



SP1 – Priority 6-1

6.1 Sustainable energy systems

Work Programme

**Revision 4 for the TREN-4 Call
June 2005**

6.1 Sustainable Energy Systems

Table of Contents

6.1.1. INTRODUCTION	2
6.1.2. OBJECTIVES, STRUCTURE AND OVERALL APPROACH	4
6.1.2.1. IMPLEMENTATION PRINCIPLES	4
6.1.2.2. HORIZONTAL ASPECTS TO BE TAKEN INTO CONSIDERATION BY PROPOSERS	4
6.1.2.3. MODALITIES FOR IMPLEMENTATION	5
6.1.3. TECHNICAL CONTENT	8
6.1.3.1. RESEARCH ACTIVITIES HAVING AN IMPACT IN THE SHORT AND MEDIUM TERM	8
6.1.3.1.1. <i>Clean energy, in particular renewable energy sources and their integration in the energy system, including storage, distribution and use</i>	8
6.1.3.1.1.1. Cost-effective supply of renewable energies	8
6.1.3.1.1.2. Large-scale integration of renewable energy sources into energy supplies	9
6.1.3.1.2. <i>Energy savings and energy efficiency, including those to be achieved through the use of renewable raw materials</i>	11
6.1.3.1.2.1. Eco-buildings.....	11
6.1.3.1.2.2. Polygeneration	12
6.1.3.1.3. <i>Alternative motor fuels</i>	14
6.1.3.1.4. <i>Priorities for 3rd SMT Call for Proposals (2005)</i>	16
6.1.3.1.5. <i>Priorities for 4th SMT Call for Proposals (2006)</i>	22
6.1.3.2. RESEARCH ACTIVITIES HAVING AN IMPACT IN THE MEDIUM AND LONGER TERM	30
6.1.3.2.1. <i>Fuel cells, including their applications</i>	31
6.1.3.2.2. <i>New technologies for energy carriers/transport and storage, in particular hydrogen</i> ..	34
6.1.3.2.3. <i>New and advanced concepts in renewable energy technologies</i>	39
6.1.3.2.4. <i>Capture and sequestration of CO₂, associated with cleaner fossil fuel plants</i>	46
6.1.3.2.5. <i>Socio-economic tools and concepts for energy strategy</i>	48
6.1.4. LINKS TO OTHER RESEARCH TOPICS AND TECHNICAL CONTENT OF JOINT CALLS 51	
6.1.4.1. LINKS TO OTHER RESEARCH TOPICS - GENERAL	51
6.1.4.2. TECHNICAL CONTENT OF JOINT CALLS IN THE FIELD OF HYDROGEN AND FUEL CELLS	52
6.1.4.2.1. <i>Rationale</i>	52
6.1.4.2.2. <i>Joint Call on component development and systems integration of hydrogen and fuel cells for transport and other applications</i>	53
6.1.4.2.2.1. Fuel Cell and Hybrid Vehicle Development.....	53
6.1.4.2.2.2. Integration of Fuel Cell systems and fuel processors for aeronautics, waterborne and other transport applications.....	55
6.1.4.2.3. <i>Joint Call for the support of the co-ordination, assessment and monitoring of research to contribute to the definition phase for a hydrogen communities initiative</i>	57
6.1.4.2.4. <i>Co-ordinated Calls on materials development and processes for fuel cells and sustainable hydrogen production and storage technologies</i>	59
6.1.5. IMPLEMENTATION PLAN AND RELATED ISSUES	60
6.1.5.1. INDICATIVE TIMETABLE AND BUDGET ATTRIBUTION (ROADMAP)	60
6.1.5.2. EVALUATION CRITERIA	60
6.1.5.3. INFORMATION DAYS.....	60
6.1.6. CALL INFORMATION	63
6.1.6.1. CONTENT OF CALL 2005.SM	63
6.1.6.2. CONTENT OF CALL 2006.SM	66
6.1.6.3. CONTENT OF JOINT CALL (1).....	70
6.1.6.4. CONTENT OF JOINT CALL (2).....	72
6.1.6.5. CONTENT OF CALL 2005.ML	74

6.1.1. Introduction

Europe's energy system demonstrates unsustainable patterns of development characterised by growing dependence on imported fossil fuels, rising energy demand and growing CO₂ emissions. These unsustainable patterns are exacerbated in key sectors like buildings and transport that are intimately linked with the quality of life of European citizens. The challenge is to alleviate and reverse these adverse trends to achieve a truly sustainable energy system, while preserving the equilibrium of ecosystems and encouraging economic development.

The strategic and policy objectives of this programme of research¹ into sustainable energy systems include reducing greenhouse gases and pollutant emissions (Kyoto), increasing the security of energy supplies, improving energy efficiency and increasing the use of renewable energy, as well as enhancing the competitiveness of European industry and improving quality of life both within the EU and globally (Johannesburg follow-up)².

In addressing these objectives through this Work Programme, a clear differentiation is made between research activities having the potential for exploitation in the short to medium term and those which are expected to have an impact in the medium to longer term. This distinction between the short-to-medium and medium-to-long term time frames is applicable to all indirect research actions in the sustainable energy sector and it is intended that the budgetary appropriations be split equally between the two time frames.

Research activities having an impact in the short to medium term

Community research is one of the main instruments which serve to support the development and implementation of new legislative instruments and other policy measures in the field of energy and to change significantly current unsustainable patterns of development. In the short to medium term, the goal is to pave the way for the introduction of innovative and cost competitive renewable and energy efficiency technologies into the market as quickly as possible through demonstration and other research actions aiming at the market, thus supporting the future development and implementation of the EU Directives on electricity from renewable energy sources and on the energy performance of buildings, as well as the proposed Directives on cogeneration (CHP) and the establishment of regulatory and fiscal measures for the promotion of liquid biofuels.

From a programme implementation perspective the objective is to bring forward and demonstrate the next generation of cost-effective technologies at full scale. The scale of demonstration projects should allow a comprehensive life-cycle assessment under real life conditions. New integrated projects will mobilise the necessary actors and resources to create real life laboratories to investigate the optimal market penetration paths and the most sustainable alternatives. Projects will include socio-economic research into the interfaces between the new energy technologies and their markets, for example innovative policy packages, financing mechanisms and user/consumer acceptance.

Proposals addressing short-to-medium term research should comply with the following guidelines:

- Deliver results, which will accelerate the market penetration of innovative energy technologies with a particular emphasis on 2010 energy policy objectives.

¹ The word "research" used in the general sense refers to research, technological development and demonstration activities.

² The research will also contribute to the ambitious objectives of the EU Environmental Technologies Action Plan (ETAP), which aims to facilitate the development and uptake of environmentally sound technologies (COM/2004/38 of 28.01.2004).

- Consist mainly of integrated demonstration actions with an optional research component of up to about 20%, including, where appropriate, pre-normative research and energy technology integration.
- Include a dissemination component (an innovation related activity).
- The risks to be addressed are mainly technological and might include market related and financial issues.
- Demonstrate reductions in the costs associated with implementation of new technologies and/or demonstrate how innovative technological solutions can be integrated under full-scale operating conditions.
- Provide inputs for the future development of energy policy and legislation, including the improvement of existing regulatory measures, whilst serving EU research and related policies.

The research components of short to medium term projects should adopt a multidisciplinary approach, including, where appropriate, socio-economic research on the future policy, market and end user impacts of the innovative energy technologies involved, in addition to technology focused research.

International co-operation is particularly welcome.³

Research activities having an impact in the medium to long term

The medium to long term research objective is to develop new and renewable energy sources, and new carriers such as hydrogen which are both affordable and clean and which can be well integrated into a future sustainable energy supply both for stationary and transport applications.

The future large-scale development of these technologies will depend on significant improvements in their cost and other aspects of competitiveness against conventional energy sources. The overall socio-economic and institutional context in which they are deployed will be covered in a synergetic approach, which takes account of energy and other related policies.

Proposals addressing medium-to-long term research should:

- Deliver results which could be widely exploited commercially or otherwise, with a time horizon generally beyond 2010; further development and particularly demonstration type actions may be necessary before technologies are ready for full-scale commercial use.
- Consist mainly of research and development activities (including pre-normative and socio-economic research and the validation of technical and economic feasibility in pilot plants and prototypes), research-related networking activities, training and dissemination activities. The main risks to be addressed are scientific and technological rather than market and financial.
- Lead to the generation, exploitation and dissemination of new knowledge and contribute to the implementation of EU research policy, whilst also contributing to the development of energy and associated policies.

³ International co-operation addresses the participation of organisations from “third countries”, i.e. States that are neither a Member State nor an associated State. Third countries with an S&T agreement with the EU: Argentina, Australia, Brazil, Canada, China, Chile, Egypt, India, Japan, Kazakhstan, Mexico, Morocco, Russia, South Africa, Tunisia, Ukraine.

The research activities to be funded in the medium-to-long term should address not only the technological aspects, but also incorporate in a multidisciplinary approach the socio-economic research necessary to overcome the non-technical obstacles for the penetration into markets of the technologies concerned.

6.1.2. Objectives, Structure and Overall Approach

6.1.2.1. Implementation Principles

The Sixth Framework Programme (FP6) differs significantly from previous ones. A key difference is its role in contributing to the creation of the European Research Area (ERA) in sustainable energy systems. This means that the aim is to assemble a *critical mass of resources*, to *integrate* research efforts by pulling them together and to make this research more *coherent* on the European scale.

Focus on priorities – to ensure concentration of effort and maximise the impact of the Programme, it is intended to focus research on a limited number of priority topics. The response to invitations to submit Expressions of Interest, together with other inputs on the strategic importance of research in certain key fields, has been used to define the content of the Work Programme and, particularly, to focus the Calls for Proposals. However, it is strongly emphasised that the previous submission of an EoI will have no bearing on the evaluation of any proposal in subsequent calls for proposals.

Priority use of the new instruments – the Commission intends to use Integrated Projects and Networks of Excellence as a priority from the start of FP6, depending upon the quality of proposals received and their relevance to the objectives of the Programme, whilst maintaining the use of the other types of instrument – Specific Targeted Research Projects, Co-ordination Actions and Specific Support Actions.

Selection of topics – approximately € 890 million is available for RTD on sustainable energy systems, spread over the four years of the Programme (2003-2006). Calls for Proposals will thus need to be selective as it will not be possible to fund all potential topics of interest within the priority areas identified in the Specific Programme. Furthermore, there may be competition between proposals both across and within research topic areas in each call, which may result in some topics not being supported.

6.1.2.2. Horizontal aspects to be taken into consideration by proposers

Proposals should follow the general guidelines for submission (see FP6 InfoPack). Important general information on cross-cutting issues is mentioned in the General Introduction to the overall Work Programme, complemented by the specific aspects related to energy below:

International scientific co-operation: global international co-operation will be encouraged for research activities addressing the environmental consequences of energy policies, energy supply inter-dependency, and cross border energy and environmental issues. The focus will be on activities of mutual concern and synergy with other international programmes and initiatives such as those of the International Energy Agency. Activities will therefore be encouraged in the form of:

- initiatives aimed at securing a leading role for Europe in international research efforts on global sustainable energy issues;
- integrated bilateral co-operation activities in sustainable energy research with third countries or groups of third countries;

- participation of third country researchers and organisations in sustainable energy research projects and networks in areas of common interest.

Cross-cutting dimension in energy research: the technologies covered by this work programme are often integrated into systems combining several of them for different applications e.g. fuel cells and hydrogen, renewable energy sources in combination with reversible fuel cells and hydrogen, hydrogen production and CO₂ sequestration, advanced hybrid systems integrating fuel cells with conventional technologies etc. Such combinations can lead to important synergies and proposals developing such approaches can be envisaged. The integration of different renewable energy technologies into supply and distribution networks, together with energy demand management, is of particular interest (see section 6.1.3.1.1.2).

See also Section 6.1.3.2 for horizontal aspects relating to calls for proposals relating to the medium and longer term.

6.1.2.3. Modalities for implementation

This part of the work programme will be implemented using Integrated Projects (IP), Networks of Excellence (NoE), Specific Targeted Research Projects (STREP), Co-ordination Actions (CA) and Specific Support Actions (SSA), as indicated in the Roadmap (Table 1).

Proposals for Integrated Projects and Specific Targeted Research Projects can be for research and technological development projects, demonstration projects or a combination of the two. For research and technological development activities, STREPs should be focused on specific topics of an exploratory and/ or high-risk innovative nature.

Proposals for Co-ordination Actions should preferably be new initiatives for the networking and co-ordination of research and innovation activities in areas of interest for the programme. If successful, the outcome of such actions could, in due course, form a basis for future IPs or NoEs.

The purpose and nature of Specific Support Actions is described in the General Introduction to the overall Work Programme. They will include actions to stimulate, encourage and facilitate the participation of organisations from the candidate countries in the activities of the priority thematic areas, in particular via the Networks of Excellence and Integrated Projects.

Further information on all of the above instruments, including levels of funding, and the issues expected to be addressed in proposals are contained in the FP6 InfoPack.

In addition, where appropriate, the Commission will issue Calls for Tender for specific studies or services required to achieve the programme objectives, particularly with regard to the promotion and dissemination of results. A list of Calls for Tender planned for 2004 for the short-to-medium and medium-to-long term parts of the programme are shown in the tables below.

Calls for Tender planned for the M-L term part of the WP in 2004:

Title	Status	Budget	Expected duration
Portfolio analysis of European Community non nuclear energy RTD projects in their overall EU context	Published in OJ, ToR being sent to applicants.	Approximately 150.000 €	8 months
Comparative Study of mechanisms, results and good practices in terms of Innovation and Transfer of results of energy RTD in national and Community's programmes.	To be launched in second semester of 2004	Approximately 150.000 €	8 months

Assessing present achievements and future potential for increased co-operation between New Member States, Candidate Countries, other Associated States and the EU in energy RTD	To be launched in second semester of 2004	Approximately 30.000 €	6 months
Perspectives of cooperation between Europe and China on energy RTD; issues and recommendations.	To be launched in second semester of 2004	Approximately 35.000 €	6 months

Call for Tender planned for the S-M term part of the WP in 2005:

Title	Status	Budget	Expected duration
Promotion, dissemination, and analysis for the CONCERTO initiative	To be launched in April / May 2005	4.5M€	4 years

In addition, in its Article 9.2(a), the Rules for Participation permit the financing of “*specific support actions for the activities of the legal entities identified in the work programmes*”. Subject to the fulfilment of all applicable procedures, the Commission intends to finance the following SSA according to this Article:

SSA to be funded for the M-L part of the WP under Art 9.2(a) of the Rules for Participation:

Title and objectives	Beneficiary	Max. EC contribution	Expected duration
<p>ETSER (Emerging Thematic Strategies in Energy Research)</p> <p>To contribute through the use of the ETSO network to a better understanding of strategic issues at hand, to assess the impact of scientific and technological developments in the energy area, to validate hypotheses made by the energy communities, to steer the definition of energy research and to support policy making by:</p> <ul style="list-style-type: none"> – Researching and synthesising specific topics related to one energy field or sub field – Helping to identify possible options towards user friendly and cost effective networking of energy RTD information systems, <p>with the objective of shaping policy making in the field of sustainable energy research.</p>	JRC - IPTS	300 000 €	3 years

The Commission represents the European Community in the Implementing Agreements (hereinafter “IAs”) concluded under the framework of the International Energy Agency where it participates in activities in certain areas of energy research.

The Commission will make annual financial contributions required by its participation, up to a total amount of 420,000 €. The annual financial contributions will be paid to the entities responsible for managing the respective agreements. The table below shows only those IAs for which the financial contribution will be paid from the budget of this part of the SP1 Work Programme. It is not an exhaustive list of all of the IAs to which the Commission participates.

The Commission may participate in additional activities agreed under the IAs mentioned above or in any other existing or future IA and in any other activities of the IEA where

such participation is in the interest of the Community, in line with the objectives and priorities of the present Work Programme, and within the limits of the budgetary provisions. The table below will be updated in any future modifications of the Work Programme.

IEA Implementing Agreements financed under the Sustainable Energy Systems WP:

Implementing Agreement	Date IA signed by the European Commission	Estimated Annual EC Contribution in nominal currency	Estimated Annual EC Contribution in euro
IEA Implementing Agreement for Co-operation in the Research and Development of Wind Turbine Systems (Task XI)	Commission signature in 1996. Expires in 2008	\$ 15,000	€ 11,589
IEA Implementing Agreement for the Establishment of a Project on Solar Power and Chemical Energy Systems (SolarPaces)	Commission signature in 1998. Expires in 2006	€ 5,250	€ 5,250
IEA Implementing Agreement for a Programme of Energy Technology Systems Analysis (ETSAP)	Commission signature in 1980. Expires in 2009	€ 24,000	€ 24,000
Programme to Develop and Test Solar Heating & Cooling Systems	Commission signature in 1979. Expires in 2009	\$ 6,000	€ 4,636
IEA Implementing Agreement for a Programme of Research, Development and Demonstration on Bioenergy (Tasks 32, 33, 34, 36, 37, 39 and 41)	Commission signature in 1995. Expires in 2004(ongoing prolongation expected)	\$ 100,000	€ 77,262
IEA Geothermal Implementing Agreement (GIA)	Commission signature in 1997. Expires in: 2007	\$ 10,000	€ 7,726
IEA Implementing Agreement on Photovoltaic Power System Programme (PVPS) (Task 1)	Commission signature in 1992. Expires in 2007	\$ 7,500	€ 5,795
IEA Implementing Agreement for the establishment of IEA Coal Research	Commission signature in 1989. Expires in 2008	GBP 57,000	€ 82,885
IEA Implementing Agreement for a Co-operative Programme on Technologies Relating to Greenhouse Gases derived from Fossil Fuel Use	Commission signature in 1991. Expires in 2006	GPB 52,500	€ 76,341
IEA Implementing Agreement for a Co-operative Programme on Ocean Energy Systems	Commission signature in 2002. Expires in 2006	€ 7,000	€ 7,000

IEA Implementing Agreement for Energy and Environment Technologies Information Centres (EETIC)	Commission signature in 1998. Expires in 2005	GPB 36,000	€ 52,348
IEA Implementing Agreement for Demand Side Management (DSM)	Expires in 2008	€ 35,000	€ 35,000

6.1.3. Technical Content

The sustainable energy systems work programme will be implemented in two complementary parts – RTD activities having the potential for exploitation in the short to medium term and those which are expected to have an impact in the medium to longer term. The differing characteristic profiles of the activities expected to be supported in each part of the programme are explained in Chapter 6.1.1. Co-ordination between the two parts will be ensured.

6.1.3.1. Research activities having an impact in the short and medium term

In accordance with the principle of focusing research effort, the following sections 6.1.3.1.1 to 6.1.3.1.3 describe the main objectives to be achieved and the strategically important areas in which research should be concentrated. These sections are followed by sections 6.1.3.1.4 and 6.1.3.1.5, which contain details of the priorities for the third call (Call 2005.SM), and the fourth call (Call 2006.SM).

6.1.3.1.1. Clean energy, in particular renewable energy sources and their integration in the energy system, including storage, distribution and use

6.1.3.1.1.1. Cost-effective supply of renewable energies

[Activity Code : SUSTDEV-1.1.1]

Actions should be aimed at bringing the next generation of more cost-effective renewable energy technologies to the market, with particular emphasis on markets in Europe. The results should enable these technologies to compete in the liberalised energy markets of the future with substantially reduced levels of subsidy, and also help to bring them within reach of developing countries. The main tasks to be carried out will explore ways to reduce the costs of the energy delivered by specific renewable energy technologies, in the form of *green electricity, heating/cooling, and liquid/gaseous biofuels*.

Electricity from biomass and/or waste derived fuels including solid as well as liquid resources e.g. black liquor, and waste recovered fuels (including the biodegradable fraction of Municipal Solid Waste) or effluents e.g. sludge. Projects should focus on one or more of the following: *optimisation of the fuel supply chain* taking into consideration all aspects of fuel production (in case of dedicated energy crops and short rotation forestry) and preparation of the fuel to high standards and specifications; *combinations with fossil fuels* designed to guarantee the continuous supply of electricity to final users, such as advanced co-firing and co-combustion; *innovative technologies for large scale electricity generation*, such as integrated gasification combined cycle plants, dedicated gasification to power plants, biomass boilers, flash pyrolysis applications where the emphasis is placed on achieving high conversion efficiencies and high reliability of the technology.

Electricity from wind : projects should focus on one or more of the following: *innovative wind farms, turbines, and components* for reliable electricity generation at reduced costs; *design tools* including advanced modelling of large turbines and the corresponding site assessments, that facilitate a move towards design limits, new design principles and materials, including more realistic load assumptions for a new generation of machines; *Actions aiming to facilitate the large scale deployment* of wind energy in unconventional sites including offshore, extreme climates, and complex terrains.

Electricity from photovoltaics. Priorities to be addressed are: *Innovative manufacturing concepts* for high efficiency PV cells/modules to be integrated into larger scale (multi-MW) photovoltaic production facilities in order to lower the Wp cost; and including low cost integrated components or devices for grid connected or stand alone PV generators; *Actions aimed at kick-starting Si-feedstock production by EU industries* to secure a reliable and affordable supply for fostering PV cell cost reductions; *Transfer to industrial scale* of a new generation of PV technologies / products to facilitate the integration of innovative solutions at lower costs; *Large area, low cost photovoltaic modules for building integrated PV (BIPV)* including architectural roof integration, and *autonomous solar electricity generation systems* in industrialised and developing countries; *Integration of photovoltaic installations* in generation schemes to feed local distribution grids, closer to the point of use and development of new devices and systems to manage these installations.

