GC.SST.2012.1-2. Smart infrastructures and innovative services for electric vehicles in the urban grid and road environment

Contents and scope: With the advent of new electrified vehicles (EV) for application in the urban environment, a significant need exists to drastically improve the convenience and sustainability of car-based mobility. In particular, research should focus on the development of smart infrastructures, and innovative solutions which will permit full EV integration in the urban road systems while facilitating evolution in customer acceptance.

Within this context, activities will focus on:

- Investigation into alternative, innovative solutions for recharging stationary EV minimising risks deriving from vandalism (e.g. inductive charging).
- Study of on-route charging technologies which would increase the vehicle range while reducing the size of on-board energy storage systems.
- Development of innovative location based Demand Management systems by means of intelligent systems integrated in both EV and charging stations that can communicate and manage adaptively the charging process autonomously, if necessary, or taking into account the priorities of the user-grid.
- Development of data security standards and crypto measures to ensure privacy protection.
- Intelligent coordinated systems (micro-grids) that balance the simultaneous demand of a given geographically location (multiple, slow and fast charging EV combined with other electric consumers) with policies that prioritise emergencies, security of the net, minimal autonomy for all the elements, etc., and that can also coordinate with neighbouring micro-grids and upper level electric grid control.

Projects may address these issues by technology development and demonstration from a technological perspective while focusing on business case analyses and impact studies demonstrating the feasibility and viability of the proposed solutions across a wide-range of operational situations.

The work should take into account projects running under the TEN-T programme on going research projects (e.g. ELVIRE, SmartV2G and PowerUP) and those resulting from the call 'GC-ICT-2011.6.8 ICT for fully electric vehicles dealing with vehicle to grid issues' and 'ICT- PSP-2011.1.3. Smart Connected Electro-Mobility'. It should also take into account the standards being developed by the European standardisation organisations (CEN-CENELEC and ETSI TC ITS) in this area.

This topic is complementary to the Topic Energy.2012.8.8.1: Strategic sustainable planning and screening of city plans (FP7-ENERGY-SMARTCITIES-2012), which supports the implementation of the Smart Cities and Communities Initiative[52] of the SET-Plan. In this context, the European Commission may ask the projects, during the negotiation, to establish strong links, where appropriate, with the projects funded under the topic Energy.2012.8.8.1 as well as with other relevant R&D projects at EU, national or regional level.

[52] http://setis.ec.europa.eu/about-setis/technology-roadmap/european-initiative-on-smart-cities

Funding scheme: Collaborative project – small or medium-scale focused research projects

Expected impact: The proposed solutions should demonstrate the enhanced attractiveness of electric mobility, both in terms of convenience and reduced total cost of ownership, while showing how they ensure a correct relationship with the electric supply network and its requirements as well as the economics of the needed investments.

GC.SST.2012.1-3. European strategy for rare materials and their possible substitution

Possible limitations of lithium for advanced energy storage systems have recently been discussed at length, and will be subject to research on battery cells. Mass production of electric vehicles however will also strengthen the demand for some other essential materials that are not abundant, or of limited supply, for European companies, primarily for electric and electronic components. Examples include rare earths, such as neodymium, and noble or other scarce metals. Essential for motors, neodymium-iron-boron alloys are the strongest permanent magnets available on earth. The reserves of neodymium are about 8 million tonnes. However, the world production is about 7 000 tonnes per year, 97% of which being concentrated in China. Also the demand for more common metals with appropriate conductive and electrolytic capabilities will increase: cobalt and nickel are used as electrode materials in storage cells, or gold, silver, palladium for any kind of electronic circuits, indium used in transparent electrodes of liquid crystal displays and touch screens, etc.

Content and scope: The development of new technologies for the electric vehicle needs to be complemented by developing a European strategy for rare materials and their possible substitution. The Support Action will focus on the following:

- Prediction of the long term needs of the European electric vehicle industry for strategic materials.
- Access to alternative supply.
- Alternative materials and technologies for electric traction and energy storage.
- Options to replace rare earth materials by new electro magnetic systems (motors, driver electronics, sensors, etc.).
- Recycling and reuse options.
- Economic, social and environmental risks of shortages.
- Political situation and development of solutions at a global scale.
- Assessment of the total landed cost associated with the use of new materials.
- Options for ensuring sufficient resilience for a given level of efficiency of the supply chain of new materials.

