.

The call covers the 2014-2015 period. The projects should address the following main areas in …….(which share?):

- *(nearly zero?) energy districts* through for example integration and management of local renewable, deep retrofitting or new buildings and use of sustainable materials , reduction of mobility demand , ICT solutions for design and operation of districts with different building typologies, increased the efficiency of heating and cooling supply etc.

  The aim is to get the best optimised solutions which have a shorter term of returns of investments and lower the energy bills for customers

- *Integrated infrastructures and processes across Energy , ICT and Transport*
  Integrate infrastructure across the sectors ICT, energy, transport to deliver on multiple uses. This might imply exploitation of synergies between requirements for smart grids, broadband infrastructures
- *Urban sustainable mobility* through the optimisation of energy and fuelling infrastructure for the operation of vehicle fleets powered by alternative energy carriers for public and private transport

The proposed projects should address in addition the areas presented above solutions for setting-up the *appropriate external environment* for these solutions to be exploited commercially. This includes: optimising policy and regulatory frameworks; open, consistent data and performance measurements; citizens' engagement and empowerment; dissemination and unlocking the market potentials worldwide.

Consortia should include both *industry and city/consumer* organisations from *at least 2 medium/large cities and communities*. In addition proposals must include a list of "at least *two follower cities*" i.e. cities willing to contribute to the process because they commit to replicate the solution at the end of the project. The follower cities should aim at improving their energy

performance or the share of use of renewables (eg. 60% reduction of primary energy for buildings, X % RES use for electricity as well as for heating and cooling°

All *activities shall be part of ambitious urban planning*. For lighthouse cities these plans have to be finished (e.g. the sustainable energy plans, compiled for the Covenant of Mayors in combination with project plans committed to under the Green Digital Charter and positively evaluated by JRC) . These plans shall be submitted with the proposal. The urban planning shall integrate buildings planning and transport/mobility planning; additional issues may be addressed as well if relevant for the city.

Projects should demonstrate *attractive business plans based on already existing city planning*, that allow large scale replication of fast economic recovery in cities of varying degrees of economic conditions (from very poor to very rich), varying sizes but in any case significant urban centres[36]and varying climatic conditions.

The industrial partners and municipality authorities should commit to replicate successful demonstration in their own and other cities, notably their 'follower cities'; the replication plans are compulsory and are part of the evaluation.

Additionally the cities in the consortium have to *have secured an overwhelming majority of the required funding* from other sources, preferably private ones, but also other EU funding sources (cohesion or regional funds for example), national or regional funding. The proposal budget would thus be limited to a contribution of around 10-15% of the overall funding needed.

But besides economic sustainability proposals must also commit to scientific and technical requirements in support to reliability. These are:

- Clear commitment from the consortium to the transferability of solutions to other cities, open standards and interoperability of systems.
- Clear commitment for the consortium to cooperate to the fullest extent with accompanying measures as well as their 'follower cities'
- Interoperability of solutions, i.e. adaptability of solutions to new user requirements and technological change as well as avoidance of entry barriers or vendor lock-in through promoting common meta-data structures and interoperable (open) interfaces instead of proprietary ones;
- Open and consistent data, i.e. making relevant data as widely available as possible – including to third parties for the purpose of applications development – whilst using common, transparent measurement and data collection standards to ensure meaningfulness and comparability of performance/outcome measurements
- Common data collection, measurement and disclosure methodology, in order to facilitate a common footprint calculation methodology and other metrics (especially for energy saving; CO2 reductions, financial savings, number of jobs created, environmental impact etc.)

Expected Impact Large scale economic investments with the repayment of implementation costs in acceptable time lines (according to the banks). Reduce the energy bills for all actors and especially for all citizens and for public authorities, while increasing the share of renewables, of energy efficiency and increasing mobility efficiency with lower emissions of pollutants and CO2. Increase the efficiency

[36]This condition is to be interpreted flexibly, but a guiding figure for the larger MS would be around 250.000 inhabitants.

of transport system and lower the cost for utility services. Increase quality of life, create local jobs (that cannot be delocalised) in cities, increase air quality, decarbonise the energy system while making it more secure and stable; create strong links between the economically strong and weak Member States through active cooperation (with benefits for all)

Instruments: CP

B-Enhancing the roll out Smart Cities and Communities solutions through common levers

Specific Challenge

Ensure a broad impact for the roll-out of the solutions tested by Smart Cities and Communities lighthouse projects through support actions accompany the lighthouse projects

Scope:

This process should target a large number of cities and make use of the existing networks such as the Smart Cities Stakeholder Platform, Green Digital Charter etc.

The projects will support actions which are tackling one or multiple of the following priority areas:

- Citizen insight and engagement and information , integrated planning and management which should overcome the thinking in sectorial or administrative silos ,
- Ensuring funding and financing through business models reflecting the solutions integrating applications from 3 sectors , modernised public procurement to better leverage the funding instruments
- Open data for planning as well as for development of new applications, open standards for which the interoperability is ensured and performance indicators

[These measures are proposed to be supported by DG CNECT and MOVE in consultation with DG ENER]

B1) Developing a framework for common, transparent data collection and performance measurement to allow comparability between solutions and best-practice identification including the development of new standards (DG CNECT +DG MOVE?)