Electricity from other renewable energy sources - projects should focus on one or more of the following: *Solar thermal power* for the large scale generation of electricity using power tower, trough or dish technologies, delivering reliable supplies of electricity to the grid at competitive prices; *Geothermal energy* for electricity generation and/or combined heat and power (CHP) generation employing innovative, environmentally sustainable and cost competitive technologies; *Small-scale hydro power plants*, for electricity generation with reduced costs, acceptable environmental impacts and competitive performance; *Ocean energy technologies*, including wave, ocean current and tidal technologies, which are ready for demonstration at full scale with a view to commercial exploitation.

Heat/cooling from renewable energy sources: projects should focus on one or more of the following : *Heat from biofuels and/or waste derived fuels*, including applications in industry and in buildings, as well as CHP, either individually or with district heating. Preference will be given to novel systems that utilise liquid or gaseous biofuels; *Solar heating and cooling* based on a new generation of solar water heating, solar space heating and/or cooling systems, or “combi-systems”, which are designed for large scale production with improved performance and reduced costs; *Solar industrial process heating or solar desalination systems* with improved performance at competitive costs; *Geothermal energy for heating and cooling* employing innovative environmentally sustainable and cost competitive technologies, including ground coupled heat pumps.

[NOTE: Priorities in the 3rd and 4th SMT Calls for Proposals are presented in sections 6.1.3.1.4 and 6.1.3.1.5.]

6.1.3.1.1.2. Large-scale integration of renewable energy sources into energy supplies

[Activity Code : SUSTDEV-1.1.2]

Short / medium term research on the large scale integration of renewable energy sources into energy supplies is needed in support of the EU's commitments to increase the percentage of renewable energy sources to 12% of final energy consumption and 21% of final electricity consumption by 2010. At the same time, the EU is committed to major

reductions in energy intensity and this will require substantial increases in the adoption of innovative technologies for the management of energy demand.

The demand for electricity is expected to grow significantly over the next decade, but the liberalisation of the energy market has led to a significant reduction in the installed over-capacity of base load power plants. In some EU countries the demand for electricity peaks more often in summer than in winter, due to a very significant increase in the demand for cooling. In a growing number of regions the low voltage distribution network to the end users shows weaknesses. Some of these problems can be addressed by installing medium and small scale power generation units, including renewable electricity generating plants, in strategic locations to stabilise the grid instead of installing new power lines.

Research on the large scale integration of renewable energy sources into existing energy supplies and networks should therefore address the inevitable and dynamic interactions between centralised and decentralised energy supplies and demands at the systems level, which is typically more complex when advanced energy management systems are employed. In this context, priority will be given to actions which contribute to a better understanding of the potential problems and solutions associated with enhanced distributed generation in existing grids, including hybrid systems and different levels of renewable energy integration, (including storage where applicable) into electricity and heat distribution grids, networks and related end-use applications.

Amongst the approaches to be adopted, the large scale integration of renewable energies should be demonstrated in clearly defined geographical areas or zones (real life laboratories), within which all of the relevant energy flows (supply and demand) can be identified, measured and assessed. Such projects are expected to involve communities together with local industries, agencies, and utilities in cities, towns and rural areas (including islands), which are committed to integrating renewable energy sources (RES) and efficient demand management technologies in a comprehensive and innovative way into their local energy economies.

Projects addressing the large scale integration of renewable energies should adopt innovative technical approaches to the production, storage, integration and use of RES electricity, RES heating and cooling and liquid and gaseous biofuels, as explained below:

RES electricity, such as wind, biomass and wastes, solar PV, geothermal, and hydro, including where appropriate the integration of *decentralised or distributed electricity generation* at different network voltage levels with intelligent demand side management programmes, local energy management techniques and the co-ordinated provision of sustainable energy services with a high degree of local autonomy and supply security; *electricity storage systems* including advanced batteries, hydrogen and other electricity storage devices either for supplying short-term peak demands or for balancing variations in renewable electricity supply, as well as innovative socio-economic approaches to integrated energy planning, leading to local policies, codes, and regulations;

Medium and low temperature RES heating and cooling, such as locally optimised schemes for providing heating and cooling from solar, geothermal and biomass sources in buildings and industry, and establishing advanced distribution systems (district heating and cooling networks) with integral storage systems as appropriate;

Liquid and gaseous biofuels and recovered fuel production and processing on a commercial basis and their use in buildings, industry and transport.

[NOTE: Priorities in the 3rd and 4th SMT Calls for Proposals are presented in sections 6.1.3.1.4 and 6.1.3.1.5.]

6.1.3.1.2. Energy savings and energy efficiency, including those to be achieved through the use of renewable raw materials

The overall objective is to substantially contribute directly or indirectly to the EU targets of (1) reducing energy intensity by 18% for the year 2010, (2) achieving a *global indicative community target of 18% of electricity consumption from co-generation by the year 2010*, (3) doubling the share of renewables from 6% to 12% for the year 2010 and (4) contributing to achieving the objectives of the internal market for energy, and (5) the policy of security of energy supply. Projects should also make a concrete input to the European Climate Change Programme.

The demand for cold (including air-conditioning, refrigeration, and freezing) has grown exponentially all over Europe in industry, residential and commercial buildings. This trend is expected to continue in the next years, and to penetrate also the market for private houses. Cooling and freezing are usually very energy intensive, and, if nothing is done, this predicted growth may annihilate all efforts of energy savings in buildings and industry, as targeted in the directive on the energy performance of buildings and in the green paper on security of energy supply. Today many new tertiary buildings are equipped with air conditioning, although appropriate eco-building design could have avoided the need to install air conditioning systems in the first place.

6.1.3.1.2.1. Eco-buildings

[Activity Code : SUSTDEV-1.1.3]

The building sector is at present responsible for more than 40% of EU energy consumption. There are technologies under development, which could substantially improve (up to 30%) the energy performance of buildings, reducing the conventional energy demand in new and existing buildings and substantially contributing to reduce energy intensity, through combined measures of rational use of energy and integration of renewable energy technologies.

The Eco-buildings concept is expected to be the meeting point of short-term development and demonstration in order to support legislative and regulatory measures for energy efficiency and enhanced use of renewable energy solutions within the building sector, which go beyond the Directive on the Energy Performance of Buildings.

The projects aim at a new approach for the design, construction and operation of new and/or refurbished buildings, which is based on the best combination of the double approach: to reduce substantially, and, if possible, to avoid the demand for heating, cooling and lighting and to supply the necessary heating, cooling and lighting in the most efficient way and based as much as possible on renewable energy sources and polygeneration.

Priority will be given to integrated research and demonstration projects aiming at improving substantially the energy performance of buildings at a large scale, transferring scientific knowledge into standards and industrial codes, and including the results of socio-economic research on integrated planning and behaviour of users. The projects must go clearly beyond the requirements of existing legislation and thus contribute to a further development of regulatory issues in this sector.

In setting this new approach, the integrated projects should bring together different skills and expertise (urban planners, architects, engineers, system integrators, investors, manufacturers, industry, energy suppliers, owners renters, etc), take advantage of advanced communication and information tools, and propose new methodologies and techniques.

[NOTE: Priorities in the 3rd and 4th SMT Calls for Proposals are presented in sections 6.1.3.1.4 and 6.1.3.1.5.]

6.1.3.1.2.2. Polygeneration

[Activity Code : SUSTDEV-1.1.4]

There is a growing awareness within the framework of the ongoing liberalisation of the energy industry, that an integrated approach to energy supply, distribution and demand management is required. For polygeneration, proposals should focus on market oriented projects involving innovative applications of energy technologies and advanced energy services, and take into account non-technological barriers such as legislative and regulatory measures. They should include EU wide dissemination of results.

Polygeneration applies to projects that improve the efficiency of an overall system covering supply and demand. It therefore covers the complete spectrum from primary energy sources to energy services for private or industrial consumers. Projects should demonstrate the supply of primary energy sources to the project site, their conversion to energy, the supply and distribution of the energy produced, the provision of energy services to consumers and the eventual production of energy carriers (such as biofuels or hydrogen), or other useful products.

Projects that aim to demonstrate the development of individual energy system components such as boilers, gas turbines, fuel cells etc *in isolation*, are considered product development projects and therefore are NOT covered by this call.

Strategic objective:

Polygeneration is the combined production of useful electricity with heat, cold, and other useful products. It encompasses conventional co-generation (combined heat and power, CHP), tri-generation (of power, heat and cold) as well as technologies for producing fuels, chemicals and other value-added products together with the basic energy amenities. Polygeneration systems may use a wide range of fossil and renewable primary energy sources. Their main benefit is in maximising the overall efficiency of the integrated system near to the point of use. Polygeneration combined with efficient district heating and cooling may provide added benefits to a larger community. Secondary benefits may include improved reliability of the supply and distribution networks, arising from better interaction between producers and distributors.

The overall objective is to support projects which will aim to reduce the demand for primary energy by at least 30% (by 2010) compared to standard commercial applications in 2003, by improving the efficiency of providing electricity, heating and cooling services in parallel to the end users.

Reductions in energy consumption contribute to combating climate change and enhance the security of energy supply. More specifically, “Polygeneration” actions should support the Cogeneration Directive and contribute to the Community target of doubling the share of cogeneration in EU electricity generation to 18% (by 2010).

Projects should deliver results that facilitate the short to medium term implementation of policy, legislative and regulatory measures in the energy fields mentioned above for increasing the global energy efficiency through an appropriate integration of supply and demand. The Directive on energy performance of buildings, which has to be transposed

before beginning of 2006, includes provisions ensuring that alternative systems such as decentralised energy supply systems, CHP, district heating/cooling systems have to be considered for new buildings. Projects also may develop appropriate tools such as demand and supply monitoring systems that may assist the implementation of this Directive.

Projects should also aim to improve the energy intensity in end use sectors, for example in residential houses, tertiary buildings, and buildings with public access, as well as industries, businesses and industrial parks. Polygeneration systems, which are appropriately integrated in the end use application, should lead to an important energy efficiency increase of the overall system. They could also demonstrate the integration of renewable sources and allow substantial reductions in installation / operating / maintenance costs.

Applications of Polygeneration:

Projects should concentrate on the demonstration of innovative pre-commercial technologies in market oriented actions, and with short to medium term exploitation prospects, addressing one of the following applications:

- 1) Polygeneration for residential and commercial buildings, district networks and the tertiary sector. Emphasis should be placed on measures to improve operating efficiency, security, reliability of performance at reduced costs and a large reduction of green house gas emissions.
- 2) Polygeneration for industrial applications with significant improvements on energy efficiency.

Projects should be demand driven and should have short to medium term exploitation prospects. In particular, they should demonstrate how new and emerging knowledge in the area can be optimised in concrete cost effective applications. Priority will be given to projects that:

- focus on novel heating or cooling solutions, innovative energy storage and load management (where applicable),
- include a significant RES contribution (the inclusion of RES in the proposals is not essential but highly desirable, and in case of proposals of equal merit priority may be given to those proposals that include RES),
- address in particular the situation in countries and regions where the potential for improvement and better utilisation of existing district heating infrastructure is significant, for example in some of the new EU Member States.

Expected results:

a) Demonstration of systems that are more competitive than conventional ones through higher system efficiencies (for example plus 30%), strengthening of the supply and distribution network at strategic points, compensating higher capital cost, and ensuring shorter pay back time;

b) Innovative integration of polygeneration systems for buildings and industrial applications so that the overall increase in the energy efficiency of the polygeneration system is achieved in a cost-effective way (short pay-back period);

[NOTE: Priorities in the 3rd and 4th SMT Calls for Proposals are presented in sections 6.1.3.1.4 and 6.1.3.1.5.]

6.1.3.1.3. *Alternative motor fuels*

[Activity Code : SUSTDEV-1.1.5]

Despite all efforts at the European, National, Regional and Local levels, greenhouse gas emissions from energy used in transport continue to grow. In addition, the transport sector remains almost exclusively dependent on oil. Activities under this heading of the work programme should contribute to the mitigation of both greenhouse gas emissions growth, over-dependence on oil and the promotion of biofuels for transport applications.

The Commission has suggested a policy objective of 20% petrol and diesel substitution by new/alternative fuels in road transport by 2020⁴. In the 2001 Commission Communication⁵ on Alternative Motor Fuels three types of alternative motor fuels that could contribute to EU energy policy objectives were identified: *biofuels*, *natural gas* and *hydrogen*.

The Alternative Motor Fuel policy of the European Commission has given priority to **liquid and gaseous biofuels** in the short and medium term. Technically they are useable, according to existing legislation, either in low blends (<5%), or unblended (100%) in dedicated engines. Their introduction in the market is supported by Directive 2003/30/EC of 07.05.2003 that set indicative targets of 2% and 5.75% market shares for biofuels respectively for the years 2005 and 2010 as well as by Directive 2003/96/EC of 27.10.2003, which allows for their de-taxation up to 100% by the Member States.

At present the **production** of biodiesel from seeds (such as rape and sunflower), bioethanol from starch (such as wheat or corn) or sugar (such as sugar beet) and biogas from effluents and organic waste streams (such as sewage sludge) is well demonstrated and the various processes are considered reliable and therefore industrial. However, there are new technologies being developed such as the production of biodiesel from animal tallow, and ethanol from lignocellulosics that require full scale demonstration in order to prove their technical and economic viability. The biomass gasification to synthesis gas route (biomass to liquid, BTL) has also attracted renewed interest although the technical hurdles still need careful attention before full scale demonstration can be achieved and several research projects have recently been initiated and supported under the first call of the sixth framework programme.

In the **market** biofuels face obstacles related to the low blend limitations and differences in their nature compared with petrol and diesel often give rise to problems such as increased volatile evaporative emissions or engine parts deterioration. However, options like BTL fuels face less demand side obstacles because there are no blending restrictions. Higher ethanol blends such as 10% (as in the USA) and 25% (as in Brazil) are widely applied by the industry and the market in some countries due to the use of dedicated vehicles. Pure ethanol is also in use in Brazil and has recently received high impetus. Fuel flexible vehicles using an 85% ethanol blend are widely introduced in both the USA and Brazil and have been used successfully since 2002 in Sweden. In the EU the use of unblended biodiesel has been demonstrated in captive fleets - mainly buses but also agricultural tractors. Buses have also been operated with diesel-ethanol blends and pure ethanol in large-scale projects in Sweden for more than 10 years.

Recent developments in the global political arena are pushing **hydrogen** beyond the usual research circles. The European Commission established a High Level Group on Hydrogen and Fuel Cells in 2002 that presented its conclusion in the form of a vision report at a

⁴ European Commission Green Paper: "Towards a European Strategy for the Security of Energy Supply". COM (2000) 769

⁵ COM (2001) 547. Commission Communication on Alternative Motor Fuels

European Conference in June 2003 (http://europa.eu.int/comm/research/energy/pdf/hydrogen-report_en.pdf). Following the recommendation of the High Level Group the European Commission has now created a European Hydrogen Technology Platform which aims at accelerating the development of the Sustainable Hydrogen Economy. On the international front, the recently created International Partnership for the Hydrogen Economy signed in November 2003 by 16 governmental partners, provides a framework for global cooperation, including developing countries.

All these initiatives acknowledge that hydrogen demonstration activities are a key priority to guide and advance the research and deployment efforts on the path to a future hydrogen economy.

Within the European Union several demonstration initiatives and projects aiming to use ***hydrogen as a transport fuel***, or in general as a new energy vector, are currently being implemented, including demonstrations of hydrogen fuelled fuel cell buses and cars and the corresponding fuelling and maintenance infrastructure. Major cities like Berlin, London, or Grenoble and regions like Lombardia, or Baden-Württemberg have also shown their commitment to develop the hydrogen economy.

The short to medium term research programme will concentrate on large-scale demonstration initiatives designed to identify and assess ways to remove existing technical, commercial, operational, organisational, and institutional barriers, which prevent alternative motor fuels and energy efficient vehicles from significantly entering the market.

The whole Well to Wheel chain should be taken into account and optimised to decrease energy losses and bring costs down to competitive levels. The final aim would be to demonstrate the environmental and societal benefits of these alternatives and to widely spread knowledge about them that would increase and ensure their progressive acceptance.

In cities, and in general in urban areas, it is easier to set up a new/alternative distribution and refuelling infrastructure for demonstration of alternative fuels and energy efficient vehicles. Furthermore, in cities the impact of such demonstration projects is much greater. Therefore, these large-scale initiatives should include demonstrations in cities of vehicle fleets⁶ and of their supply and fuelling infrastructure. The scale of the activities should allow the assessment of the alternative fuel pathways in real life environments. Research on socio-economic, public acceptance and dissemination aspects would also be part of the initiatives.

Application driven research and large scale demonstration working on both the supply and demand sides, will deliver a better understanding of the organisational, institutional and financial frameworks required to successfully introduce innovative solutions and bold changes aiming at the reduction of oil dependency and greenhouse gas emissions in road transport.

Relevant and interested stakeholders should become part of European partnerships that will implement these innovative demonstrations of alternative fuels and energy efficient vehicles. The key stakeholders are city and regional authorities, working closely together with fleet operators, vehicle and equipment manufacturers, technology providers, fuel and feedstock suppliers and researchers.

Priority will be given to projects integrating the following topics:

⁶ A vehicle fleet is considered a coherent group of at least three vehicles normally operated by a single operator. In addition, a fleet operates around a central point where specific fuelling and maintenance infrastructure is available.

- *Demonstration of alternative fleets;*
- *Demonstration of innovative, energy efficient, cost-efficient and safe production, storage and distribution of alternative fuels;*
- *Demonstration of new ways of using alternative fuels in energy efficient vehicles;*
- *Assessment and monitoring of new and ongoing activities;*
- *Communication and dissemination*

Further information can be found on the following web site:
http://europa.eu.int/comm/dgs/energy_transport/rtd/6/index_en.htm.

[NOTE: Priorities in the 3rd SMT Call for Proposals are presented in sections 6.1.3.1.4 and 6.1.3.1.5.]

6.1.3.1.4. Priorities for 3rd SMT Call for Proposals (2005)

Research areas and topics for 2005 (Call 2005.SM) – Call closed.

Cost-effective supply of renewable energies:

[Activity Code : SUSTDEV-1.1.1]

a) Proposals for Integrated Projects (IP's) are invited for the following topics, which are described in section 6.1.3.1.1.1, within which priority will be given to the highest quality proposals and to actions aiming to accelerate growth in the production of renewable electricity :

Innovative combinations of biomass with fossil fuels for large scale supply of renewable electricity and / or CHP to final users at more competitive costs and/or increased energy efficiency, such as advanced co-firing and co-combustion; priority will be given to projects which address the whole supply chain for the biomass fuels including new energy crops (growing, harvesting, transportation and logistics), as well as local fuel handling technologies and innovative approaches to the use of combustion ash with a high fraction of biomass residues.

Innovative demonstrations of improvements to energy recovery and renewable electricity production using waste materials and other commonly available biomass feedstocks (biodegradable fraction of Municipal Solid Waste, Refuse Derived Fuels or biomass residues or a mixture of such feedstocks and other bioenergy materials) for large scale supply of renewable electricity and heating / cooling to final users at more competitive costs and improved environmental parameters, such as: advanced combustion / incineration technologies, advanced fuel handling, advanced treatment of exhaust gases and residues. Priority will be given to proposals demonstrating an integrated approach, which covers the whole supply chain (feedstock preparation, transport logistics, conversion and waste recovery), innovative technologies with high yields (energy to electricity conversion), and using readily available raw and residual material in an efficient way.

b) Proposals for Specific Targeted Research Projects (STREPS's) are invited in the following areas (described in section 6.1.3.1.1.1), within which priority will be given to the highest quality proposals and to actions aiming to accelerate growth in the production of renewable electricity :

Innovative approaches to improving the yield of medium to large scale biogas plants at competitive costs, for example by advanced process design, management systems and process monitoring (advanced automation systems), measurement or control techniques, innovative up-scaling, improved environmental performance; priority will be given to projects which address the whole supply chain, including the integration of several waste streams and the maximisation of

renewable electricity and heat production at more competitive costs (reduced plant investment and operating costs).

Innovative combinations of biomass and wastes with fossil fuels for large scale supply of renewable electricity to final users, such as advanced co-firing and co-combustion;

Innovative wind farms, components and design tools for reliable electricity generation at reduced costs using either onshore or offshore installations, with particular emphasis on issues related to low wind speeds, extreme load cases, complex terrains, advanced micro-siting techniques, and micro-climates;

Innovations in PV manufacturing plant at an industrial scale, which demonstrate integrated solutions for mass producing solar PV cells and modules at lower costs;

Geothermal energy using innovative integrated systems with optimised efficiency and reduced costs for electricity generation, and / or combined heat and power (CHP), using environmentally sustainable technologies.

Ocean / marine energy technologies, including wave, ocean current and tidal stream technologies, which are ready for demonstration at full scale with a view to commercial exploitation .

c) Proposals for Co-ordination Actions (CA's) and Specific Support Actions (SSA's) are invited in the areas described in Section 6.1.3.1.1.1.