The above aspects should be covered only to the extent necessary in relation to existing EU level initiatives in order to ensure complementarity and to minimise duplication. *During negotiations, complementarity with work performed in response to topic 'NMP.2012.4.1-4. Substitution of critical raw materials: networking, specifying R&D needs and priorities' will be ensured.*

Funding scheme: Coordination and Support Action (supporting actions).

Expected impact: A small and well focussed project within the European Green Cars Initiative that includes input from all relevant stakeholders which will deliver a materials roadmap and recommendations for strategic plans to solve the specific long-term materials issues for the Electric Vehicles sector.

GC.SST.2012.1-4. Modelling and testing for improved safety of alternatively-powered vehicles

Contents and scope: Modelling tools and testing procedures have a fundamental role to play to ensure that future Electric Vehicles not only respect current and future safety requirements, but balance this with performance and reliability on one hand, and light weight, production feasibility and cost on the other.

Activities will focus on the development and experimental validation of numerical simulation and physical testing methodologies, and on the application of such tools in order to:

- Investigate solutions for improving the crashworthiness and performance of future generation alternatively-powered vehicles and their constituent components and sub-systems which may be critical from a safety and reliability perspective (e.g. batteries and high-pressure storage tanks). In particular, to improve pedestrian protection and vehicle-to-vehicle compatibility in case of crash with larger and heavier opponents and keep into account slightly different angles of impact to validate performance beyond EURO-NCAP tests.
- Develop evaluation criteria with regard to injury prevention of occupants of electrical and lightweight vehicles.
- Analyse the weight saving potentials of new safety oriented structural designs.
- Verify technological feasibility and economic viability of the solutions proposed.

Implementation and management: To achieve practical demonstration and validation, coordination or ex-ante clustering with projects in topic GC.SST.2012.1-1 (Innovative advanced lightweight materials for the next generation of environmentally-friendly electric vehicles) would be preferred.

Funding scheme: Collaborative project – small or medium-scale focused research projects

Expected impact: Projects should demonstrate that the advanced modelling and testing tools can be used to ensure improved performance in terms of combined injury prevention, safety in asymmetric crashes (in terms of height and weight) and low environmental impact of next generation alternatively-powered vehicles at an acceptable cost, while fostering the constitution of interdisciplinary consortia (academia, research and testing centres, supply industry, vehicle manufacturers, SMEs, etc.).

GC.SST.2012.1-5. Integration and optimization of range extenders on Electric Vehicles

Although Electric Vehicles are able to cover almost 80% of average travel needs, the residual need of many vehicle users for occasional longer distance travel means that range-extended

electrified vehicles provide an important path towards increasing the market penetration and customer acceptance of electrified vehicles by relieving the so-called "range anxiety".

Contents and scope: The focus of the research will be on developing and optimizing the concept of the fully-integrated, range-extended, electrified light duty vehicle which will offer both significantly reduced impact on the environment and long range capability. The aim is to optimise the integration and control of the electrified vehicles equipped with a range-extender while ensuring that the range in pure-electric mode, typically charged using the grid, is sufficient to cover average daily mileage.

The activities should address the following issues:

- Optimisation of the ICE used as the range extender and of its after treatment system.
- Impact on optimal battery capacity.
- Advanced control strategies.
- Modularisation.
- Performance, safety, recyclability and cost.
- Characterisation, standardisation and synergies with other applications.

The activities should not focus on the development of the range-extender engine itself, nor of electric machines, which were already addressed in previous calls.

Funding scheme: Collaborative project – small or medium-scale focused research projects

Expected impact: With respect to the 2020 Emission Regulation targets for urban cars and low cost Near Zero Emission Vehicle, the expected impact has to be motivated in terms of:

- Overall performance, particularly in terms of the expected CO_2 emissions reduction of the range-extended EV.
- Safety, recyclability and life-cycle sustainability.
- Helping European automotive industry to maintain world-class status.

GC.SST.2012.1-6. Advanced energy simulation and testing for Fully Electric Vehicles (FEV)

Contents and scope: Advanced modelling tools and testing procedures (from one-dimension to three dimensional approaches) have a fundamental role to play in optimising during the earliest project phases both the energy dimensioning of FEVs and their “energy management strategies”. They reduce project development lead-time and are used to build-up requirements for subsystems and their related control units. Research will focus on the development and validation of numerical simulation, virtual prototyping and physical testing and on the application and standardisation of such tools in order to:

- Investigate solutions for improving the efficiency and performance of future generation EV and their constituent components and sub-systems that may be critical from the energy efficiency point of view. The development of these systems is however excluded.