Work has to build on results from CONCERTO as well as the ICT-PSP pilots and could embrace other initiatives as the Green Button of the DoE in the US and 'The Social Energy Collective' in the Netherlands. In addition these common data collection standards should allow for economies of scale (and scope) with 3rd-party applications developers.

Performance measurements should consider the solution's impact on GHG reductions, improved energy efficiency and increased integration of RES into a city's energy mix. Moreover quantification of economic, and possibly even social, performance of the solution at hand has to be included to evaluate the potential value for money and consumer engagement. In short, key performance indicators are to be developed at least along the environmental and economic dimensions of sustainability. This work has to build on existing initiatives, notably the ITU.

Expected impact:

Involvement of society in data management processes of cities according to the value of information and improvement of level of trust of citizens. Stimulate market for data-enabled services/solutions (supporting entrepreneurship). Improved territorial knowledge for smart city planning.

Instruments: CP

B2) Set-up of European thematic networks of existing local partnerships (see DG MOVE proposal)

B3) De- risking the Smart cities and communities lighthouse projects for fast roll-out (see DG MOVE proposal)

B4) Developing tools to stimulate efficient replication of smart cities and communities solutions (see DG MOVE proposal)

B5) Development of networks of public procurers (see DG MOVE proposal)

B6) Challenge prize competition: smart solutions for better cities and communities (see DG MOVE proposal)

Contribution from Challenge 5

2015: Improving the air quality of European cities

Specific challenge: The majority of the European population lives in urban environments where citizens are frequently exposed to levels of air pollutants exceeding the limit values established by the European directives. The sources of pollution in cities are linked to urban activities such as transport and heating and to other activities such as energy production, industrial activity and agriculture. In addition, trans-boundary pollution represents an important contribution to air pollution in European cities. Air pollution and climate change are strongly connected and there is therefore a need to consider both environmental and climate considerations when designing emission abatement strategies.

Scope: Development of technological options and strategies to fight against air pollution and climate change ensuring the involvement of the main sectors transport, energy and agriculture.

Research will include the development and application of tools in support of air quality governance in the EU Member States and regions, integrated assessment tools for the design of adequate abatement strategies taking into account the specific circumstances of the different regions of Europe and the development and application of source apportionment advanced techniques to determine the origin of air pollution. Actions should foster the integration of assessment and monitoring tools with technological options and strategies to reduce the negative effects of air pollution on human health and climate change.

Expected impact: Improved air quality in EU cities. Reduction of the negative effects on health and climate together with the costs associated with air pollution in Europe. Increased competitiveness of European economy. Rapid market deployment of technological and non-technological innovative solutions. Societal transformation to a green and low carbon economy.

Proposed instrument: Collaborative Project (100%) – Two stage

Annex 1

Technology Readiness Level

TRL 0: Idea
Unproven idea or concept where no peer reviewed analysis or testing has been performed.

TRL 1: Basic Research
The initial scientific research has been completed. The basic principles of the idea have been qualitatively postulated and observed. The process outlines have been identified. No experimental proof and detailed analysis are yet available

TRL 2: Technology formulation
The technology concept, its application and its implementation have been formulated. The development roadmap is outlined. Studies and small experiments provide a "proof of concept" for the technology concepts.

TRL 3: Applied Research
The first laboratory experiments have been completed. The concept and the processes have been proven at laboratory scale, table-top experiments. Potential of materials and up scaling issues have been identified.

TRL 4: Small Scale Prototype Development Unit (PDU)
The components of the technology have been identified. A PDU has been built a laboratory and controlled environment. Operations have provided data to identify potential up scaling and operational issues. Measurements validate analytical predictions of the separate elements of the technology. Simulation of the processes has been validated. Preliminary LCA and economy assessment models have been developed.

TRL 5: Large Scale Prototype Development Unit
The technology has been qualified through testing in intended environment, simulated or actual. The new hardware is ready for first use. Process modelling (technical and economic) is refined. LCA and economy assessment models have been validated. Where it is relevant for further up scaling the following issues have been identified: Health & safety, environmental constraints, regulation, and resources availability.

TRL 6: Prototype System
The components and the process have been up scaled to prove the industrial potential and its integration within the energy system. Hardware has been modified and up scaled. Most of the issues identified earlier have been resolved. Full commercial scale system has been identified and modelled. LCA and economic assessments have been refined.

TRL 7: Demonstration System
The technology has been proven to work and operate a pre-commercial scale. Final operational and manufacturing issues have been identified. Minor technology issues have been solved. LCA and economic assessments have been refined.

TRL 8: First of the kind commercial System
The technology has been proven to work at a commercial level through a full scale application. All operational and manufacturing issues have been solved.

TRL 9: Full commercial application
The technology has been fully developed and is commercially available for any consumers.