Grid issues

[Activity Code : SUSTDEV-1.1.7]

Building on the recent work carried out in these fields in the context of medium to long term research actions, proposals for Specific Targeted Research Projects (STREPs), Coordination Actions (CA's) and Specific Support Actions (SSA's) are invited in the areas of the large scale integration of renewable energy sources, described in Section 6.1.3.1.1.2 and Polygeneration described in section 6.1.3.1.2.2. In particular, support is envisaged for :

Distributed generation: research and demonstrations aimed at maintaining the stability of the electricity grid as the installed capacity of distributed generation using RES and/or polygeneration is increased. Priority will be given to actions aimed at demonstrating the optimal use and management of distributed generation and storage to address existing and potential bottlenecks, achieve an increase in the security of distribution grids, improve the ability of the grid to meet peak demands, improve the stability of the grid, or improve the overall management of the grid thus saving the costs of conventional reinforcement. Demonstration actions should be implemented by market actors which are responsible for distribution grids, together with end users where appropriate, using medium and small scale CHP and RES electricity generators. [N.B. see also section 6.1.3.2.2 of this Work programme for research activities having an impact in the medium and longer term.]

Management of electricity grids linked to large scale decentralised wind power generation: research and demonstrations addressing the design and management of electricity grids linked to large scale decentralised wind power generation. Priority will be given to strategic research actions (including system output forecasting) aimed at addressing the intermittency of wind power generation, and to demonstrations of innovative control technologies, intelligent management systems (with related information technologies), and / or storage, which address the large scale transmission of renewable electricity at trans-regional or EU level. Actions should be implemented by consortia involving organisations (market actors such as transmission system operators, developers, and manufacturers), which are responsible for the regulation, development and management of high voltage transmission networks, supplied by large scale on- or off-shore wind farms.

Polygeneration

[Activity Code : SUSTDEV-1.1.4]

Proposals for Integrated Projects (IP's) and Specific Targeted Research Projects (STREPs), are invited in the areas of **Polygeneration**, described in section 6.1.3.1.2.2. In particular, support is envisaged for:

Improvement of the competitiveness of Polygeneration

Objectives and problems to be solved: Improve the competitiveness of polygeneration in all applications through the demonstration of innovative technologies or innovative combinations of existing technologies.

Work to be done: Demonstrate innovative technologies with short and medium term exploitation. A flexible multi-fuel approach should be supported, including renewable fuels and waste and the development of advanced energy services at lower costs.

Expected results: Projects should lead to the efficient combined production and use of electricity, heat, cold, energy carriers (such as biofuels or hydrogen), or other useful products.

Innovative integration of polygeneration

Objectives and problems to be solved: Proposals should aim at improving the innovative interaction between suppliers of electricity, heat, cold, energy carriers or other useful products and the corresponding demands. They should lead to an overall improvement in energy efficiency, in the cost-benefit rate of the project, and in the quality and security of supply.

Work to be done: Demonstrate in specific pre-commercial applications the integration of the supply and demand chain for polygeneration installations connected into supply and distribution networks.

Expected results: New technologies, (pre-standardisation work), and innovative community energy management systems should make the connection of polygeneration plants more attractive to network operators. Fuel flexibility (including renewables) and improvements in operation and maintenance should increase the attractiveness of polygeneration in the decentralised energy market.

Alternative motor fuels

[Activity Code : SUSTDEV-1.1.5]

Proposals for Integrated Projects (IP's), Specific Targeted Research Projects (STREPs), and Coordination Actions (CA's) are invited in the areas of Alternative Motor Fuels, described in section 6.1.3.1.3.

The primary aim of this Call is to establish European partnerships for innovative demonstration of alternative fuels and energy efficient vehicles. In particular, one in the field of biofuels (European Partnership: **Biofuel-Cities**) and a second one in the field of hydrogen (European Partnership: **Hydrogen for transport**). These Partnerships could be composed of new projects financed by this call as well as on-going projects. The two Partnerships will be supported by Coordination Actions as described below. Each Partnership will constitute a coherent set of demonstration activities conducted through integrated projects and specific targeted research projects. In order to achieve this coherence, high quality projects may be clustered.

Biofuel-Cities

The **purpose** of Biofuel Cities is to demonstrate the use of new and innovative technologies that will permit extensive use of biofuels in cities covering the complete chain from feedstock to biofuels production, distribution and utilisation in vehicle fleets. The use of biofuels should focus on petrol or diesel blends higher than the present 5% biofuels so that such high blends or pure biofuels will be demonstrated at European scale. Projects should involve the issue of how to

motivate end users and citizens to use biofuels for example through their local authorities and other local stakeholders.

All the new projects will be part of Biofuel Cities, in order to coordinate efforts and actively contribute to reaching the targets of Directive 2003/30/EC. Existing demonstration projects on biofuels production will be encouraged to join this Partnership.

Three types of proposal are invited:

- Priority will be given to Integrated Projects (IPs) that would address all the four topics a-b-c-d described below embracing all the links of the Well to Wheel chain.
- Proposals for Specific Targeted Research Projects (STREPs) are invited for innovative biofuels production demonstrations (topic b-c-d, as below).
- Proposals for a Coordination Action (CA) are invited to provide a coherent link between the resulting IPs and STREPs from this call and other on-going initiatives and other European Union supported projects in the biofuels field. This horizontal action should develop the European Partnership for the demonstration of biofuels technologies in Europe, providing a framework for dissemination of results and active communication. It should also include an independent common assessment⁷ and monitoring framework of the projects from a socio-economic, energy efficiency, environmental and safety perspective.

Topics:

a.- Demonstration of **alternative motor fuel vehicle fleets** such as: buses; post distribution; waste collection; taxis; local delivery; airport fleets; and passenger vehicles. These fleets should demonstrate **new ways of using biofuels in energy efficient vehicles**, with particular attention to high blends of bio-fuel (higher than 5%) and also the use of pure bio-fuels fleets. Introduction of innovative energy efficient concepts such as the combination of electric hybrid technologies with high blends of biofuels will be given priority. However, work on wholly electric vehicles will not be supported.

b.- **Innovative, energy efficient, cost-effective and safe large scale production, storage and distribution of biofuels** that could supply fuel to the abovementioned demonstration fleets.

c.- **Assessment and monitoring** from the perspectives of socio-economic, energy efficiency, environmental and safety perspective.

d.- **Communication and dissemination.**

Hydrogen for transport

Following the Growth Initiative⁸, the European Council of 12 December 2003 invited the European Commission to implement public private partnerships and to orient projects and funds in the field of hydrogen towards the priorities identified in the Quick Start Programme, namely hydrogen production and use in communities.

The purpose of this call for hydrogen is two fold:

- to coordinate under a single and coherent initiative (instrument: Coordination Action, CA), in the form of a European Partnership⁹, the projects resulting from this call. In order to optimise the current effort the most important on-going demonstration projects and initiatives in hydrogen for transport will be invited to join this partnership. It should provide European and Global visibility to the projects and to their results. This European Partnership should also provide an

⁷ For this assessment framework the CA will build on the work developed by on-going projects

⁸ COM (2003) 690. Commission Communication on a European initiative for growth investing in networks and knowledge for growth and jobs. It includes the so-called "Quick Start programme".

⁹ The Hydrogen for Transport European Partnership will be part of the European Hydrogen Technology Platform.

independent common assessment¹⁰ and monitoring framework of the projects from a socio-economic, energy efficiency, environmental and safety perspective. Finally, in view of future very large scale hydrogen demonstrations, this Partnership will prepare the ground for such initiatives in close coordination with the IP resulting from the joint Call on coordination, monitoring and assessment of research on hydrogen that also aims at preparing future activities.

- to supplement existing efforts with new Integrated Projects (IPs) addressing the priority topics (a-b-d-e and when relevant c) of this section embracing all links in the Well to Wheel chain:

a.- **Demonstration of hydrogen fleets.** Priority will be given to innovative captive fleets that complement, from a technology point of view, technologies currently under demonstration in Europe, for instance hybrid fuel cells buses. Appropriate fleets could be: buses; post distribution; waste collection; taxis; local delivery; airport fleets; and passenger vehicles.

b.- **Demonstration of innovative, cost-efficient and safe production, storage, distribution and fuelling systems of hydrogen.**

c.- *Exploring synergies between sector and technology pathways. Demonstration of the benefits for transport and stationary applications of using hydrogen simultaneously for both cases.*

Demonstration of the potential benefits of linking biofuels and hydrogen technology pathways.

d.- **Assessment and monitoring** from a socio-economic, energy efficiency, environmental and safety perspective.

e.- **Communication and dissemination.**

Thematic Promotion and Dissemination

[Activity Code : SUSTDEV-1.1.8]

Proposals for Specific Support Actions (SSA's) are invited for the promotion and dissemination of the results of international, national, and / or other actions in all of the areas described in Sections 6.1.3.1.

The promotion of renewable energy supplies together with the efficient management of energy demand and alternative motor fuels, should lead to well integrated, efficient and cost effective solutions for reducing the dependency of the EU on conventional fuels.

The actions proposed here should not replace the dissemination which is carried as part of each individual FP6 project, but should use the combined results from different projects as the basis for a thematic approach to promotion and dissemination.

The actions proposed here should be based mainly on promoting and disseminating the results of technology research and demonstration projects, including any lessons learned concerning the policy and legislative context in which they were implemented. Actions which are designed mainly to tackle non-technological market barriers should be proposed to the Intelligent Energy – Europe programme. Together, these two programmes act as an incubator for the policies and measures that promote renewable energy technologies and the rational use of energy in the EU.

In particular, support is envisaged for actions which address :

Renewable electricity technologies, for use in large scale grid connected applications, including marketing campaigns and the dissemination of results from new technology demonstration projects. Each action should set its messages in the context of the relevant EU policy and legislation, for example the Directive on the promotion of electricity from renewable energy sources (2001).

¹⁰ For this assessment framework the CA will build on the schemes developed by on-going projects

Renewable heating and cooling technologies, for applications in buildings and industry, including marketing campaigns and the dissemination of results from new technology demonstration projects. Each action should set its messages in the context of the relevant EU policy and legislation, for example in the White Paper on renewable energy sources (1997).

Production and distribution of liquid and gaseous biofuels, for applications in buildings and transport, including marketing campaigns and the dissemination of results from new technology demonstration projects. Each action should set its messages in the context of the relevant EU policy and legislation, for example the Directives on Biofuels (2003).

Eco-buildings, for domestic and tertiary applications, including marketing campaigns and the dissemination of results from new technology demonstration projects. Each action should set its messages in the context of the relevant EU policy and legislation, for example the Directive on the Energy Performance of Buildings (2002).

Polygeneration, for applications in buildings and industry, including marketing campaigns and the dissemination of results from new technology demonstration projects. Each action should set its messages in the context of the relevant EU policy and legislation, for example the Directive on Cogeneration (2004).

Energy demand management and renewable energy supply in high performance communities, including marketing campaigns and the dissemination of results from new technology demonstration projects. Each action should set its messages in the context of the relevant EU policy and legislation, for example the Green Paper on the security of energy supplies (2001).

Alternative Motor Fuels, including marketing campaigns and the dissemination of results from new technology demonstration projects. Each action should be co-ordinated with the actions supported under the Biofuels Cities initiative, and set its messages in the context of the relevant EU policy and legislation, for example the Directives on Biofuels (2003).

6.1.3.1.5. *Priorities for 4th SMT Call for Proposals (2006)*

Research areas and topics for 2006 (Call 2006.SM)

Cost-effective supply of renewable energies:

[Activity Codes: SUSTDEV-2005-1.1.1-1 to SUSTDEV-2005-1.1.1-7]

a) Proposals for Specific Targeted Research Projects (STREP's) are invited in the following areas (described in section 6.1.3.1.1.1), within which priority will be given to the highest quality proposals, to actions aiming to accelerate growth in the production of renewable heating and cooling and, where appropriate, to proposals involving partners from countries or regions, where renewable energy and energy efficiency policies, support schemes and commitments need to be strengthened, as well as third countries (notably developing countries and emerging economies):

Demonstrations of innovative designs of automated biomass heating systems with substantially reduced capital costs for introduction to mass markets in the domestic and tertiary buildings sectors; priority will be given to innovative designs and systems which also permit the use of fuels with lower quality, (eg: pellets from agricultural by-products or wastes), whilst maintaining high emissions standards.

Solar heating and cooling based on a new generation of solar water heating, solar space heating and/or cooling systems, *or* "combi-systems", which are designed for large scale production with improved performance and reduced costs; solar industrial process heating or solar desalination systems with improved performance at competitive costs

Geothermal energy using innovative integrated systems with optimised efficiency and reduced costs for heating and cooling, using environmentally sustainable technologies.

Innovative wind farms, components and design tools for reliable electricity generation at reduced costs, either onshore or offshore, with particular emphasis on issues related to low wind speeds, extreme load cases, complex terrains, advanced micro-siting techniques, and micro-climates; priority will be given to actions which will facilitate the large scale deployment and grid integration of wind energy including storage and closer cooperation between the wind energy sector, public authorities, the financial community and RTD institutions;

Demonstrations of the next generation of PV technologies / products, including PV in buildings, which demonstrate innovative integrated solutions for supplying solar electricity at lower costs, and / or innovations in manufacturing plant aimed at mass producing solar PV technologies or products at lower costs;

Ocean / marine energy technologies, including wave, ocean current and tidal stream technologies, which are ready for demonstration at full scale with a view to commercial exploitation .

b) Proposals for Co-ordination Actions and Specific Support Actions are invited in the areas described in Section 6.1.3.1.1.1

Eco-buildings

[Activity Code : SUSTDEV-1.1.3]

Proposals for Specific Targeted Research Projects (STREP's) are invited in the following area, described in Section 6.1.3.1.2.1, within which priority will be given to the highest quality proposals and, where appropriate, to proposals involving partners from countries or regions, where renewable energy and energy efficiency policies, support schemes and commitments need to be strengthened, as well as third countries (notably developing countries and emerging economies)

In particular, support is envisaged for projects that focus on innovative technological solutions within the context of an holistic approach to the design and operation, and giving priority to retro-fitted buildings. Projects should demonstrate ambitious reductions in energy consumption (lower by at least 30% compared with national regulations for new buildings based on the Energy Performance of Buildings Directive), together with attractive payback periods.

Grid issues

[Activity Codes: SUSTDEV-2005-1.1.7-1 to SUSTDEV-2005-1.1.7-2]

Building on the recent work carried out in these fields in the context of medium to long term research actions, proposals for Specific Targeted Research Projects (STREPs), Coordination Actions (CA's) and Specific Support Actions (SSA's) are invited in the areas of the large scale integration of renewable energy sources, described in Section 6.1.3.1.1.2 and Polygeneration described in section 6.1.3.1.2.2. In particular, support is envisaged for :

Distributed generation: research and demonstrations aimed at maintaining the stability of the electricity grid as the installed capacity of distributed generation using RES and/or polygeneration is increased. Priority will be given to actions aimed at demonstrating the optimal use and management of distributed generation and storage to address existing and potential bottlenecks, achieve an increase in the security of distribution grids, improve the ability of the grid to meet peak demands, improve the stability of the grid, or improve the overall management of the grid thus saving the costs of conventional reinforcement. Demonstration actions should be implemented by market actors which are responsible for distribution grids, together with end users where appropriate, using medium and small scale CHP and RES electricity generators. *(Note; The costs of electricity generators will not be eligible for support in these demonstration actions.)*

Management of electricity grids linked to large scale wind power generation: research and demonstrations addressing the design and management of electricity grids linked to large scale wind power generation. Priority will be given to strategic research actions (including system output forecasting) aimed at addressing the intermittency of wind power generation, and to demonstrations of innovative control technologies, intelligent management systems (with related information technologies), and / or storage, which address the large scale transmission of renewable electricity at trans-regional or EU level. Actions should be implemented by consortia involving organisations (market actors such as regulators, transmission system operators, developers, and manufacturers), which are responsible for the regulation, development and management of transmission networks, supplied by on- or off-shore wind farms. *(Note; The costs of electricity generators will not be eligible for support in these demonstration actions.)*

Polygeneration

[Activity Code : SUSTDEV-1.1.4]

Proposals for Specific Targeted Research Projects (STREP's) are invited in the following area, described in Section 6.1.3.1.2.2, within which priority will be given to the highest quality proposals and, where appropriate, to proposals involving partners from countries or regions, where renewable energy and energy efficiency policies, support schemes and commitments need to be strengthened, as well as third countries (notably developing countries and emerging economies)

In particular, support is envisaged for projects that focus on innovative technological solutions aiming to improve the competitiveness of polygeneration in all applications through the demonstration of innovative technologies or innovative combinations of existing technologies. Projects should address the interaction between suppliers of electricity, heat, cold, energy carriers or other useful products and the corresponding demands. They should lead to an overall improvement in energy efficiency, in the cost-benefit rate of the project, and in the quality and security of supply.

CONCERTO II

[Activity Code : SUSTDEV-1.1.6]

Proposals for Integrated Projects (IP's) are invited for support under the co-ordinated initiative "CONCERTO II", which is a joint initiative between the research activities of Large-scale integration of renewable energy sources into energy supplies, Eco-buildings and Polygeneration (optional), described in sections 6.1.3.1.1.1, 6.1.3.1.1.2, and 6.1.3.1.1.3.

*Note: Proposers are reminded that IP proposals for Demonstration projects should include a description of the activities for the **full duration** of the project, and chapters of the proposal should **not exceed** the lengths recommended in the Guide for Proposers, which is associated with this Call. Additional information on how to prepare proposals for CONCERTO projects is available in the form of a "Guidance Note for CONCERTO Proposers" on the web site : http://europa.eu.int/comm/dgs/energy_transport/rtd/6/index_en.htm*

Objectives and problems to be solved:

The CONCERTO initiative should support research and demonstration focused on optimising the sustainability of energy systems in local communities through the innovative integration of RE technologies directly into eco-buildings, electricity distribution networks, district heating systems, and other energy demanding systems, with advanced thermal and electrical storage and improved energy efficiency, as well as on the measurement (including remote metering) assessment design and management of energy flows.

In particular, participation in a CONCERTO project should permit communities to demonstrate sustainable energy solutions in which energy efficiency and renewable energy sources are integrated from an economic perspective, and which deliver high quality energy services.

Innovation in demonstration actions:

Priority will be given to proposals which involve trans-national technological cooperation and demonstrate innovations leading to highly improved cost effectiveness, either via improvements to individual technologies and/or via innovative integrations of technologies. Innovation is also expected with regard to the measurement and management of energy flows in CONCERTO communities.

Emphasis on communities in CONCERTO:

CONCERTO is a major European initiative which will support the demonstration of new and innovative technical solutions making local communities more sustainable and highly energy-efficient. Such communities should be in clearly defined geographical areas or zones (cities, towns, rural areas or islands), within which all relevant energy flows (including centralised and decentralised) can be identified for measurement and research / assessment purposes. In each community, politicians, planners, developers, industry and citizens should actively cooperate to optimise the sustainability of their energy flows.

Demonstration Actions

1. In order to substantially improve the overall performance of energy systems in new and / or existing communities, CONCERTO projects should involve integrated demonstration actions, which are economically attractive for replication. The following three components are compulsory in a CONCERTO project, and proposals should include detailed information concerning the specific costs and expected performance of each component :A significant **increase in the share of renewable energy** sources consumed by the CONCERTO community (green electricity, heating / cooling)Where appropriate, **energy storage** may be included to cover the intermittence of RE supplies.

The size of each RE demonstration plant (and energy storage system where appropriate) should be clearly specified, together with the cost per MW installed. The renewable energy produced by a CONCERTO community should, as far as possible, be utilised within the CONCERTO community and should be managed in an optimised way to fit with the local energy demands. The approach adopted by the CONCERTO community, which aims to increase the share of RES consumed within its community, should be clearly explained.

2. **Eco-buildings** focus on innovative technological solutions within the context of an holistic approach to the design and operation of new or retro-fitted buildings, and should demonstrate ambitious reductions in energy consumption compared with national regulations for new buildings based on the Energy Performance of Buildings Directive, together with attractive payback periods. For CONCERTO, priority will be given to innovative demonstrations involving the refurbishment or retrofitting of existing buildings, aiming to achieve a lower energy consumption per m² than would be achieved by a new building which meets national regulations for new buildings based on the Energy Performance of Buildings Directive in the same location. Innovative demonstrations of highly cost effective new buildings, which achieve overall energy consumptions per m², that are substantially lower (lower by at least 30%) than those specified in national regulations for new buildings based on the Energy Performance of Buildings Directive, may also be accepted.

The gross floor area of each type of building should be specified together with the predicted annual energy consumption per m², (broken down by space heating, cooling, water heating, lighting, etc), and the energy consumption targets according to national regulations for new buildings based on the Energy Performance of Buildings Directive. Details should also be provided of the energy efficiency measures to be employed

3. **Intelligent management, control and measurement** of energy supplies, including local distribution grids and distributed generation, together with efficient energy demand management
4. **Polygeneration (optional for CONCERTO communities)** involves CHP and / or district heating, preferably using RE sources, which should demonstrate technological solutions which improve the competitiveness of innovative technologies or innovative combinations of existing technologies. Polygeneration demonstrations should address the interaction between suppliers of electricity, heat, cold, energy carriers or other useful products and the corresponding demands. They should lead to an overall improvement in energy efficiency, in cost-effectiveness, and in the quality and security of supply.

The size of each element (electricity, heating, cooling, other) of the polygeneration demonstration plant should be clearly specified, together with the cost per MWe installed. How the energy delivered by the polygeneration plant will be utilised by the CONCERTO community should also be explained.

Short to medium term Research actions:

Research actions should be directly linked to the objectives of the CONCERTO project concerned, typically addressing the management, measurement and analysis of the energy flows in the community. Where appropriate, research in a CONCERTO project may also address specific issues related to the innovative technologies or integration schemes that are being demonstrated.