- Assess the effect of different subsystems, solutions in terms of energy efficiency and related increase of autonomy, on different specific real life driving cycles, that will take into account traffic constraints, road slope evolution, etc.
- Verify the technological feasibility and economic viability of the advanced solutions proposed.

Implementation and management: Projects should have interdisciplinary consortia (academia, research and testing centres, supply industry, vehicle manufacturers, SMEs, etc.), and work should be complementary to projects funded under previous calls of the EGCI, national or ERANET+ schemes.

Funding scheme: Collaborative project – small or medium-scale focused research projects

Expected impact:

- Projects should demonstrate that the advanced modelling and testing tools can be used to ensure improved energy efficiency and performances of the next generation EV and HEV by taking into account all the real constraints, at an acceptable and assessed cost.
- Reduction of testing time for life cycle testing up to 50% using new test methodologies.
- New test methods for identification of second life applications together with battery qualification & testing for these applications.
- Real world testing of batteries on the test bench instead of field testing: combination of mechanical, thermal and electrical load.
- Reduced development time and improvement loops for battery systems by combined testing and simulation methods.
- Increased reliability and durability as well as reduced validation time.

GC.SST.2012.1-7. Demonstration of Urban freight Electric Vehicles for clean city logistics

Content and scope: The objective of the project is to demonstrate logistic solutions with electric vehicle applications to optimise urban logistics efficiency to improve transport flow management and reduce environmental impact in urban areas. Fleets are expected to include autonomous road vehicles with differing drive-train technologies, provided that electricity for the electric drive can be taken from the grid. The project time-frame should consider latest technological developments in EU-funded or national and regional programs. Fuel cell electric vehicles are not included here, as they are covered by the Fuel Cells and Hydrogen JTI. The project will address the following issues:

- Assessment of the state of the art of city freight movements and development of new governance models, based on real, and close, co-operation between public bodies, retailers and distributors. These can be used in order to deploy sustainable policies able to assure environmental improvements with economical sustainability.
- Demonstration of urban and logistics solutions with electric vehicle fleets with the aim to validate the feasibility of logistics solutions on the basis of electric vehicle applications.

- Demonstration of required ICT for final users and fleet managers.
- Assessment of public acceptance of demonstrated new delivery systems.
- Assessment of the impact on urban transport and delivery market such as size of deliveries, frequencies and vehicle types.
- Assessment of the impact on energy, environment, overall efficiency and cost.

Implementation and management: A typical consortium will include cities, logistics fleet operators, vehicles and equipment manufacturers, utilities, research centres and universities. The project should have a predominant demonstration component. The marginal cost associated with the innovation element compared to state-of-the-art vehicles will be considered as eligible cost. This demonstration project should take into account the first results of projects under topic GC.SST.2011.7-5. (Urban – interurban shipments).

Funding scheme: Collaborative project

Expected impact:

- Optimisation of urban logistics efficiency to improve transport flow management and reduce environmental impacts (noise, CO_2 emissions and pollutants) as well as typical congestion in urban areas.
- Contribute to the clarification of the safety, economic and technical viability of electrical vehicles for clean city logistics applications.
- Input for further deployment of clean logistics systems technologies through the European Investment Bank instruments.

Area 7.2.7.2. Research for heavy duty vehicles for medium and long distance road transport

Research will primarily concentrate on increasing the efficiency of vehicles by energy management, aerodynamics and low rolling resistance, as well as on eco-driving and innovative truck designs. A demonstration action on heavy duty vehicles running with liquefied methane is also included.

GC.SST.2012.2-1. Extreme low rolling resistance tyres

Contents and scope: The objective of research is to develop an innovative tyre concept that will reduce the rolling resistance without compromising performance, not; safety and cost (e.g. wet/low temperature performance, mileage, reliability, noise) for both steering and trailer tyres. Load capacity should be maintained or improved. Interaction with the road surface should be considered and appropriate parameters for maximum effectiveness (rolling resistance, braking and road holding, abrasion of tyre and surface, etc.) and robustness of the designed tyre for good performance on the widest possible variety of EU pavements should be defined in cooperation with infrastructure stakeholders.

The activities will address the following aspects:

- Design of new tread pattern for reduced rolling resistance.