Composition of CONCERTO project Consortia :

CONCERTO proposals should demonstrate substantial EU added value from technological cooperation between partners from different countries. CONCERTO proposals should provide evidence of a strong commitment from the relevant authorities, local market actors and decision-makers. Typical CONCERTO project consortia will also include, utilities, energy technology providers, energy service providers, energy agencies, energy research and analysis teams, socio-economists and energy users. The involvement of SME's in CONCERTO projects is important, whether they participate as partners or as sub-contractors, and their roles should be clearly explained. Proposals from communities in countries or regions, where renewable energy and energy efficiency policies and commitments need to be strengthened, are particularly welcome.

CONCERTO project consortia are expected to include Associated communities, which participate in the project, but do not receive EC support for demonstration actions in their own community. Such Associated communities should have a clear role in the project, contributing to the design, development and implementation of the technology demonstration actions, as well as to the research, analysis, promotion, and dissemination of results. They should also be committed to

developing local policies and plans for increasing the sustainability of the energy systems in their own communities.

Structure of a typical CONCERTO project

CONCERTO projects should involve the full menu of activities, typically including

- about 70% for **demonstration** (of the integration of Renewable Energy and Energy Efficiency technologies),
- up to about 20% for **research** (associated communities are welcomed to participate if appropriate), including the development and analysis of innovative technology integration schemes; technology and market/economic risk assessment; socio-economic analysis; and performance management, monitoring and optimisation of energy flows at the level of local communities,
- up to about 5% for the promotion and **dissemination** of project results, including the involvement of “associated communities”.
- up to about 2% for **training** (optional)
- up to about 7% for **management**

Expected results

Projects are expected to produce well monitored field experience of energy flows (supply and demand patterns), in local communities having a high percentage of renewable energy supply, together with detailed information on the performance and reliability of the innovative energy supply and end use technologies involved. A socio-economic research component should analyse the local trends in energy costs, prices and savings, as well as the social impacts, quality and added values of the energy services provided. The projects are also expected to include analyses of technical and market risks, cost reduction potentials and future market potentials for the technologies and approaches adopted.

The results from such projects will demonstrate the high potential for improving the sustainability of energy systems in cost effective ways in local communities, which can be achieved by addressing energy supply and demand with a fully integrated approach. They should also result in new “good practices”, which can be used in the future as examples to raise the confidence of potential decision-makers, investors and final users.

In addition, the technical and socio-economic analyses from such projects, which integrate technology, social and economic aspects, will support the future development and implementation of energy policy, by providing well documented field experience which can be used as a basis for

- developing new regulations (e.g. for distributed electricity generation),
- improving the security of energy supplies in future energy markets,
- the further development of support schemes for Renewable Energy and Energy Efficiency technologies (e.g. feed in laws, green certificate schemes, energy taxation),
- planning guidance, and
- energy cost and price reductions.

Thematic Promotion and Dissemination

[Activity Codes: SUSTDEV-2005-1.1.8-1 to SUSTDEV-2005-1.1.8-7]

Proposals for Specific Support Actions (SSA’s) are invited for the promotion and dissemination of the results of international, national, and / or other actions in all of the areas described in Sections 6.1.3.1, within which priority will be given to the highest quality proposals and, where appropriate, to proposals involving partners from countries or regions, where renewable energy and energy efficiency policies, support schemes and commitments need to be strengthened, as well as third countries (notably developing countries and emerging economies)

The promotion of renewable energy supplies together with the efficient management of energy demand and alternative motor fuels, should lead to well integrated, efficient and cost effective solutions for reducing the dependency of the EU on conventional fuels.

The actions proposed here should not replace the dissemination which is carried as part of each individual FP6 project, but should use the combined results from different projects as the basis for a thematic approach to promotion and dissemination.

The actions proposed here should be based mainly on promoting and disseminating the results of technology research and demonstration projects, including any lessons learned concerning the policy and legislative context in which they were implemented.

They should provide significant added-value to the actions which will be launched following the Call S-M 2005 (third Call). Actions which are designed mainly to tackle non-technological market barriers will not be funded in the research programme. Such proposals should be submitted to the Intelligent Energy – Europe programme. Together, these two programmes act as an incubator for the policies and measures that promote renewable energy technologies and the rational use of energy in the EU.

In particular, support is envisaged for actions which address :

Renewable electricity technologies, for use in large scale grid connected applications, including marketing campaigns and the dissemination of results from new technology demonstration projects. Each action should set its messages in the context of the relevant EU policy and legislation, for example the Directive on the promotion of electricity from renewable energy sources (2001).

Renewable heating and cooling technologies, for applications in buildings and industry, including marketing campaigns and the dissemination of results from new technology demonstration projects. Each action should set its messages in the context of the relevant EU policy and legislation, for example in the White Paper on renewable energy sources (1997).

Production and distribution of liquid and gaseous biofuels, for applications in buildings and transport, including marketing campaigns and the dissemination of results from new technology demonstration projects. Each action should set its messages in the context of the relevant EU policy and legislation, for example the Directives on Biofuels (2003).

Eco-buildings, for domestic and tertiary applications, including marketing campaigns and the dissemination of results from new technology demonstration projects. Each action should set its messages in the context of the relevant EU policy and legislation, for example the Directive on the Energy Performance of Buildings (2002).

Polygeneration, for applications in buildings and industry, including marketing campaigns and the dissemination of results from new technology demonstration projects. Each action should set its messages in the context of the relevant EU policy and legislation, for example the Directive on Cogeneration (2004).

Energy demand management and renewable energy supply in high performance communities, including marketing campaigns and the dissemination of results from new technology demonstration projects. Each action should set its messages in the context of the relevant EU policy and legislation, for example the Green Paper on the security of energy supplies (2001).

Alternative Motor Fuels, including marketing campaigns and the dissemination of results from new technology demonstration projects. Each action should be co-ordinated with the actions supported under the Biofuels Cities initiative, and set its messages in the context of the relevant EU policy and legislation, for example the Directives on Biofuels (2003).

CIVITAS Dissemination and Best Practice Transfer Action

[Activity Code : SUSTDEV-2005-3.1.1.1.6]

Proposals are invited for a Specific Support Action (SSA) for the CIVITAS Initiative.

Objective: The CIVITAS Initiative addresses Energy and Transport objectives in an integrated way. The Clean Urban Transport demonstrations and evaluation activities undertaken within the CIVITAS are producing a wealth of experiences that are relevant for politicians, technicians and the scientific world. In the year 2006 the first group of demonstration projects is coming to an end. The objective of this action is to ensure that that these projects experiences are exploited up to a maximum level; that the validation and promotion of results and knowledge transfer are continued; that innovative means for dissemination and take up are implemented; that networks for information exchange are maintained and expanded; and that the wider impacts of CIVITAS are assessed.

Scope: The practical work programme should include studies and actions to promote the transfer and take up of project results; preparation of publications and topic-based best practice guides; establishment of interactive partnerships between cities; organised site-visits; 'on the job' information exchange and learning; presentations and workshops; international networking; impact studies; and the preparation of scientific articles and conferences.

Expected results: It is expected that the selected project will offer an umbrella for a number of activities that should address:

First target group - cities and local level actors:

- Ensuring knowledge transfer, identification, description and active promotion of the CIVITAS results and best practices through different means, paying attention to the achieved technical results, the processes and the framework conditions;
- Maintaining topic or project-based networks for information exchange and validation of results that were established between the CIVITAS demonstration cities at technical and political level, and enlarging them with committed 'newcomers';
- Establishing partnerships to transfer results between CIVITAS demonstration cities and cities that will be or are candidates for receiving funding to improve their urban transport systems in the framework of the European Union's Regional Policy.

Second target group – policy-makers and implementers at all levels:

- Assessing the contribution of CIVITAS and the project results to EU policy and development of policy recommendations, with a specific emphasis on the Lisbon Strategy, Sustainable Development Strategy, Energy policy, Transport policy and Environmental policy;
- Undertaking scientific validation of the CIVITAS project results, both public and political acceptance, as well as scientific validation, including some post-project monitoring, and ensuring a high quality and targeted dissemination of these results to the scientific world and to Member States programmes;
- Setting up, maintaining, where appropriate translating, and exploiting an electronic library of the educational material developed by the CIVITAS projects, as part of the CIVITAS website.

The selected project should consolidate, build on and provide added value to the results of the CIVITAS I and II demonstration projects and the activities undertaken by the METEOR and GUARD projects. Dissemination activities will also need to be coordinated with other energy and transport dissemination projects. The cities and local level actors that will benefit from the

projects' activities should be (largely) identified in a transparent way after contract signature and should provide a reasonable own contribution.

6.1.3.2. Research activities having an impact in the medium and longer term

In accordance with the principle of focussing research effort, the following sections 6.1.3.2.1 to 6.1.3.2.5 first describe the main objectives to be achieved and the strategically important areas in which research should be concentrated. They then go on to provide details of the technical content of the third call (Call 2005.ML) and the fourth call (Call 2006.ML).

Where appropriate, quantified targets are set out in the Work Programme. They are ambitious long-term targets (15-20 years) and not easy to achieve. Nevertheless, they are a clear indication of the scale of achievements to which an individual proposal should aspire.

Specific horizontal aspects to be taken into account in the third call (Call 2005.ML)

1) Small and medium sized enterprises

Strengthening the competitiveness of the European energy sector is an important objective of this priority theme with particular attention being given to innovation aspects and the substantial participation of SMEs. Innovation related aspects need to be clearly addressed and well-defined dissemination and exploitation plans presented, showing the optimal use of projects results. SMEs play a vital role in the energy chain and will be key to promoting innovation. With a target of 15% of the budget reserved for their participation within FP6, a strong mobilisation by all project consortia to include SMEs wherever appropriate must be ensured, in particular in the new instruments.

In this context, note that Integrated Projects offer the possibility to reserve a portion of the budget for future and currently non-identified partners. Using this opportunity for SME partners that will take an active part in exploiting the results is an option to be considered.

RTD topics which are particularly suitable for strong SME participation are highlighted in the following technical sections.

2) International co-operation

International co-operation represents an important dimension of the Sixth Framework Programme. Funding can be available for the participation of researchers, teams and institutions from third countries¹¹ in projects within this Priority Thematic Area of Research, with the following overall objectives:

- To help European researchers, businesses and research organisations in the European Union and in the countries associated with the Framework Programme to have access to knowledge and expertise existing elsewhere in the world, and
- To help ensure Europe's strong and coherent participation in the research initiatives conducted at international level in order to push back the boundaries of knowledge or help to resolve the major global issues.

As regards funding, priority will be given to third countries that have signed a scientific and technical co-operation agreement with the EU¹² and, particularly, INCO target

¹¹ "Third country" means a State that is neither a Member State nor an associated State.

¹² Third countries with an S&T agreement with the EU: Argentina, Australia, Brazil, Canada, China, Chile, Egypt, India, Japan, Kazakhstan, Mexico, Morocco, Russia, South Africa, Tunisia, Ukraine.

countries and those associated with the EU in multi-lateral co-operation initiatives in the field of sustainable energy systems (e.g. IPHE¹³, JREC¹⁴ and CSLF¹⁵).

The full list of INCO target countries can be found in Annex C of the Work Programme.

Applications for third country funding can be made in proposals for new projects submitted to this call. The participation of third countries and justification for their funding should be included in the project proposal in the usual way (i.e. as normal partners).

6.1.3.2.1. Fuel cells, including their applications

[Activity Code : SUSTDEV-1.2.1]

Research is needed to reduce the cost and improve the performance, durability and safety of fuel cell systems for stationary and transport applications, to enable them to compete with conventional combustion technologies. This will include the optimisation and simplification of fuel cell components and sub-systems as well as modelling, testing and characterisation protocols. The long term goal is to achieve commercial viability by 2020 for many applications.

For fuel cells, the strategically important areas in which research should be concentrated are:

1) the development of competitive fuel cell and related component technologies for stationary and transport applications (*covering both low temperature fuel cell systems, including stacks, fuel processors, etc. and high temperature fuel cell systems*). RTD in this area will be on functional materials, manufacturing processes and component level development, aimed at improving performance and durability, whilst also reducing costs. *N.B. Aspects relating to materials research are the subject of a Co-ordinated Call with the nano-materials technologies programme – part of Thematic Priority 3. Where applicable, this is clearly indicated in the individual topics described below.*

2) Fuel cell systems applications (*research will concentrate on systems and integration for various applications, exploiting, where appropriate, synergies between applications, e.g. technologies for multi-fuel capability*). In this area the research will include mathematical modelling, systems simulation and testing, system simplification and optimisation and cost reduction of auxiliary components and balance of plant. Stationary fuel cell CHP systems for small domestic (~ 1 to 5kW) and large scale de-centralised (MW scale) are covered in this section. Medium scale stationary (typically 100-500kW), and large and small FC systems and generic on-board fuel processing for transport (APUs, automotive, truck, rail, marine and aircraft applications) are covered under the *Joint Call on component development and systems integration of hydrogen and fuel cells for transport and other applications* with the express intention to promote component and sub-system synergies for these applications (see section 6.1.4.2.2).

¹³ International Partnership for the Hydrogen Economy (IPHE) members : Australia, Brazil, Canada, China, France, Germany, Iceland, India, Italy, Japan, Korea, Norway, Russia, United Kingdom, United States, European Commission.

¹⁴ The Johannesburg Renewable Energy Coalition (JREC) launched at the World Summit on Sustainable Development includes 85 members from the Northern and Southern hemispheres. The JREC members are committed to achieve a significant increase in the share of renewable energy.

¹⁵ Carbon Sequestration Leadership Forum (CSLF) members : Australia, Brazil, Canada, China, Colombia, European Commission, Germany, India, Italy, Japan, Mexico, Norway, Russian, Federation, South Africa, United Kingdom, United States.

Research areas and topics for 2005 (Call 2005.ML) – Call closed.

Proposals are invited for the following topics:

Basic materials and industrial process research on functional materials for fuel cells.

Fundamental research on multi-functional materials is required to achieve breakthroughs to overcome the remaining technological barriers to commercialisation of fuel cells and hydrogen. For fuel cells, effort is to be directed at reducing cost, improving specific performance and durability and overcoming temperature related problems (thermal stress, humidification, corrosion, low temperature performance). This implies development of highly efficient, low cost multi-functional materials and processes.

Research will therefore include fundamental materials research on proton and ion conducting electrolytes (polymer and ceramic), gas diffusion layers, non-noble catalysts, including in-situ characterisation and modelling to improve *inter alia* understanding of gas and water transport and degradation mechanisms.

Research is also expected to include high performance materials, capable of being produced at large scale and low cost, for bi-polar plates, electrode sealing.

IPs should also address the suitability for scaling up to mass manufacture, issues relating to recycling and disposal, and include studies and detailed value analysis to support cost predictions for series production.

RTD focus should be on materials suitable for Proton Exchange Membrane Fuel Cell (PEMFC) operation in the range 130-200°C, and on materials enabling Solid Oxide Fuel Cell (SOFC) to operate at intermediate temperatures (ca 600°C), ensuring complementarity with recently launched projects in these fields.

Instrument: this topic is open only for IP proposals. To address the goals of this topic it is expected that two IPs could be funded - addressing respectively polymer electrolyte fuel cells and ceramic electrolyte fuel cell materials; the IP's will normally link materials research to process research (e.g. feasibility to bring process to pilot scale).

The IPs should include multi-disciplinary teams comprising scientists and process engineers, with a strong industrial participation. Opportunities for including research organisations from third countries specialising in relevant materials research should be fully explored –including in particular those participating in the International Partnership for the Hydrogen Economy (IPHE).

NOTE: The research activities carried out under this topic should be complementary to, and will be co-ordinated with, the activities for STREPs to be proposed in the same topic in the work programme for Priority 3 (NMT) to be updated in September 2004.

Development of durable, cost-competitive high temperature fuel cell systems for clean, safe, and cost-effective decentralised/centralised power generation, combined heat/cold and power for eventual applications in the scale hundreds of kW to several MW. Support will be for technologies having the potential to reach 1000 €/kW in production scale (at system level), 50.000 hours durability and exceeding 60% efficiency, or 80% in CHP mode. Research will focus on system level issues: new systems design including hybrid concepts, modularity; modelling and integration; BoP including system electronic control and associated power electronics; grid connection; fuel flexibility; safety, energy/environment life cycle analysis; testing and verification of components and subsystems at representative pilot scales.

Instrument: this topic is open only for IP proposals. To address the goals of this topic it is expected that one IP could be funded. Opportunities for including innovative SMEs should be fully explored - especially as regards component level development.

NOTE: The focus here is large scale stationary generation and CHP. Proposals relating to intermediate scale (e.g. 100-500kW) fuel cell systems adaptable to stationary, road,

marine and aircraft applications will be considered under the Joint Call on component development and systems integration of hydrogen and fuel cells for transport and other applications (see section 6.1.4.2.2.2).

Development of cost-competitive fuel-cell systems for small scale domestic CHP systems in the 1 to 5 kW range and associated BoP components. The main target is to develop packaged solutions for small domestic Fuel Cell Combined Heat/Cold and Power systems with a cost of less than 400 €/kW (for series production), and with a durability of more than 30000 hours. Research will focus on system level issues: new system design, modularity; system modelling and integration; BoP; electronic control systems aiming at optimal heat/cold/power management, gas/electrical grid connection and/or connection with local RES systems; fully integrated fuel processor and reformat gas purification (if necessary), fuel flexibility (e.g. NG, LPG); system safety, energy/environment life cycle analysis; bench testing and verification of components and systems, recycling and disposal. Preference will be given to proposals which cover as many technical and socio-economic issues as appropriate to achieving synergies between component technologies, system integration and fuel processing for various applications.

Instrument: this topic is open only for IP proposals. To address the goals of this topic it is expected that one IP could be funded. Opportunities for including innovative SMEs should be fully explored - especially as regards component level development.

NOTE: The focus here is small scale domestic CHP. Proposals relating to intermediate scale (e.g. 100-500kW) fuel cell systems adaptable to stationary, road, marine and aircraft applications will be considered under the Joint Call on component development and systems integration of hydrogen and fuel cells for transport and other applications, including Auxiliary Power Units and on-board fuel processors (see section 6.1.4.2.2.2)

Generic tools for FC systems modelling, testing, safety and quality assurance.

Development of integrated mathematical modelling tools to support design, manufacture, safety, quality assurance and optimisation of integrated fuel cell systems. System level modelling should be integrated with testing, enabling performance benchmarking of combinations of real and virtual components – so-called “hardware in the loop” concepts (e.g. use of models to simulate duty cycles and apply simulated loads). Scope and resolution of modelling development may extend to individual component and system levels, covering multi-phase fluid flows, heat and mass transfers, chemical kinetics at cell, stack, fuel processor and system level (this must be complementary to existing research on modelling); model verification through laboratory and bench testing; validation of FC test protocols and procedures which may involve bench testing of state of the art components; building on previous networking activities, or linking with ongoing projects.

Instrument: this topic is open only for STREP proposals. To address the goals of the topic, it is expected that more than one STREP could be funded. Proposals should address specific theoretical aspects of modelling and/or system modelling and testing; consideration should be given to integrate modelling and testing where relevant and appropriate (e.g. “hardware in the loop” concepts).

Industrial participation preferably including software companies for model development is essential; the aim should be to consolidate a comprehensive, complementary EU modelling/ testing infrastructure capability for objective, independent simulation/testing of prototype components and demonstrators; opportunity for SME participation; model development (especially theoretical aspects) may benefit from international co-operation.

N.B. See also Joint Calls in Chapter 6.1.4.

Research areas and topics for 2006

It is expected that the final call for M-L term actions will be focussed on Co-ordination Actions, Specific Support Actions and, possibly, further international co-operation initiatives. Details will be confirmed in a further update of the Work Programme in 2005.

6.1.3.2.2. *New technologies for energy carriers/transport and storage, in particular hydrogen*

[Activity Codes : SUSTDEV-1.2.2 (hydrogen); SUSTDEV-1.2.3 (electricity)]

Hydrogen and electricity have the potential to become the principal, interlinked energy carriers in a future sustainable energy economy. Together they can provide a unique pathway for gradually becoming progressively less dependent on fossil fuels, reducing greenhouse gas and pollutant emissions and increasing the contribution of renewable energy sources.

In the long term, hydrogen could play a key role in adapting energy supply to energy demand as hydrogen has the potential for large-scale, even seasonal, energy storage. The transition towards future sustainable energy networks based on a large share of renewable and distributed generation requires the preparation of the European energy system for the large-scale integration of Distributed Energy Resources (DER). This concept will play a key role in transforming the conventional electricity transmission and distribution grid into a *unified and interactive energy service network* using common European planning and operation methods and systems.

For hydrogen, the strategically important areas in which research should be concentrated are : **clean production** (*development and techno-socio-economic assessment of cost-effective pathways for hydrogen production from existing and novel processes*), **storage** (*exploration of innovative methods, including hybrid storage systems, which could lead to breakthrough solutions*), **basic materials** (*functional materials for electrolysers and fuel processors, novel materials for hydrogen storage and hydrogen separation and purification*), **safety** (*pre-normative RTD required for the preparation of regulations and safety standards at EU and global level*), and **preparing the transition to a hydrogen energy economy** (*support the consolidation of current EU efforts on hydrogen pathway analysis and road mapping*).

For electricity, the strategically important areas in which research should be concentrated are : **a new approach for large-scale implementation of Distributed Energy Resources (DER) in Europe** (*design, development and validation of novel components and DER solutions needed for future interactive energy service networks, including the integration of intermittent Renewable Energy Sources and Distributed Generation*), and **the development of key enabling technologies** (*for distributed energy networks with high energy efficiency, power quality and security of service, including analysis of RTD needs for transmission systems; advanced power electronic converters and distributed storage systems for network applications; and high temperature superconductor based components for electrical applications, such as generators, fault current limiters and transformers*).

Research areas and topics for 2005 (Call 2005.ML) – Call closed.

Proposals are invited for the following topics:

HYDROGEN

Advanced concepts for electrochemical hydrogen production¹⁶. The main objective is the development of highly efficient electrochemical systems that allow achieving substantial cost reductions and high current densities compared to the state-of-the-art alkaline water electrolyzers. Research should focus on: synthesis and testing of innovative, low-cost materials to be used in the main components (i.e. electrodes, electrolytes, interconnectors, etc). Final outcome should be the development of low-cost fabrication techniques for all these components and the design, construction and testing of a prototype electrolyser. The target peak efficiency should be higher than 90% and durability exceeding 50.000 hours. The potential integration of the prototype electrolyser with intermittent renewable energy sources should also be assessed with a view to matching characteristics in order to obtain optimally efficient, zero-emission hydrogen production system. Due attention should be given to matching electrolyser performance and durability with expected application and duty cycles. Reversible fuel cell electrolyzers are also of interest, providing technologies proposed offer real prospects of achieving at least 50% round trip efficiency and comparable durability.

Instrument: this topic is open only for STREP proposals. To address the goals of the topic, it is expected that more than one STREP could be funded. This topic may be particularly suitable for the participation of innovative SMEs - especially as regards component level development.

NOTE : cross-cutting proposals for complete, Renewable Energy Source based hydrogen production systems using electrolysis may be considered, provided they introduce innovative concepts for optimising the complete system – integrating state-of-the-art systems is not considered innovative in this context.

Development of advanced small fuel processing units for de-centralised hydrogen production. The main target is the development of new, efficient and low cost multi-fuel processors for liquid and gaseous hydrocarbon fuels (NG, LPG, gasoline, diesel, methanol, ethanol) for distributed production of hydrogen for final use in hydrogen dispensers for transport and stationary applications (e.g. fuel cells). Main emphasis should be on fundamental research for the comprehension and development of novel, efficient and cost-effective functional materials (e.g. catalysts, membranes) including design and fabrication techniques and integrated concepts for the fuel reforming, water gas shift and final hydrogen purification steps. Engineering aspects of the fuel processing unit, including innovative heating methods and optimisation of the balance of plant components, should also be addressed with a view to future commercial development of integrated, packaged, concepts capable of fuelling in the order of 20 to 100 vehicles per day. The scope for gaining efficiency improvements due to scale by combining hydrogen supply for vehicle fuelling dispensers with hydrogen supply for localised stationary applications should be investigated. Substantial efficiency improvement (and consequent overall CO₂ reductions) and reduced capital costs with respect to the state-of-the-art processing units should be the expected outcome.

Instrument: this topic is open only for STREP proposals. To address the goals of the topic, it is expected that one STREP could be funded. This topic may be particularly suitable for the participation of innovative SMEs - especially as regards component level development.

¹⁶ The 3rd call for proposals focuses research efforts on decentralised hydrogen production as critical technologies for the transition to mass hydrogen markets. The development of technologies needed for the large-scale centralised production of hydrogen (e.g. high temperature thermochemical water splitting) is being addressed in ongoing activities as well as in other topics of the Work Programme (e.g. CO₂, biomass, concentrated solar thermal). The various options will continue to be considered in the future, depending on the results of these activities.

Development of innovative materials and novel storage methods, which could lead to breakthrough solutions for hydrogen storage. The main objective is to develop advanced and novel materials and methods for radically new reversible hydrogen storage media for stationary and transport applications. Research should address: (i) novel analytical and characterisation tools and measurement techniques to better understand the physico-chemical mechanisms of hydrogen storage in the novel materials investigated; (ii) new materials, storage methods and fabrication processes that provide the energy density and the charge/discharge storage/restitution rates needed for the different sources of hydrogen and potential end use applications; (iii) development of numerical methods for optimal storage systems design, based on phenomenological modelling of thermo-mechanical-chemical behaviour of materials. The emphasis should be on breakthrough innovative solutions that can simultaneously enhance safety, energy efficiency, storage kinetics, weight ratio (potential for at least 6% hydrogen gravimetric uptake at storage system level for vehicles) and operating conditions. For transport applications two types of solutions should be investigated: “reversible on-board storage” (based on metal hydrides, carbon and non-carbon adsorbents, or hybrid concepts) and “regenerative off-board storage” (based mainly on chemical hydrides). Up-scaling and efficient processes for producing the most promising materials may also be addressed, as well as development of test protocols, evaluation facilities, and storage systems development.

Instrument: this topic is open only for IP proposals. To address the goals of this topic it is expected that one IP could be funded. Opportunities for including research organisations from third countries specialising in relevant materials research should be fully explored - including in particular those participating in the International Partnership for the Hydrogen Economy (IPHE).

NOTE: The research activities carried out under this topic should be complementary to, and will be coordinated with, the activities for STREPs on leading edge research on specific nano-structured materials to be proposed in the same topic in the work programme for Priority 3 (NMT) to be updated in September 2004.

Pre-normative research for regulations and standards for hydrogen storage and delivery systems. The main objective is to generate the technical knowledge base necessary for assuring safety, operability, and maintainability of hydrogen storage and delivery systems for transport and stationary applications. This will include a mix of theoretical analysis, impact assessment and component and system testing to support the definition of best practice for safe handling and use of hydrogen. This pre-normative effort should build on current and previous RTD and demonstration experience to provide the basis for a framework comprising regulations and codes of best practice - which will be required for cost-efficient, pan-European harmonised approval and permitting processes for hydrogen storage and delivery. Work is expected to include investigation of minimum safe set-back distances, lifetime safety assessment of components and systems, development of fully integrated hydrogen safety systems, based on the results of risk analysis and FMEA. Research may also include simulation, measurement, detection and management of unscheduled hydrogen releases.

Instrument: this topic is open only for STREP proposals. To address the goals of the topic, it is expected that more than one STREP could be funded. Opportunities for including research organisations from third countries specialising in relevant pre-normative research should be fully explored – including in particular those participating in the International Partnership for the Hydrogen Economy (IPHE).

N.B. See also Joint Calls in Chapter 6.1.4.

Advanced grid architectures for the integration of DER within local distribution networks, including micro-grids. The objective is to develop and validate advanced grid architectures which enable a large integration of DER into LV distribution networks and which can be interconnected with other networks or islanded. Experimental validation of one or more micro-grid architectures in different cases (islanded, interconnected or hybrid) should be tested with technical and commercial protocols and advanced hardware such as power electronics and smart storage. Proposals should address among others the following subjects: development, comparison and testing of new alternative control concepts and algorithms; grid connected and islanded operation; development of interface and communication protocols and components, including aspects related to storage, micro-grids and energy trading.

Instrument: this topic is only open for STREP proposals. To address the goals of the topic, it is expected that more than one STREP could be funded. This topic may be particularly suitable for the participation of innovative SMEs.

Operation concepts and tools for maximising the value of DG/RES in electrical power systems (Large-scale Virtual Power Plants, LSVPP). The objective is the development and validation of Decentralised Energy Management Systems with high penetration of Distributed Generation and Renewable Energy Sources while maintaining the stability and power quality of the distribution networks. Emphasis will be put on the development of “Large-Scale Virtual Power Plants” concepts to operate active networks so as to exploit/optimize the multiple benefits of large numbers of DG/RES (such as economics, network reliability and environmental impacts) and open markets that are now near to reaching cost effectiveness. The scope of the topic should be limited to the work that is essential for the development of the LSVPP concept. Power electronics, business models, social acceptance and regulatory frameworks addressed in this topic should be complementary to running projects in this and other areas of the FP6. The work should focus on key issues to develop LSVPP which operate active networks, such as: system level development; energy system compatibility and simulation tools; operational functions and strategies; distributed real-time monitoring and control of distributed generators; storage systems and loads; real-time energy exchange and ancillary services trading; optimisation of the generators mix, including their location on the grid; “plug and play” communication solutions for DG/RES components; interaction with existing supervisory systems; environmental benefits and validation in a pilot installation.

Instrument: this topic is only open for IP proposals. To address the goals of the topic, it is expected that one IP could be funded. Opportunities for including SMEs should be fully explored.

European Network of Excellence of DER Laboratories for Pre-standardisation. The objective of this NoE should be to integrate the major existing EU laboratories and world class research groups to develop common requirements, quality criteria, as well as proposing European test and certification procedures for systems and components aiming at establishing the sustainable integration of RES and DG in future electricity networks. The goal is to overcome present fragmentation and redundancy resulting from separate

¹⁷ See also Section 6.1.3.1.1.1 of this Work Programme for research activities having an impact in the short and medium term.

¹⁸ RTD activities related to the development of systems and tools for large scale blackouts analysis and prevention might be also relevant to the theme on interdependencies of the strategic objective on security and dependability of the IST Work Programme 2005-2006, to be published towards the end of the year. If appropriate, projects financed by the two programmes will be co-ordinated and could be clustered.

national activities and regulations by developing an integrated European Group for pre-normative research on DER at the European and international level.

Instrument: this topic is only open for NoE proposals. To address the goals of the topic, it is expected that one NoE could be funded. Opportunities for including research organisations from the new Member States and Candidate Countries should be fully explored.

Advanced power electronic converters for the future European Electricity Network.

The scientific and technical objectives are the development and validation of new power electronic converters for transmission and distribution networks, designed to optimise power transmission capabilities, improve power quality and reliability, minimise losses and cost, integrate storage devices etc. Proposals should address in particular the following subjects: the study, design, development and validation of power converters for electricity networks based on advanced power electronic components, including optimised control strategies. Interaction with electricity grids and an appropriate economic assessment should be covered as well.

Instrument: this topic is only open for STREP proposals. To address the goals of the topic, it is expected that more than one STREP could be funded.

HTS Devices for Electricity Networks. The objective of this topic is the development and testing of HTS devices to improve the performance and stability, or efficiency of electricity networks. Emphasis will be put on the engineering of functional devices and their application and operation in electrical networks to demonstrate functionality and system benefits. Such HTS devices could include generators, transformers and current limiters. Proposals should address in particular the following subjects: modelling of the HTS device and evaluating its impact on electrical system performance; HTS conductor winding or manufacturing technologies, excluding the development of materials or conductors themselves; designing of the HTS device; developing cooling and cryogenic systems and laboratory testing of devices as well as the relevant economic analysis. Proposals should include the development of a pilot prototype.

Instrument: this topic is only open for STREP proposals. To address the goals of the topic, it is expected that more than one STREP could be funded.

Preparing the Future European Electricity Transmission Networks. Transmission System Operators in Europe are facing similar networks problems and, not being in competition between themselves, should welcome common solutions. At present, collaboration is limited, and research is dispersed under often redundant national initiatives which might benefit from co-ordination at European level. The objective of this topic is to consolidate the RTD needs and efforts required for the definition of a future European Transmission Network able to optimise the reliability of power supply within growing European Distributed Generation and Renewable Energy markets and offering a transparent access to new players. This Co-ordination Action should mainly assess the feasibility to setup an autonomous European Energy Grid Research Organisation, co-financed by TSOs (including neighbours of EU-25 members), the EC and other relevant actors. The main objective of the Organisation should be to consolidate and co-ordinate the R&D needs and effort for the design, development and validation of the concepts of the Future European Electricity Network, compatible with a large penetration of RES and DG, and to develop a dynamic simulator of the network, useful for testing as well as for the training of grid operators.

The Co-ordination Action should aim at: agreeing on and co-ordinating common objectives and RDT needs for the future European Transmission Network; identifying potential partners of the Organisation and potential financing tools and means; defining the legal framework for the Organisation and its implementation plan.

Instrument: this topic is only open for CA proposals. To address the goals of the topic, it is expected that one CA could be funded.

Co-ordination Action for European Distributed Energy Resources. The objective is to launch, co-ordinate and promote activities aimed to consolidate all European RTD activities for the large-scale integration of DER in the electricity market. The topic builds on an existing Thematic Network in 5FP, but expands the scope and so will require a new partnership with a well balanced participation from the utility, equipment supply and research sectors. The work should contribute to overcome the fragmentation in national research structures by consolidating all European DER research activities and should cover the assessment of cost benefits and barriers of DER Systems within the present and future regulation frameworks of the EU-25. Proposals should address among others the following subjects: overall analysis of results and recommendations obtained from 5FP & 6FP RTD projects in the field of DER integration; identification and assessment of the latest critical developments in Europe and their optimal use for European progress in DER integration, including technical testing, market and legislative aspects as well as a useful action for the dissemination of project results in 5-6FP, promotion of public awareness and institutional training programmes. It would require co-ordination and dialogue with major EU electricity traders, regulators, policymakers, manufacturers and public/private research groups to facilitate the streamlining of the integration of DER in the European market and third countries. Efforts may address requirements and interfaces with international initiatives in this field.

Instrument: this topic is only open for CA proposals. To address the goals of the topic, it is expected that one CA could be funded. Opportunities for including actors from new Member States and Candidate Countries should be fully explored.

Research areas and topics for 2006

It is expected that the final call for M-L term actions will be focussed on Co-ordination Actions, Specific Support Actions and, possibly, further international co-operation initiatives. Details will be confirmed in a further update of the Work Programme in 2005.

6.1.3.2.3. *New and advanced concepts in renewable energy technologies*

[Activity Codes : SUSTDEV-1.2.4 (PV); SUSTDEV-1.2.5 (biomass); SUSTDEV-1.2.6 (Other RES)]

Renewable energy technologies have, in the long term, the potential to make a large contribution to the EU and world energy supply. The main targets are to decrease the cost of electricity and fuel to competitive levels through developing highly efficient concepts and bringing about major cost reductions in the entire production chain, as well as improving the reliability, safety, availability and durability of renewable energy systems.

For **photovoltaics**, the strategically important areas in which research should be concentrated are : **innovative concepts and fundamental materials research for the next generation of PV technologies** (e.g. organic or hybrid solar cells), **thin film PV technology** (development of cost-effective PV cells and modules based on new and improved technologies and materials), **PV processing and automated manufacturing technologies** (to reduce the costs and improve materials usage in the manufacture of PV cells and modules), **PV components and systems – balance of systems** (research into components and their integration into the overall system) and **the research for innovative applications of PV in buildings and the built environment** (to develop integrated PV module systems which are configured for ease of mounting on building

roofs and facades, hybrid PV/heating systems). The main targets are to: decrease the investment cost for PV systems to 1-2 €/Wp (with a module cost of 0.5-1 €/Wp) by 2015 and to decrease PV electricity cost to significantly below 0.1 €/kWh by 2015.

For **biomass**, the strategically important areas in which research should be concentrated are : RTD for **reliable, efficient and cost-effective combustion technologies** (*with significant reduction of atmospheric pollutants, operation of large scale systems with multifuel resources including co-firing, self-running processes for small scale systems using standardised feed-stock*), **reliable and cost-effective gasification systems** (*aimed at the efficient production of electricity and clean hydrogen-rich gas*), **new methods for cost effective production of clean biofuels** (primarily from lignocellulosic feedstock) **to be used in combustion engines and fuel cells including pre-normative research and standardisation, energy from bio-residues and energy crops** (*innovative, low emission waste-to-energy and crop-to-energy concepts and technology development*) and **biomass fractionation processes (bio-refinery)** for the integrated production of energy and other products. The main targets are: to decrease the cost of electricity production with biomass to 0.05 €/kWh by 2015-2020 and to decrease the cost of biofuels to 10 €/GJ (0.036 €/kWh) by 2020.

For **other renewable energy sources** having the potential to contribute significantly to the EU energy supply in the medium-to-long term, the strategically important areas in which research should be concentrated are : **wind** (*research and integration of efforts needed to solve the challenges of on- and off-shore systems by developing innovative new materials, enhanced aerodynamics, and novel designs for structures and foundations, along with associated pre-normative research. Methods and techniques that reduce the uncertainty of costs and production, on the basis of more accurate and cheaper measurement and modelling of site climate conditions - both for resource assessment and design*), **geothermal** (*to verify the technical feasibility, cost-effectiveness and environmental sustainability of electricity production from enhanced geothermal systems and other unconventional geothermal resources, through innovative research into exploration, resource assessment and management techniques, cheaper and more advanced drilling and stimulation technologies, and more efficient power cycles*), **ocean** (*new concepts to improve the availability and predictability of deliverable energy, coupled with better installation and production methods, and harmonised testing methods to support the development of cheaper and safer on- and offshore systems*), and **concentrated solar thermal** (*for electricity and heat generation: new concepts for low-cost, efficient and reliable components and systems, and hybrid systems capable of operating with solar and other fuels; for non-electrical processes: high temperature chemical solar reactors for the production of energy carriers such as hydrogen*). The main target is to decrease the cost of electricity production with these RES to 0.05 €/kWh by 2020.

Research areas and topics for 2005 (Call 2005.ML) – Call closed.

Proposals are invited for the following topics:

PHOTOVOLTAICS

Advanced techniques for low-cost thin-film cells and modules. The objective is to provide the scientific and technological basis for industrial mass production of cost effective and highly efficient, environmentally-sound, large-area thin film solar cells and modules. This includes development of the process know-how and the production technology as well as the design and fabrication of specialised equipment. The research

should aim at improving existing technologies and also at identifying and testing new materials and technologies with higher potential for cost reduction. Cadmium-free compound semiconductor based, as well as silicon based, thin-film technologies should be covered. Advances in materials and device concepts on cell and module level should be included. The cost target for module production is 0.5 euro/Wp.

Instrument : this topic is only open for IP proposals. To address the goals of the topic, it is expected that one IP could be funded.

Pre-normative actions focusing on performance assessment, including BIPV codes.

The objective is to conduct pre-normative research, to develop more reliable test procedures and measurement methods for innovative types of PV modules, harmonising measurement and evaluation techniques. The research should cover, for example, development and validation of PV module life-time assessment procedures for several PV technologies, including crystalline silicon and thin-film PV, and for building-integrated PV codes and standards. The activities should aim at improving the competitiveness of the PV industry for both the European and world market.

Instrument : this topic is only open for IP proposals. To address the goals of the topic, it is expected that one IP could be funded.

R&D on high throughput industrial manufacturing of thin-film silicon PV modules using low-cost roll-to-roll technology. The objective is to develop roll-to-roll technology (metal and polymer foil substrates) resulting in modules costing less than 0.5 €/Wp and with 11% efficiency lasting more than 20 years.

Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that one STREP could be funded.

Development of solar-grade silicon feedstock, wafers and cells. The objective is to achieve a significant cost reduction through more efficient cleaning processes for raw materials; to secure high volume production of solar grade silicon; and to develop recycling techniques for end-of-life products. The research should cover purification of metallurgical silicon feedstock, aiming to reduce costs down to 15 Euros per kg and to shorten energy payback time to 6 months; manufacturing of 150 mm x 150 mm wafers aiming at 16 to 17 % cell-efficiency for large-scale, low-cost automated production with increased yield.

Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that one STREP could be funded.

Large area CIS module for MW-scale production. The objective is to develop advanced manufacturing techniques for low-cost, stable, high efficiency and environmentally sound thin-film CIS solar cells and large area modules. The research should cover transfer from laboratory scale to cost-effective mass production of modules; Cd-free large area modules; and electro-deposition techniques for the CIS layer.

Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that one STREP could be funded.

Stable organic PV cells and modules. The objective is to integrate the EU research groups and centres of excellence in the area of organic and dye-sensitized nanocrystalline materials, with a view to the accelerated development of low-cost, stable PV cells. Activities could include the setting-up of efficient tools and structures for communication, information exchange between the researchers, dissemination of information to industry (e.g. stakeholders' forum, "virtual academy") and the analysis of socio-economic and environmental impact of the technologies; joint research will focus on the optimisation of system performance combined with low-cost manufacturing.

Instrument : this topic is only open for NoE proposals. To address the goals of the topic, it is expected that one NoE could be funded. Efforts should be made to include innovative SMEs.

BIOMASS

Cost effective liquid biofuel production from biomass. The objective is to explore the non-thermal production of bioethanol from lignocellulosic feedstock, primarily for the transport sector. Important research items are amongst others process development, process optimisation from laboratory to pilot-scale (e.g. enzymatic hydrolysis, process integration), feedstock logistics and the comparative assessment of lignocellulosic bioethanol potential in terms of cost, environmental benefits and socio-economic aspects.

Instrument : this topic is only open for IP proposals. To address the goals of the topic, it is expected that one IP could be funded.

Energy from crops. The objective is to develop productive and low cost agricultural feedstock production systems covering the whole chain from perennial crops to energy. Issues to be addressed include increased yield and improved characteristics of crops, crop management and harvesting, pre-treatment, handling, logistic issues and conversion technologies. Proposals should focus on specific crops, e.g. crops that are either relevant for northern Europe or for southern Europe.

Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that more than one STREP could be funded.

Production of hydrogen-rich gas from multiple biomass feedstock. The objective is to develop non-thermal processes for the production of hydrogen rich gas for use in power or bio-fuel production using a broad feedstock basis (including bio-residues). Research should cover bacterial and enzymatic pathways, innovative methods to increase bio-degradation yield, gas cleaning and gas quality assessment.

Instrument : this topic is only open for IP proposals. To address the goals of the topic, it is expected that one IP could be funded.

Integrated production of energy and other products through the concept of bio-refinery. The objective is to cover the whole chain from various biomass-based production schemes downstream to upgraded materials and chemicals, refined fuels and direct conversion to energy in order to integrate the production of bio-energy and other bio-products (fuels, chemicals and materials) through the bio-refinery approach. Research should address in particular integrated biomass-based production systems using advanced fractionation and conversion processes.

Instrument : this topic is only open for IP proposals. To address the goals of the topic, it is expected that one IP could be funded.

Pre-normative research and standardisation The objective is to cover pre-normative research on (a) a wide spectrum of liquid biofuels (including bio-ethanol, biodiesel, synfuel and other types of biofuels), and (b) solid biofuels (including recovered solid biofuels). The research should address rapid testing and quality management, and should aim to prepare for future standardisation and certification.

Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that more than one STREP could be funded.

Advanced biomass gasification technologies. The objective is to develop innovative gasification technologies for efficient power production (for example Integrated Gasification Combined Cycle) for multiple biomass feedstock. Projects should address

one or more of the following topics: feedstock handling and processing, advanced and low-cost hot flue gas cleaning, gas quality assessment, process integration and optimised control systems to allow operation on varying load and feedstock properties.

Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that more than one STREP could be funded.

Co-ordination of research activities in the field of biomass co-firing. The objective is to co-ordinate ongoing research and to promote the development and uptake of innovative methods and technologies to expand the use of biomass co-firing, both in new and in existing power plant. Proposals should address the assessment of ongoing research, the identification of best practices, gaps in knowledge and barriers to implementation, and propose strategies for implementation as well as directions for future research.

Instrument : this topic is only open for CA proposals. To address the goals of the topic, it is expected that one CA could be funded. Opportunities for including research organisations from the new Member States and Candidate Countries should be fully explored. The participation of Third Countries is particularly encouraged.

OTHER RENEWABLE ENERGY SOURCES:

WIND

Innovative materials, modelling and designs for future wind energy converters. The objective is to develop significantly improved wind turbine components from blade tip to foundations using new materials, improved modelling techniques and innovative designs aiming at lightweight, reliable and efficient turbines with reduced environmental impact. Issues to be addressed include new materials, adaptation and improvement of models, development of lightweight, high-strength and durable turbine components, optimisation of blades and generators, systems interfacing, research on machine loads and the response of the structure, and integration of advanced control and monitoring issues. Furthermore, the objectives should include pre-normative research on wind turbine components and performances (in particular blades and power curves) and developing harmonised measurement and testing methods, with a view to prepare for standardisation and certification.

Instrument : this topic is only open for IP proposals. To address the goals of the topic, it is expected that one IP could be funded. Efforts should be made to include innovative SMEs.

Design and development of large (> 5MW) turbines. The objective is to develop very large turbines (> 5MW), in particular for use in offshore wind farms, for which designs can no longer be an upscaling of existing smaller models. Issues to be addressed include the development of advanced drive trains and controls, optimisation of turbine size and installation costs.

Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that one STREP could be funded.

Output forecasting for multi-MW offshore wind- and wave energy installations. The objective is to co-ordinate existing model-development activities, including proper interfacing towards integration of the various models to assess and predict power output for offshore wind- and wave-energy installations. This coordination should lead to better coherence of models, improved confidence in output data to reduce the technical and economic risks prior to installation, and to improve the control systems for power take-off and grid supply planning. Issues to be addressed include resource assessment, optimisation of the topology of wind- and wave-energy installations, short to long term wind and wave

power prediction using meteorological data, and economic simulations to minimise investment risks.

Instrument : this topic is only open for CA proposals. To address the goals of the topic, it is expected that one CA could be funded.

GEOHERMAL

Co-ordination and structuring of research, technology transfer and information dissemination in the field of enhanced geothermal systems and other unconventional geothermal resources. The objective is to co-ordinate ongoing research and to promote the development and uptake of innovative methods and technologies to expand the exploitation of unconventional geothermal resources, in particular enhanced geothermal systems. Proposals should address the assessment of ongoing research, the identification of best practices, gaps in knowledge and barriers to implementation, and propose strategies for implementation as well as directions for future research.

Instrument : this topic is only open for CA proposals. To address the goals of the topic, it is expected that one CA could be funded. Opportunities for including research organisations from the new Member States and Candidate Countries should be fully explored.

Improved exploration methods for deep geothermal resources. The objective is to develop innovative, cost-effective and accurate exploration methods for deep geothermal resources in order to reduce the risk prior to drilling. The research should cover the development of integrated geophysical techniques for the detection of fractured and/or fluid bearing prospective geothermal zones, and include advanced processing, interpretation and modelling approaches.

Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that one STREP could be funded.

High-temperature downhole tools and instruments. The objective is the development and testing of innovative, reliable tools and instruments for the characterisation and exploitation of high-temperature unconventional geothermal energy resources.

Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that one STREP could be funded.

OCEAN

New concepts for ocean energy converters. The objective is to create the knowledge and critical mass to develop new and innovative technologies and prototypes for wave and tidal stream energy converters. Issues to be addressed should include amongst others new materials and coatings, manufacturing systems, power take-off systems, output prediction, grid connections, mooring or foundations, harmonised testing methods and comparative assessment of the converters' potential in terms of cost and environmental and socio-economic impact. An important point would be to provide research services and testing facilities to developers and SMEs.

Instrument : this topic is only open for IP proposals. To address the goals of the topic, it is expected that one IP could be funded. Efforts should be made to include innovative SMEs.

Reliable, low-cost ocean energy converters. The objective is the development and real sea testing of prototypes of proven concepts with significant potential for reaching the cost targets for power production. Issues to be addressed include performance monitoring, maintenance and control, and reliability assessment.

Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that more than one STREP could be funded.

CONCENTRATED SOLAR THERMAL

Development of solar thermal reactors for hydrogen production. The objective is to address the development of new and innovative solar thermal reactors (including hybrid systems) to produce hydrogen at significantly reduced costs compared to existing technologies. Proposals should focus on either thermo-chemical reactions, reforming, cracking or gasification pathways. Issues to be addressed include cost, performance, life cycle, environmental and socio-economic impact assessments.

Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that one STREP could be funded.

Solar hybrid power plants. The objective is to develop and test a prototype hybrid power plant that combines concentrating solar thermal (CST) systems with other fuels, with a view to providing reliable, affordable and environmentally sustainable heat and power. Issues to be addressed include the development of components that allow dual operation, as well as the optimisation or the development of innovative CST components.

Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that one STREP could be funded. Opportunities to include research organisations from Third Countries should be explored.

Research areas and topics for 2006

It is expected that the final call for M-L term actions will be focussed on Co-ordination Actions, Specific Support Actions and, possibly, further international co-operation initiatives. Details will be confirmed in a further update of the Work Programme in 2005.

6.1.3.2.4. *Capture and sequestration of CO₂, associated with cleaner fossil fuel plants*

[Activity Code : SUSTDEV-1.2.7]

Global and EU energy supply will, for the foreseeable future (2015 - 2020), be dominated by fossil energy sources. However, their CO₂ emissions are a major drawback in the context of global climate change. The challenge is therefore to be able to use these fossil fuels whilst eliminating CO₂ through cost-effective capture and sequestration and at the same time maintaining EU industrial competitiveness in global markets. *Targets: reduce the cost of CO₂ capture from 50-60 € to 20-30 € per tonne of CO₂ captured, whilst aiming at achieving capture rates above 90%, and assess the reliability and long term stability of sequestration.*

For capture and sequestration of CO₂, the strategically important areas in which research should be concentrated are : **post-combustion CO₂ capture** (RTD on new and retrofit options for post-combustion capture of CO₂ and suitability for subsequent sequestration options.), **pre-combustion CO₂ capture** (RTD on pre-combustion CO₂ capture options such as de-carbonisation and oxy-fuel techniques. RTD on suitability of captured gases for subsequent sequestration options will form part of this research.), **geological sequestration of CO₂** (RTD aiming at safe, reliable and stable cost-effective sequestration options such as saline aquifers, enhanced coal bed methane and enhanced oil recovery. Sequestration potential, long term geological stability and geochemical interactions, public acceptance and cost are key issues.), and **chemical/ mineral sequestration of CO₂** (Comparison of the available options, as well as other innovative solutions and uses of the products. Public acceptance, sequestration potential, transport and mining activities, environmental impact, applied chemistry and kinetics are key issues.).

Research areas and topics for 2005 (Call 2005.ML) – Call closed.

Proposals are invited for the following topics:

CO₂ capture and hydrogen production from gaseous fuels. In the transition to the hydrogen economy, decarbonised fossil fuels will be pivotal. Previous European projects have addressed mostly solid fuels. The main objective is to research and develop technologies to produce hydrogen and at the same time capture CO₂ from gaseous fuels then select the most promising one and take it to a pilot stage demonstration. Important elements include a wide technical scope looking at several technologies, with for example costing studies, environmental aspects, dissemination and hydrogen quality.

Instrument : this topic is only open for IP proposals. To address the goals of the topic, it is expected that one IP could be funded. Opportunities for including research organisations from third countries should be fully explored – including in particular those participating in the Carbon Sequestration Leadership Forum (CSLF).

The monitoring and verification of CO₂ geological storage. a promising way forward for the mitigation of CO₂ emission is geological storage. A crucial aspect of it is reliability and safety which will come from R&D into monitoring, measurements and verification on multiple sites. The main objective is to prove the reliability and safety, in the long term, of geological CO₂ storage and to provide the R&D necessary to have a basis for monitoring and verification leading to guidelines for site certification and accepted standards. These would be for example useful for CO₂ storage to qualify in emission trading schemes. An important element is the Integration of large scale site - specific monitoring activities under one project as well as for example the simulation studies and monitoring and verification tools needed for the research. Important is the development of common tools to study the long term behaviour of CO₂ in reservoirs as

well as to prove storage integrity at all relevant time scales and transport safety with in-depth risk assessment studies.

Instrument : this topic is only open for IP proposals. To address the goals of the topic, it is expected that one IP could be funded. Opportunities for including research organisations from third countries should be fully explored – including in particular those participating in the Carbon Sequestration Leadership Forum (CSLF).

Preparing for large scale H₂ production from decarbonised fossil fuels including CO₂ geological storage. The European Initiative for Growth is aimed at stimulating economic growth through a number of key projects promoting transport and energy networks, and development of core technologies that are considered key to future economic growth. The Quick-start Programme of the Initiative for Growth, includes a project on the hydrogen economy, which has a component aimed at the production of hydrogen from decarbonised fossil fuels (HYPOGEN). The Hypogen initiative is of 10 years estimated duration and an indicative budget of 1.3b€, with the clear goal of providing Europe with a realistic and economically viable route to a hydrogen economy based eventually on RES. The Hypogen initiative will be carried out in close co-ordination with the hydrogen communities component (Hycom) of the hydrogen economy Quick-start project.

The challenges associated with the establishment of large scale facilities for the production of hydrogen with CO₂ storage will require large scale research and demonstration activities in the coming years. It is of utmost importance to coordinate, monitor and assess permanently all the efforts done in research and demonstration.

The main objective is to prepare the ground for large-scale European facilities producing hydrogen and electricity from fossil fuels with CO₂ capture and geological storage. Important elements are R&D into the opportunities in terms of size, sites, technologies and stakeholders. The identification of financing mechanisms, environmental and public acceptance issues as well as legal and regulatory frameworks should be addressed. The possibility of expanding the use of existing facilities should also be included. The planning phase will require the assessment of different technologies under development for example from projects funded under FP6. It will aim at recommendation of best options towards achieving sufficient maturity to undertake pilot and large-scale validation.

Instrument : this topic is only open for IP proposals. To address the goals of the topic, it is expected that one IP could be funded.

Advanced separation techniques. Advanced separation techniques, including chemical looping and oxyfuel cycles are promising break-through technologies which would allow for a step reduction of the cost and efficiency penalties associated with CO₂ capture. The main objective is to develop new and innovative separation techniques such as membranes, sorbents, PSA, TSA, etc, for the separation of CO₂ from flue gas or partially oxidised gases, to obtain a highly pure CO₂ stream. Oxygen enriched combustion and new oxygen production techniques should also be envisaged. Important elements could include component development, material research, process integration, cost evaluation, life cycle analysis, CO₂ purification processes and thermodynamics. Consideration should also be given to the implications of the CO₂ purity for subsequent transport.

Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that more than one STREP could be funded. This topic may be particularly suitable for the participation of innovative SMEs.

Mapping geological CO₂ storage potential matching sources and sinks. The assessment of the potential for storage in geological formations, in conjunction with the sources available throughout Europe is a critical issue for the uptake of CO₂ storage on a large scale. The main objective is to assess the potential for CO₂ geological storage in

areas of Europe where it has not been done yet, particularly in Eastern and Southern Europe, to complement the mapping already done in GESTCO. Important elements will be to establish the CO₂ sources in these regions and to develop site selection criteria such as a potential storage assessment versus major source characterisation.

Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that one STREP could be funded. Opportunities for including research organisations from third countries should be fully explored – including in particular those participating in the Carbon Sequestration Leadership Forum (CSLF).

European Co-ordination and networking activities in CO₂ capture and storage. The co-ordination of the actors and activities involved in the European CO₂ R&D project is required to ensure a coherent approach, avoid redundancies, identify gaps, establish a clear strategy for the future and give visibility to the actions taken. The main objective is to promote the co-ordination of existing EU funded RTD activities in the field of CO₂ capture and storage, and establish the EU as a centre of excellence in the field, and ensure continuity after the actions taken by CO₂NET2. Important elements will be the organisation of meetings and communication between the EU projects and to act as an information hub, to organise dissemination events, including press releases, public awareness brochures. Teaching and training activities in coordination with other projects are also important. Identification of opportunities, e.g. carbon trading. Strategy definition and roadmapping. Specific dissemination activities targeted at new member states.

Instrument : this topic is only open for CA proposals. To address the goals of the topic, it is expected that one CA could be funded. Opportunities for including actors from new Member States and Candidate Countries should be fully explored.

Research areas and topics for 2006

It is expected that the final call for M-L term actions will be focussed on Co-ordination Actions, Specific Support Actions and, possibly, further international co-operation initiatives. Details will be confirmed in a further update of the Work Programme in 2005.

6.1.3.2.5. Socio-economic tools and concepts for energy strategy

[Activity Code : SUSTDEV-1.2.8]

Socio-economic research related to energy RTD will be systematically integrated into research carried out in the technological areas described in the preceding sections. Nevertheless, common and harmonised tools should be developed to tackle the complex social and economic issues of new energy technologies. Competition with conventional energy technologies in a medium to long term perspective, questions of socio-environmental damages of energy production and consumption, of the implementation of new and emerging energy technologies into society and of shaping the future sustainable energy system should be covered. Foresight exercises should be carried out to build up strategies for energy governance as well as to define alternative ways to achieve sustainable development objectives.

For socio-economic tools and concepts, the strategically important areas in which research should be concentrated are: **energy total costs** (*to evaluate and compare the systems costs including the quantification of the social and environmental damages*), **social acceptability and behaviour** (*optimal conditions for implementing the medium and long term energy technologies including economic aspects, consumer preferences and citizen needs*), **socio-economic impact of sustainable policies** (*to evaluate these policies in a EU*

and world perspective, especially focusing on the New EU Member States and the Mediterranean Countries), **quantitative and qualitative forecasting methods** (Energy-Economy-Environment forecasts for the long and very long-term, i.e.2030-2100 dealing with issues such as resource depletion, climate change, radioactive waste management and ethical issues).

Research areas and topics for 2005 (Call 2005.ML) – Call closed.

Proposals are invited for the following topics:

Methods for the economic and environmental assessment of energy generation including externalities and security of supply. The objective is to make a comparative cost analysis (including social and environmental factors) for present and future energy generation alternatives, considering investment behaviour and decision-making processes. Issues to be addressed should include a comparison of total energy costs (whole life, whole systems costs including impacts of acidification, eutrophication, and visual intrusion) for different energy technologies taking account of different local conditions and evaluate the security of supply for EU power and gas markets.

Instrument : this topic is only open for CA proposals. To address the goals of the topic, it is expected that one CA could be funded. Opportunities for including research organisations from the new Member States and Candidate Countries should be fully explored.

Social acceptability, behavioural changes and international dimension related to sustainable energy RTD. The objective is to develop social acceptance measurement tools and public participation techniques applicable in different cultural contexts to promote the use of Renewable Energy Technologies (RET) and to extend the measures of Rational Use of Energy (RUE). The research should cover social issues including public perception risks which can result from the implementation of sustainable energy options (RET, RUE, hydrogen and CO₂ capture) in developed and developing countries. In view of the international dimension of this topic, participation is particularly welcomed from proposers in the New Member States as well as from countries neighbouring the EU in the Southern and Eastern Mediterranean and the remaining Accession States. Dissemination actions should receive significant attention.

Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that more than one STREP could be funded.

Modelling, forecasting, and new paradigms for a low carbon energy sector. The objective is to develop Energy, Economy, Environment modelling tools and qualitative forecasting methods for the medium and long term (2030-2100) focusing on EU issues (e.g. post-Kyoto targets) and including aspects such as energy RTD databases and fossil fuel reserves. The research should cover the development, improvement and up-dating of models (world and European energy, macro-economics and econometrics) and of databases (energy RTD, fossil fuels reserves, etc.); application of models to world and EU policies (emissions trading, green certificates, reliability of infrastructure in an energy liberalised market); and building scenarios, especially devoted to the technology transition to 2050 and highlighting the most effective energy RTD strategies.

Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that one STREP could be funded.

Research areas and topics for 2006

It is expected that the final call for M-L term actions will be focussed on Co-ordination Actions, Specific Support Actions and, possibly, further international co-operation initiatives. Details will be confirmed in a further update of the Work Programme in 2005.

6.1.4. Links to Other Research Topics and Technical Content of Joint Calls

6.1.4.1. Links to other research topics - general

Activities will be integrated and co-ordinated, as necessary, within and between actions and activities in this and other priorities, including the activities of the Joint Research Centre and national programmes.

Co-ordination within this priority thematic area (No. 6)

The potential for future collaboration will be closely monitored in the following areas :

- Priority 6.2 : Sustainable surface transport;
- Priority 6.3 : Global change and eco-systems.

Proposals that address more than one thematic area will be accommodated by the Commission, provided the proposal addresses areas covered by this work programme. The general principle for the submission of proposals is:

- Proposals must clearly address the objectives and priorities set out in the relevant work programme sections and should be submitted to the priority area to which they are most closely linked. For example, generic RTD on fuel cells (stacks, catalysis, components, systems, ...) is tackled in the medium to long term priorities of sustainable energy systems; research for the integration of stacks, components and systems into transport vehicles should be dealt with by sustainable surface transport.

Co-ordination with other priority areas for research

The potential for future collaboration will be closely monitored in the following areas :

- Priority 2 : Information Society technologies;
- Priority 3 : Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices;
- Supporting policies and anticipating scientific and technological needs;
- Support for the co-ordination of national activities.

Proposals that address more than one thematic area will be accommodated by the Commission, provided the proposal addresses areas covered by this work programme. The general principle for the submission of proposals is:

- Proposals which intend to develop a new technology (e.g. information and communication, biotechnology, nanotechnology, ...) should seek funding from the priority area most directly linked with such a technology; proposals aimed at the use or integration of a given technology in RTD activities to pursue the objectives of “Sustainable “Energy Systems” should be addressed to this priority.

In addition, it should be noted that energy related RTD may also be carried out in the context of the Specific Programme “Structuring the European Research Area”, for example in the areas of “*horizontal research activities involving SMEs*”, “*specific measures in support of international co-operation*”, “*human resources and mobility*”, “*research infrastructures*”, and “*science and society*”.

6.1.4.2. Technical Content of Joint Calls in the field of hydrogen and fuel cells

6.1.4.2.1. Rationale

Hydrogen and fuel cell technologies are recognised as core long term technologies for realising global sustainable energy. Hydrogen complements electricity and together they represent the most promising mass market energy vectors for delivering sustainable energy for stationary heat and power and transport in the long term. However hydrogen and fuel cell energy systems represent a radical paradigm shift in the way Europe produces and uses energy. To bring hydrogen and fuel cells to the point of commercial readiness and viability in terms of performance and cost, substantial effort on research, technological development and validation is still needed.

The availability of new materials with improved performance and at competitive cost will be a key factor to commercialisation. In particular, nanotechnology can open new solutions for innovative products and processes.

Deepening co-operation through co-ordinated and joint calls will deliver benefits in terms of building critical mass, better coverage of the domain, cross-fertilisation of ideas between an extended range of disciplines and stakeholders, and ensure that cross-cutting evaluations deliver the best strategic combination of complementary projects.

Where appropriate, Integrated Projects should address societal, health, environmental, ethical and regulatory issues. In particular, validation and benchmarking, as well as education and training aspects should be included. Strategies for management of risk should be included in IPs, where relevant. All IPs should have strong industrial participation.

A well co-ordinated, strategically selected set of FP6 projects will provide a concerted and essential technical input to the European Hydrogen and Fuel Cell Technology Platform, as well as to the transport related technology platforms ERTRAC, ERRAC and ACARE and the Alternative Motor Fuels policy initiative. It will also help establish the definition and detailed planning phase of a substantial and broad ranging hydrogen communities technology initiative designed to stimulate growth and accelerate the move towards the hydrogen economy, under the Growth initiative¹⁹

The results of the activities to be funded under these joint and other coordinated calls on the field of H₂ and fuel cells will form the basis for delivering the technologies which should be tested, validated and demonstrated in the hydrogen economy projects identified as Quick-Start in the Growth initiative.

¹⁹ Following the Growth Initiative (*), the European Council of 12 December 2003 invited the European Commission to implement public private partnerships and to orient projects and funds in the field of hydrogen towards the priorities identified in the Quick Start Programme, namely hydrogen production and use in communities.

(*) COM(2003)690: Commission Communication on a European initiative for Growth investing in networks and knowledge for growth and jobs. It includes the so-called "Quick Start Programme"

6.1.4.2.2. Joint Call on component development and systems integration of hydrogen and fuel cells for transport and other applications

(Joint Call between Thematic Priorities 4, 6.1.ii and 6.2 – Call closed.)

Rationale

The aim is to develop the core technologies for hydrogen and fuel cell systems for transport applications – many of which may also be applicable to stationary applications. The cost/ performance/ reliability/ packaging targets for transport applications are amongst the most demanding for hydrogen and fuel cells. Safety, reliability, weight, performance and packaging are nowhere more demanding than in aeronautics. Nevertheless, synergetic development of components and systems can lead to a progressive market evolution, starting with premium price, niche market applications in aircraft, trains, ships, stationary Combined Heat and Power (CHP) and leading to trucks, buses and eventually to the automotive mass market. The main aim is to develop generic technology and modular systems - built up from components that can be manufactured in essentially similar configurations, but with different qualities, to meet the specific performance, lifetime and cost requirements of the different applications (e.g. FC stacks, Membrane Electrode Assemblies (MEAs), batteries, power electronics). Essential components include stacks and major sub-systems such as fuel processors, Auxiliary Power Units (APUs), and individual components.

There is a need to develop a comprehensive approach to systems integration. Tools are required for integrating complete hydrogen /fuel cell energy systems, comprising the fuel processor (if applicable), stack and Balance of Plant (BoP). The aim is optimised overall system efficiency by better transient control and integrated heat and water management - adapted to small and large scale stationary and transport applications (automotive, bus, truck, ship and rail auxiliary power units). Overall system safety shall be addressed.

6.1.4.2.2.1. Fuel Cell and Hybrid Vehicle Development

[Activity Code : SUSTDEV-AERO-2004-Hydrogen-1.1]

The development of electric drivetrains and components for hydrogen Internal Combustion Engines(ICE)/ electric hybrid vehicles is essential for opening the pathway to commercialisation of fuel cell vehicles. Hybrid drivetrains will deliver economies of scale for components and electronic control systems. Efficient, low cost, mass market electrical and electronic drive-train components should be developed in a modular and scalable way, and proved in the near term in hybrid fuel cell platforms - whilst at the same time pursuing the possibility of coupling them with innovative, hydrogen-fuelled energy converters in similar hybrid configurations. This will underpin the development of a strong EU-based industry for fuel cell electric drivetrain components and energy storage devices (batteries, supercapacitors).

Objective: The overall target is to validate a hybrid vehicle with “well to wheel” energy efficiency exceeding 35% on the extended urban European drive cycle, and “tank to wheel” CO₂ emissions not exceeding 80g/km CO₂, when fuelled by hydrogen derived from fossil based fuels, and near zero CO₂ and pollutant emissions if fuelled by hydrogen produced from renewable sources.

RTD Activity:

System level RTD: The latest component technologies should be integrated in vehicle platforms to enable validation of key operating parameters. The platforms should

consolidate previous RTD effort on advanced batteries, supercapacitors, electric motors, control systems, advanced combustion engines, fuel cell stacks, etc, to arrive at systems optimised for energy efficiency over the European drive cycle. Where appropriate, and innovation is not compromised, system integration should contribute to developing standardised “open system” interfaces and modules for electrical and mechanical systems and communications protocols in order to create more open markets for the component suppliers, covering where possible, both parallel and serial hybrid configurations.

Fuel cell system components: Generic development of low-cost, mass market components for fuel cell auxiliary equipment, including air compressors, fans, humidification and water management systems, hydrogen consumption measurement, H₂ safety sensors, hydrogen control valves, compact, high heat transfer heat exchangers; proposals should be complementary to recent projects, such as HyTRAN, and the FUERO cluster project.

Electric drivetrain components: Development of energy storage devices for hybrid drivetrain components including super-capacitors, high power batteries (with sufficient power and energy to cover duration of FC system cold-start), efficient, high energy density traction (including lightweight hub) motors; low cost, more efficient power electronic devices, including converters, inverters, and electronic control systems, and including drive-by-wire and control strategies designed to optimise energy conversions and component life. This effort should build on the STREPs on hybrid systems funded in the second call, as well as previous and running projects in this area (e.g. SUVA, EST, ELMAS, INMOVE, OPTELEC, S-CAP, SCOPE, CAMELIA, PROBATT, etc..)

Component and system safety will be a high priority to be addressed in co-operation with the Network of Excellence HySafe which will develop a prioritised action plan for analysing and testing hydrogen handling and hydrogen system safety.

The main deliverables will be a fully integrated platform and sub-systems designed to prove the most promising hybrid FC vehicle concept with potential hybrid hydrogen ICE platform applications taken into consideration. Validation shall include component and system performance and lifetime testing and cost assessment, with forecasts for future development potential, based on the latest component developments and full scale testing on the bench and / or prototypes if necessary.

Instruments: *One IP, combining component development with delivery of at least one optimised hybrid platform for testing:*

Fuel cell stack development is not the subject of this joint call and will be covered separately under Sustainable Energy .

Scope for two STREPs focussing on specific component technology bottlenecks.

Component development is an opportunity to involve innovative SMEs.

Where applicable, the aim should be to develop modular components adaptable to requirements of applications in domestic power generation, road vehicles, shipborne, trainborne or aircraft or aerospace equipment.

Dual use applications may also be considered.

Consortia should demonstrate a coherent exploitation strategy linking hybrid hydrogen ICE/electric development with fuel cell development and leading to early market entry of hybrid powertrains.

6.1.4.2.2.2. Integration of Fuel Cell systems and fuel processors for aeronautics, waterborne and other transport applications

[Activity Code : SUSTDEV-AERO-2004-Hydrogen-1.2]

Airborne, water-borne, rail, and stationary CHP or Uninterruptable Power Supply (UPS) systems represent premium power applications for fuel cells. A significant market is predicted for stationary CHP, ship propulsion and ship/aircraft auxiliary power units in the power range 100-500kW. Safety, reliability and durability are paramount considerations and, for aeronautics especially, packaging and weight constraints are also extremely stringent. For aeronautics there is interest to develop and prove concepts for Auxiliary Power Units i) fuelled by reforming on-board kerosene, and ii) fuelled by liquid hydrogen. Vessels for inland waterways and autonomous urban light rail also represent applications where hydrogen fuel cells can bring substantial environmental benefits, through reduced water and air pollution. Ship-borne fuel cell systems may be developed for main propulsion or to provide auxiliary power for “hotel” loads and deck equipment. Fishing vessels, short-sea ferries are also potential applications for hydrogen-fuelled, fuel cell propulsion in environmentally sensitive areas (e.g. inland or coastal waterways). Two main lines of research are envisaged, and may be pursued in parallel, or in an integrated way :-

- Generic RTD on fuel processors for on-board hydrogen production from hydro-carbon fuels for ships, aircraft, and trucks.
- Generic RTD on components and systems development and integration for fuel cell systems for compact domestic CHP, and for auxiliary power units (APUs) in the power range 100kW to 500kW, for aircraft, ships.

Objectives:

The aim here is for a generic, preferably modular approach, developing integrated systems and components that can be adapted or re-configured to meet the different applications requirements. Fuel processors should achieve at least 85% efficiency (H₂ LHV), and less than 10ppm CO, S.

Integrated hydrogen fuel cell systems for aircraft will aim at power densities at system level exceeding 0.5 kW /kg and 0.5 kW/ l. Stationary CHP and ships systems will aim at 0.2 kW/kg and 0.25 kW/l excluding any fuel processor. Fuel cell system efficiency for CHP should exceed 80% when operating in combined mode.

Joint RTD activities

Generic RTD on fuel processors for middle distillate hydrocarbon fuels used in ships and aircraft: The focus is on middle distillates – especially kerosene and diesel for aircraft, ship and truck applications, addressing requirements specification, system integration, design development and realisation of fuel processor systems for aircraft, ship and truck applications. RTD emphasis is on generic reforming technologies *for middle distillate fuels (diesel, kerosene)*, including de-sulphurisation, CO removal and reformat gas clean up; investigation of different reformer/clean-up configurations (e.g. micro-reactor, hybrid) aimed at optimising system efficiency and packaging, through better system integration, and adapted to fuel cell requirements. Scope of work is likely to include: development of lower cost, more active reformer catalysts; sealing; lightweight, corrosion resistant reactor materials amenable to low cost fabrication; development and application of modelling tools to optimise system integration, simulate two-phase fluid flows, chemical kinetics and heat transfer.

RTD on integrated hydrogen fuel cell systems: Development of integrated, modular fuel cell systems and Balance of Plant in the power range 100-500kW, adaptable to aeronautics

APUs, marine, and stationary applications – aiming at optimising overall efficiency, taking into account the balance of electricity and heat for ship and aircraft “hotel” loads, aircraft control systems, ship propulsion, cargo handling and/or cargo-conditioning equipment. For ships, effort should also be directed at the use of hydrogen as a fuel for marine fuel cell applications, including aspects relating to refuelling.

For ships and domestic CHP *only*, a comprehensive pre-normative analysis of hydrogen and fuel cell *system safety* should be carried out, including hazard and risk analysis. For ships, this may extend to fuel handling, refuelling, and storage on board. The impact on overall ship design of introducing hydrogen and fuel cell systems should be carefully analysed with a view to developing integrated ship systems, optimised for energy consumption, operating costs and pollution abatement. Strategies, procedures and equipment should be developed for dealing with emergencies at sea, such as loss of propulsion, storm, fire, accident. For aircraft the system will include development and integration of a LH2 storage tank, filling and tank safety systems and sensors. System interfaces will be covered by other research activities.

Instruments: Indicatively two IPs as follows:

IP 1: Generic fuel processor: combining basic research, system integration and prototype demonstration (e.g. 10-50 kW) for proof of concept of a fuel processor for high sulphur diesel, marine diesel, and kerosene. Partnership should include competent manufacturers, research undertakings, reformer fabricators and catalyst suppliers, and representative organisations from end user applications, such as aircraft, ship, truck. Dual use applications may also be considered.

IP 2: Integrated fuel cell systems: integrated fuel cell system platforms in which the stack, and stack-related, balance of plant are adaptable to aircraft, ship and stationary CHP applications demonstrating proof of concept. The developed fuel cell systems should address all the issues for power modules approximately in the range 100-500kW, including validation within the overall operating environment (for example vehicle system architecture). For ship systems this includes proof of concept under sea-going conditions. Smaller systems may be appropriate as pilot research systems, provided they are representative of full-scale systems. The core of the IP will be the fuel cell system, developed as far as possible in a generic way, and then customised in up to three possible platform configurations.

Platform 1: fuel cell power unit, supplying stationary CHP, and CHP for ship hotel and cargo conditioning loads; this may include the development of a fuel processor for marine diesel, if not covered in a proposal for IP 1.

Platform 2: an autonomous hydrogen fuelled fuel cell system for ship, and stationary CHP, supplying propulsion /hotel CHP, and cargo conditioning loads. Consortia should endeavour to include innovative SMEs for component development.

Platform 3: Fuel cell APU, based on kerosene reformer technology or direct hydrogen

Proposals concerning waterborne hydrogen and fuel cell systems should complement and build on the work being carried out in the feasibility study FCSHIP and the specific support action New-H-Ship, as well as any waterborne fuel cell related projects that may be supported under the second call.

Aeronautics related activities should complement the ongoing and previously funded activities such as the Technology Platform POA and the CRYOPLANE project.

Proposals on fuel processing should be complementary to recent projects, such as DIRECT, Bio-FEAT, HyTRAN.

Dual use applications may also be considered.

6.1.4.2.3. *Joint Call for the support of the co-ordination, assessment and monitoring of research to contribute to the definition phase for a hydrogen communities initiative*

(Joint Call between Thematic Priorities 4, 6.1.ii and 6.2 – Call closed.)

[Activity Code : SUSTDEV-AERO-2004-Hydrogen-2]

Rationale:

The European Initiative for Growth is aimed at stimulating economic growth through a number of key projects promoting transport and energy networks, and development of core technologies that are considered key to future economic growth. The Quick-start Programme of the Initiative for Growth, includes a project on the hydrogen economy, which has a component aimed at the development of fully integrated, largely autonomous hydrogen communities, combining hydrogen fuel cell systems for stationary CHP, and transport, and exploiting where possible synergies between applications (Hycom). The hydrogen communities initiative is of 10 years estimated duration and an indicative budget of 1.5 b€, with the clear goal of providing sufficient pump-priming actions to stimulate the start up and growth of hydrogen industries and markets in Europe. The initiative should provide sufficient critical mass for a substantial joint procurement programme for validation of prototypes based on the most promising technologies in a range of applications, under different operating conditions (climatic, duty cycle, primary energy source, etc). Three phases are envisaged – definition, planning and co-ordination, detail design and implementation, and test and validation. The scoping and planning phase for the hydrogen communities initiative, as well as possibly the following implementation and validations phases, will be carried out in close co-ordination with the hydrogen production component (Hypogen) of the hydrogen economy Quick-start project.

The challenges associated to technologies for these hydrogen communities will require large scale research and demonstration activities in the coming years. Such activities would require a paramount investment. It is of utmost importance to coordinate, monitor and assess permanently all the efforts done in research and demonstration. Research will deliver new knowledge and technologies, and demonstration will test and validate these technologies in real life environments, i.e. hydrogen communities. Despite the different nature of research and demonstration activities (e.g. different type of risks, different actors, different users of results, different instruments) their implementation requires a close coordination and interaction, from the planning to the execution stage.

Objective:

To co-ordinate, assess and monitor research to contribute to the definition, planning and co-ordination phase for a 10 years large scale hydrogen communities initiative, designed to test and validate the potential for hydrogen as universal sustainable energy vector for communities, jointly with electricity. The scale of the envisaged initiative, is such that a comprehensive co-ordination, assessment and monitoring of research for the planning and definition phase addressing technological options together with socio-economic, operational and safety aspects is necessary to proceed with the following stages of this initiative.

Co-ordination of projects that are pursuing similar or complementary objectives will help to optimise efforts. Constant monitoring and assessment will stimulate the activities and will accelerate the learning process allowing measuring progress towards intermediate milestones and final targets.

In addition a constant technology watch would be necessary to guarantee a quick uptake by the market, or by demonstration initiatives, of the emerging results from research and development activities. In addition, the monitoring and assessment of the demonstrations, foreseen in a complementary action, will provide feedback and guidance for the definition and planning of research.

RTD Activity:

Research monitoring and assessment, together with permanent technology watch, to identify technological solutions under development that could provide potentially economically and sustainable viable hydrogen sources and energy conversion options (e.g. conventional combustion and fuel cells), addressing climatic, economic and social diversity in Europe, as well as synergies between applications and technologies.

The planning phase will require stocktaking of different technologies under development and assessment of their potential for implementation and the needs for further development. It will seek to ensure the alignment of on-going research work with the hydrogen communities initiative goals and recommendation of best options towards achieving sufficient maturity to undertake pilot and large-scale validation.

Studies should assess the potential use in communities of renewable hydrogen (e.g. from wind, ocean, solar, biomass) or hydrogen from de-carbonised fossil energy sources, or possibly by-product hydrogen in remote autonomous communities “hydrogen villages”, “hydrogen islands”, or a “hydrogen community within a community” (e.g. hydrogen industrial park, campus or an airport).

The work will include the assessment of potential RTD stakeholders and their possible ways of involvement (e.g. financial, technological, development, equipment/infrastructure supply, legal structures, financial aspects, etc) in the different phases.

The studies are likely to address further development of specific renewable energy converters, optimised throughout the power conversion chain, to the specific requirements of production of sufficiently pure hydrogen for fuel cell applications. The planning phase should also require input from socio-economic research to establish the cost effectiveness, social and environmental implications of the range of hydrogen paths evaluated, as well as scoping the further analysis needed to assess impacts in the following phases.

The project will monitor and assess input from relevant on-going and future research activities funded under FP6 (e.g. HyWAYS, NATURALHY, HyTRAN, HySAFE, STOREHY, etc).

This call will be carried out in close co-ordination with the short to medium term part of the Sustainable Energy Systems Work Programme that aims at supporting “seed” demonstration projects for future hydrogen communities and establishing the Partnership “Hydrogen for Transport” that will include a similar assessment and monitoring framework for demonstration activities. This Partnership will deliver best practices in terms of stakeholder involvement and co-ordination, as well as proposals for possible management structures for the implementation and demonstration aspects of hydrogen communities.

Instruments:

One IP conducting a set of comprehensive co-ordination, monitoring, assessment and planning actions and studies, which should involve major stakeholders including research suppliers as well as developers and users of technologies.

A Co-ordination Action is envisaged in the short and medium term part of the Sustainable Energy Systems Work Programme (see chapter 6.1.3.1.4), aimed at the co-ordination and

assessment of demonstration activities. The two projects will be implemented in close association.

6.1.4.2.4. Co-ordinated Calls on materials development and processes for fuel cells and sustainable hydrogen production and storage technologies

(Co-ordinated Calls between Thematic Priorities 3 and 6.1.ii)

Topics relating to these areas are included in the Call 2005.ML described in this Work Programme. A complementary call, dealing with other aspects of the same areas, will be undertaken by the Thematic Priority 3 (NMT) and will be described in a future update of the NMT Work Programme (planned for September 2004).

6.1.5. Implementation Plan and Related Issues

6.1.5.1. Indicative timetable and budget attribution (roadmap)

It is intended to implement the Programme through a series of Calls for Proposals, with fixed closing dates. Table 1 shows the indicative roadmap for the whole of the Sixth Framework Programme.

Specific details of the calls for proposals covering the first two years of the programme are provided in Sections 6.1.6 (Call information) and 6.1.3 (Technical content).

6.1.5.2. Evaluation criteria

The set of criteria applicable to this work programme, together with the corresponding evaluation thresholds, is given in Annex B. In addition, Annex B outlines how the following will be addressed: gender issues, ethical and/or safety aspects, and the education dimension.

6.1.5.3. Information Days

The European Commission, EU Member States and Associated States frequently organise Information Days, where those interested in submitting proposals may attend for a presentation of the Calls and the Framework Programme, obtain documentation, ask questions and meet potential consortium partners.

Details of Information Days planned by the Commission are available on the Cordis website:

<http://www.cordis.lu/sustdev/energy/>

For national Information Days, please contact the relevant National Contact Point:

<http://www.cordis.lu/fp6/ncp.htm>

Table 1 : Roadmap

The following table shows the indicative timetable and budget allocation for the whole of the duration of the Specific Programme. In addition, for each call, the technical areas open and the types of instrument* to be used are also shown. N.B. The Joint Calls are shown separately in Table 2.

Call Identifier :	2003.SM	2003.ML	2004.SM	2004.ML	2005.SM	2005.ML	2006.SM	2006.ML
Planned launch date :	17 December 2002		17 June 2003	10 Oct 2003	8 June 2004	8 Sept 2004	June 2005	Sept 2005
Planned closing date :	18 March 2003		17 December 2003		8 December 2004		December 2005	
Research activities having an impact in the short and medium term								
6.1.3.1.1 <i>Cost-effective supply</i>	IP, STRP, CA, SSA	-	-	-	IP, STRP, CA, SSA	-	STRP, CA, SSA	-
6.1.3.1.1.2 <i>Large-scale integration</i>	CA, SSA	-	IP (CONCERTO), STRP, CA, SSA	-	-	-	IP (CONCERTO)	-
6.1.3.1.2.1 <i>Eco-buildings</i>	IP, STRP	-	IP only (CONCERTO)	-	-	-	IP (CONCERTO), STREP, SSA	-
6.1.3.1.2.2 <i>Polygeneration</i>	-	-	IP only (CONCERTO)	-	IP, STRP, CA, SSA	-	IP (CONCERTO), STREP, SSA	-
6.1.3.1.3 <i>Alternative motor fuels</i>	IP, STRP, CA, SSA	-	IP, SSA	-	IP, STRP, CA, SSA	-	SSA	-
Research activities having an impact in the medium and longer term								
6.1.3.2.1 <i>Fuel cells</i>	-	All instr.	-	CA, SSA	-	IP, NoE, STRP, CA	-	CA, SSA
6.1.3.2.2 <i>Energy carriers</i>	-	All instr.	-	CA, SSA	-	IP, NoE, STRP, CA	-	CA, SSA
6.1.3.2.3 <i>Renewables</i>	-	All instr.	-	CA, SSA	-	IP, NoE, STRP, CA	-	CA, SSA
6.1.3.2.4 <i>CO₂ sequestration</i>	-	All instr.	-	CA, SSA	-	IP, NoE, STRP, CA	-	CA, SSA
6.1.3.2.5 <i>Socio-economic tools</i>	-	All instr.	-	CA, SSA	-	IP, NoE, STRP, CA	-	CA, SSA
Indicative % of the overall budget	10%	24.5%	13%	0.5%	16%	25%	15%	tbd
Indicative Budget	82 M€	198 M€	107 M€	up to 3 M€	132M€	190 M€	125M€	tbd
Tentative % for the New Instruments	65%	65%	65%	0%	65%	65%	65%	tbd

Notes: Dates and budget figures are indicative. Applicants should verify the closing dates in the text of the relevant call, as published in the Official Journal. The proposals will be evaluated and selected according to the guidelines and procedures laid down in the Guidelines on Proposal Evaluation Procedures, using the single stage submission procedure.

Complementary calls could be launched if the proposals from above calls do not adequately cover the priority topics of the WP. These complementary calls could also include funds for topping up or expanding consortia in on-going activities.

* Integrated Projects (IP), Networks of Excellence (NoE), Specific Targeted Research Projects (STRP), Co-ordination Actions (CA) and Specific Support Actions (SSA).

Table 2 : Roadmap for joint calls in the area of hydrogen and fuel cells

Call Identifier :	Joint Call (1)	Joint Call (2)
Planned launch date :	8 June 2004	8 June 2004
Planned closing date :	8 December 2004	8 December 2004
Thematic priorities involved in the Joint Call	4, 6.1.ii and 6.2	4, 6.1.ii and 6.2
Instruments	IP, STRP	IP
Indicative Budget	35 M€	4.5 M€
Tentative % for the New Instruments	65%	100%
<p>Notes: Dates and budget figures are indicative. Applicants should verify the closing dates in the text of the relevant call, as published in the Official Journal.</p> <p>The proposals will be evaluated and selected according to the guidelines and procedures laid down in the Guidelines on Proposal Evaluation Procedures, using the single stage submission procedure.</p>		

Note : There are also Co-ordinated Calls on “materials development and processes for fuel cells and sustainable hydrogen production and storage technologies”, in conjunction with Thematic Priority 3 (nanotechnologies). Topics relating to these areas are included in the Call 2005.ML described in this Work Programme. A complementary call, dealing with other aspects of the same areas, will be undertaken by the Thematic Priority 3 (NMT) and will be described in a future update of the NMT Work Programme (planned for September 2004).

6.1.6. Call Information

The following sections describe the indicative content of the Calls for Proposals envisaged to cover the final two years of FP6. Note, however, that only the Call Information published in the Official Journal has legal effect.

6.1.6.1. Content of Call 2005.SM²⁰

Call closed.

1. **Specific Programme:** Integrating and strengthening the European Research Area
2. **Activities:**
 - Priority thematic area of research “Aeronautics and Space”.
 - **Priority thematic area of research “Sustainable development, global change and ecosystems”. Sub-priority “Sustainable energy systems”**
 - Priority thematic area of research “Sustainable development, global change and ecosystems”. Sub-priority “Sustainable surface transport”
3. **Call title:** Periodic call in the area of “Aeronautics and Space”, **“Sustainable energy systems”** and “Sustainable surface transport”.
4. **Call identifier:** FP6-2004-TREN-3
5. **Date of publication**²¹: 8 June 2004
6. **Closure date(s)**²²:
 - **“Aeronautics and Space”:**
 - **“Sustainable energy systems”: 8 December 2004 at 17.00 (Brussels local time).**
 - “Sustainable surface transport”:
7. **Total indicative budget:** 252 M €, broken down as follows
 - “Aeronautics and Space”: 64 M€
 - **“Sustainable energy systems”: 132 Million €**
 - “Sustainable surface transport”: 56 M €

Instrument ²³	€ (millions)
IP	176
STREP and CA	76
SSA	

²⁰ Note that the call for the short-to-medium term part of “sustainable energy systems” will form part of a call including elements of “aeronautics and space” as well as “sustainable surface transport”.

²¹ The director-general responsible for the publication of this call may publish it up to one month prior or after its envisaged publication date.

²² When the envisaged publication date is either advanced or delayed, closure date(s) will be adjusted accordingly, if needed, in the published call for proposals.

²³ IP = Integrated project; NOE = Network of excellence; STREP = Specific targeted research project; CA = Coordination action; SSA = Specific support action

8. Areas called and Instruments:

– Aeronautics and Space

Area	Topic	Instrument

– Sustainable energy systems

Area	Topic	Instrument
Section 6.1.3.1.1.1 « Cost effective supply of renewable energies »	Innovative combinations of biomass with fossil fuels	IP
	Innovative demonstrations of improvements to energy recovery and renewable electricity production using waste materials and other commonly available biomass feedstocks	IP
	Innovative approaches to improving the yield of medium to large scale biogas plants	STREP
	Innovative combinations of biomass and wastes with fossil fuels	STREP
	Innovative wind farms, components and design tools	STREP
	Innovations in PV manufacturing plant at industrial scale	STREP
	Geothermal energy	STREP
	Ocean / marine energy technologies	STREP
	All	CA and SSA
	Section 6.1.3.1.1.2 “Large scale integration of renewable energy sources and energy efficiency” and Section 6.1.3.1.2.2 “Polygeneration”	Grid issues - Distributed electricity generation
Grid issues - Management of electricity grids linked to large scale decentralised wind power generation		STREP, CA and SSA
Section 6.1.3.1.2.2 “Polygeneration”	Improvement of the competitiveness of polygeneration	IP and STREP
	Innovative integration of polygeneration	IP and STREP
Section 6.1.3.1.3 “Alternative motor fuels”	Biofuel-Cities.	IP, STREP, CA
	Hydrogen for transport	IP, CA
Section 6.1.3.1. “Thematic promotion and dissemination”	Renewable electricity technologies	SSA
	Renewable heating and cooling technologies	SSA
	Production and distribution of liquid and gaseous biofuels	SSA
	Eco-buildings	SSA
	Polygeneration	SSA

	Energy demand management and renewable energy supply in high performance communities	SSA
	Alternative motor fuels	SSA

– Sustainable surface transport

Area	Topic	Instrument

9. Minimum number of participants²⁴:

Instrument	Minimum number of participants
IP, STREP and CA	3 independent legal entities from 3 different MS or AS, with at least 2 MS or ACC
SSA	1 legal entity from a MS or AS

10. Restriction on participation: None.

11. Consortia agreements:

- Participants in IP are required to conclude a consortium agreement.
- Participants in STREP, CA, and SSA resulting from this call are encouraged, and may be required, to conclude a consortium agreement.

12. Evaluation procedure:

- The evaluation shall follow a single stage procedure.
- Proposals will not be evaluated anonymously.

13. Evaluation criteria: See Annex B of the work programme for the applicable criteria (including their individual weights and thresholds and the overall threshold) per instrument.

14. Indicative evaluation and contractual timetable:

- Evaluation results: estimated to be available within some 4 months after the closure date
- Conclusion of first contracts: it is estimated that the first contracts related to this call will come into force 8 months after the closure date.

15. Additional terms:

- It is expected that this call should not result in more than 40 to 50 projects

²⁴ MS = Member States of the EU; AS (incl. ACC) = Associated States; ACC = Associated candidate countries.

Any legal entity established in a Member State or Associated State and which is made up of the requested number of participant may be the sole participant in an indirect action.

6.1.6.2. Content of Call 2006.SM²⁵

1. **Specific Programme:** Integrating and strengthening the European Research Area
2. **Activities:**
 - Priority thematic area of research “Aeronautics and Space”.
 - Priority thematic area of research “Sustainable development, global change and ecosystems”. Sub-priority “Sustainable energy systems”
 - Priority thematic area of research “Sustainable development, global change and ecosystems”. Sub-priority “Sustainable surface transport”
3. **Call title:** Periodic call in the area of “Aeronautics and Space”, “Sustainable energy systems” and “Sustainable surface transport”.
4. **Call identifier:** **FP6-2005-TREN-4-Aero** (for “Aeronautics and Space”) / **FP6-2005-TREN-4** (for “Sustainable energy systems” and “Sustainable surface transport”).
5. **Date of publication:** 08/07/2005
6. **Closure date(s):** 04/11/2005 at 17.00 (Brussels local time) (for “Aeronautics and Space”) and 22/12/2005 at 17.00 (Brussels local time) (for “Sustainable energy systems” and “Sustainable surface transport”).
7. **Total indicative budget: 214 M€**, broken down as follows
 - “Aeronautics and space”: 53 M€
 - “Sustainable energy systems”: 125 M €
 - “Sustainable surface transport”: 36 M €

Instrument ²⁶	€ (millions)
IP	139
STREP or CA	75
SSA	

²⁵ Note that the call for the short-to-medium term part of “sustainable energy systems” will form part of a call including elements of “aeronautics and space” as well as “sustainable surface transport”.

²⁶ IP = Integrated project; STREP = Specific targeted research project; CA = Coordination action; SSA = Specific support action

8. Areas called and Instruments:

- Aeronautics and Space

Area	Topic	Instrument
Open Upstream Research (See Section 1.3.1.4.)	Reduced separation standards Research Domain 4.c	STREP
	Innovative air traffic management research Research Domain 4.g	STREP
	Co-ordination Action Research Domain 4.h	CA
	Air Transport System Wide Information Management Research Domain 4.j	STREP
	ATM Safety regulation and supervisory functions Research Domain 4.k	STREP
	Mitigating capacity constraints due to Wake vortex Research Domain 4.l	STREP
	Environmentally responsible air transport Research Domain 4.m	STREP
1.3.2 Integrated Focused Downstream Research	Subject 13. Improvement of ATM system processes through validation	IP

- Sustainable energy systems

Area	Topic	Instrument
Section 6.1.3.1.1.1 « Cost effective supply of renewable energies »	Demonstrations of innovative designs of automated biomass heating systems	STREP
	Solar heating and cooling	STREP
	Geothermal energy	STREP
	Innovative wind farms, components and design tools	STREP
	Demonstrations of the next generation of PV technologies / products	STREP
	Ocean / marine energy technologies	STREP
	All	CA, SSA
Section 6.1.3.1.1.2 “Large scale integration of renewable energy sources and energy efficiency” and Section 6.1.3.1.2.2 “Polygeneration”	Grid issues - Distributed electricity generation	STREP, CA and SSA
	Grid issues - Management of electricity grids linked to large scale decentralised wind power generation	STREP, CA and SSA
Section 6.1.3.1.2.1 “Eco- buildings	Eco-buildings	STREP

Section 6.1.3.1.2.2 “Polygeneration”	Polygeneration	STREP
Section 6.1.3.1.1.2 “Large scale integration of renewable energy sources and energy efficiency”	CONCERTO II– Managing energy demand and renewable energy supply in high performance communities	IP
Section 6.1.3.1.2.1 “Eco-buildings”		
Section 6.1.3.1.2.2 “Polygeneration”		
Section 6.1.3.1. “Thematic promotion and dissemination”	Renewable electricity technologies	SSA
	Renewable heating and cooling technologies	SSA
	Production and distribution of liquid and gaseous biofuels	SSA
	Eco-buildings	SSA
	Polygeneration	SSA
	Energy demand management and renewable energy supply in high performance communities	SSA
	Alternative motor fuels	SSA
Section 6.1.3.1.3 “Alternative Motor fuels	CIVITAS Dissemination and Best Practice Transfer Action	SSA

- Sustainable surface transport

Area	Topic	Instrument
Objective 1 « New technologies and concepts for all surface transport modes (road, rail and waterborne) »	CIVITAS Dissemination and Best Practice Transfer Action	SSA
Objective 3 « Re-balancing and integrating different transport modes »	New concepts for trans-European rail freight services	IP
	Motorways of the sea (MoS)	IP
	EU co-ordination and promotion forum on intermodal passenger travel	CA
	Knowledge base for intermodal passenger travel	STREP
	Vessel data management (Voyage data recorder, Electronic logbooks)	STREP
Objective 4 « Increasing road, rail and waterborne safety and avoiding traffic congestion »	Improve infrastructure cost allocation methods	STREP
	Design appropriate contractual relationships	STREP

9. Minimum number of participants²⁷:

Instrument	Minimum number of participants
IP, STREP and CA	<u>3 independent legal entities from 3 different MS or AS, with at least 2 MS or ACC</u>
SSA	<u>One legal entity from a MS or AS.</u>

10. Restriction on participation: None.

11. Consortia agreements:

- Participants in IP are required to conclude a consortium agreement.
- Participants in STREP, CA and SSA resulting from this call are encouraged, and may be required, to conclude a consortium agreement.

12. Evaluation procedure:

- The evaluation shall follow a single stage procedure.
- Proposals will not be evaluated anonymously.

13. Evaluation criteria: See Annex B of the work programme for the applicable criteria (including their individual weights and thresholds and the overall threshold) per instrument.

14. Indicative evaluation and contractual timetable:

- Evaluation results: estimated to be available within some 3 - 4 months after the closure date;
- Conclusion of first contracts: it is estimated that the first contracts related to this call will come into force 10 months after the closure date.

15. Additional terms:

- It is expected that this call should not result in more than 60 to 70 projects.

²⁷ MS = Member States of the EU; AS (incl. ACC) = Associated States; ACC = Associated candidate countries.

Any legal entity established in a Member State or Associated State and which is made up of the requested number of participant may be the sole participant in an indirect action.

6.1.6.3. Content of Joint Call (1)

Call closed.

1) Specific programme: Integrating and strengthening the European Research Area

2) Activities: Priority thematic areas of research of:

“Aeronautics and space”,

“Sustainable development, global change and ecosystems, 1) Sustainable Energy Systems, ii) Research activities having an impact in the medium and longer term”
and

“Sustainable development, global change and ecosystems, 2) Sustainable surface transport”.

3) Call title: Thematic call in the area of *“Component development and systems integration of hydrogen and fuel cells for transport and other applications”.*

4) Call identifier: FP6-2004-Hydrogen-1

5) Date of publication²⁸: 8 June 2004

6) Closure date²⁹: 8 December 2004 at 17.00 (Brussels local time).

7) Total indicative budget: 35 Million €, broken down as follows:

Instrument³⁰	€ (millions)
IP	35
STREP	

8) Areas called and instruments:

Area	Instrument
Fuel Cell and Hybrid Vehicle Development. See Section 6.1.4.2.2.1 of the “Sustainable Energy Systems” Work Programme, Section 4.1.1 of the “Sustainable Surface Transport” Work Programme or Section 1.4.2.1 of the “Aeronautics and Space” Work Programme.	IP, STREP

²⁸ The director-general responsible for the publication of this call may publish it up to one month prior or after its envisaged publication date.

²⁹ When the envisaged publication date is either advanced or delayed, closure date(s) will be adjusted accordingly, if needed, in the published call for proposals.

³⁰ IP = Integrated project; STREP = Specific targeted research project

[Activity Code : SUSTDEV-AERO-2004-Hydrogen-1.1]	
<p>Integration of fuel cell systems and fuel processors for aeronautics, waterborne and other transport applications.</p> <p>See Section 6.1.4.2.2.2 of the “Sustainable Energy Systems” Work Programme, Section 4.1.1 of the “Sustainable Surface Transport” Work Programme or Section 1.4.2.1 of the “Aeronautics and Space” Work Programme.</p> <p>[Activity Code : SUSTDEV-AERO-2004-Hydrogen-1.2]</p>	IP

9) Minimum number of participants³¹:

Instrument	Minimum number of participants
IP and STREP	3 independent legal entities from 3 different MS or AS, with at least 2 MS or ACC.

10) Restrictions on participation: None.

11) Consortium agreements:

- Participants in IP are required to conclude a consortium agreement.
- Participants in STREP resulting from this call are encouraged, but not required, to conclude a consortium agreement.

12) Evaluation procedure:

- The evaluation shall follow a single stage procedure.
- Proposals will not be evaluated anonymously.

13) Evaluation criteria : See Annex B of the work programme for the applicable criteria (including their individual weights and thresholds and the overall threshold) per instrument and their application.

14) Indicative evaluation and contractual timetable:

- Evaluation results: estimated to be available within some 4 months after the closure date;
- Conclusion of first contracts: it is estimated that the first contracts related to this call will come into force before the end of 2005.

³¹ MS = Member States of the EU; AS (incl. ACC) = Associated States; ACC = Associated candidate countries.

Any legal entity established in a Member State or Associated State and which is made up of the requested number of participants may be the sole participant in an indirect action.

6.1.6.4. Content of Joint Call (2)

Call closed.

1) **Specific programme:** Integrating and strengthening the European Research Area

2) **Activities:** Priority thematic areas of research of:

“Aeronautics and space”,

“Sustainable development, global change and ecosystems, 1) Sustainable Energy Systems, ii) Research activities having an impact in the medium and longer term” and

“Sustainable development, global change and ecosystems, 2) Sustainable surface transport”.

3) **Call title:** Thematic call in the area of “Support of the co-ordination, assessment and monitoring of research to contribute to the definition phase for a hydrogen communities initiative”.

4) **Call identifier:** FP6-2004-Hydrogen-2

5) **Date of publication**³²: 8 June 2004

6) **Closure date**³³: 8 December 2004 at 17.00 (Brussels local time).

7) **Total indicative budget:** 4.5 Million €, broken down as follows:

Instrument ³⁴	€ (millions)
IP	4.5

8) **Areas called and instruments:**

Area	Instrument
<p>Support of the co-ordination, assessment and monitoring of research to contribute to the definition phase for a hydrogen communities initiative.</p> <p>See Section 6.1.4.2.3 of the “Sustainable Energy Systems” Work Programme, Section 4.1.2 of the “Sustainable Surface Transport” Work Programme or Section 1.4.2.2 of the “Aeronautics and Space” Work Programme.</p> <p>[Activity Code : SUSTDEV-AERO-2004-Hydrogen-2]</p>	IP

³² The director-general responsible for the publication of this call may publish it up to one month prior or after its envisaged publication date.

³³ When the envisaged publication date is either advanced or delayed, closure date(s) will be adjusted accordingly, if needed, in the published call for proposals.

³⁴ IP = Integrated project

9) Minimum number of participants³⁵:

Instrument	Minimum number of participants
IP	3 independent legal entities from 3 different MS or AS, with at least 2 MS or ACC.

10) Restrictions on participation: None.

11) Consortium agreements:

- Participants in IP are required to conclude a consortium agreement.

12) Evaluation procedure:

- The evaluation shall follow a single stage procedure.
- Proposals will not be evaluated anonymously.

13) Evaluation criteria : See Annex B of the work programme for the applicable criteria (including their individual weights and thresholds and the overall threshold) per instrument and their application.

14) Indicative evaluation and contractual timetable:

- Evaluation results: estimated to be available within some 4 months after the closure date;
- Conclusion of first contracts: it is estimated that the first contracts related to this call will come into force before the end of 2005.

³⁵ MS = Member States of the EU; AS (incl. ACC) = Associated States; ACC = Associated candidate countries.

Any legal entity established in a Member State or Associated State and which is made up of the requested number of participants may be the sole participant in an indirect action.

6.1.6.5. Content of Call 2005.ML

Call closed.

- 1) **Specific programme:** Integrating and strengthening the European Research Area
- 2) **Thematic priority/ domain:** Priority thematic area of research “Sustainable development, global change and ecosystems, 1) Sustainable Energy Systems, ii) Research activities having an impact in the medium and longer term”.
- 3) **Call title:** Thematic call in the area of “Sustainable development, global change and ecosystems, 1) Sustainable Energy Systems, ii) Research activities having an impact in the medium and longer term”.
- 4) **Call identifier:** FP6-2004-Energy-3
- 5) **Date of publication**³⁶: 8 September 2004
- 6) **Closure date(s)**³⁷: 8 December 2004 at 17.00 (Brussels local time).
- 7) **Total indicative budget:** 190 Million €, broken down as follows:

Instrument ³⁸	€ (millions)
IP and NOE	124
STREP and CA	66

There will be competition between proposals both across and within research topic areas in this call, which may result in some topics not being supported. Whilst quality will be the determining factor in the selection of proposals, it is expected that at least 50% of the overall budget for this call be allocated to the Areas “*Renewable energy technologies*” and “*Socio-economic tools and concepts*” and about 50% to the Areas “*Fuel cells*”, “*New technologies for energy carriers*” and “*Capture and sequestration of CO₂*”.

8) Areas called and instruments:

Section of the Work Programme	Topic/ area	Instrument
See section 6.1.3.2.1 (Fuel cells) [Activity Code : <i>SUSTDEV-1.2.1</i>]	See the pertinent sections of the Work Programme for precise details of the topics and	IP, NOE, STREP and CA, as specified in the pertinent sections of the Work Programme.
See section 6.1.3.2.2 (New technologies for energy carriers) [Activity Codes : <i>SUSTDEV-1.2.2 and SUSTDEV-1.2.3</i>]		

³⁶ The director-general responsible for the publication of this call may publish it up to one month prior or after its envisaged publication date.

³⁷ When the envisaged publication date is either advanced or delayed, closure date(s) will be adjusted accordingly, if needed, in the published call for proposals.

³⁸ IP = Integrated project; NOE = Network of excellence; STREP = Specific targeted research project; CA = Coordination action.

See section 6.1.3.2.3 (Renewable energy technologies) [Activity Codes : <i>SUSTDEV-1.2.4, SUSTEDEV-1.2.5 and SUSTDEV-1.2.6</i>]	areas open for this call.	
See section 6.1.3.2.4 (Capture and sequestration of CO ₂) [Activity Code : <i>SUSTDEV-1.2.7</i>]		
See section 6.1.3.2.5 (Socio-economic tools and concepts) [Activity Code : <i>SUSTDEV-1.2.8</i>]		

9) Minimum number of participants³⁹:

Instrument	Minimum number of participants
IP, NOE, STREP and CA	3 independent legal entities from 3 different MS or AS, with at least 2 MS or ACC.

10) Restrictions on participation: None.

11) Consortium agreements:

- Participants in IP and NOE are required to conclude a consortium agreement.
- Participants in STREP and CA and resulting from this call are encouraged, but not required, to conclude a consortium agreement.

12) Evaluation procedure:

- The evaluation shall follow a single stage procedure.
- Proposals will not be evaluated anonymously.

13) Evaluation criteria : See Annex B of the work programme for the applicable criteria (including their individual weights and thresholds and the overall threshold) per instrument and their application.

14) Indicative evaluation and contractual timetable:

- Evaluation results: estimated to be available within some 4 months after the closure date;
- Conclusion of first contracts: it is estimated that the first contracts related to this call will come into force before the end of 2005.

³⁹ MS = Member States of the EU; AS (incl. ACC) = Associated States; ACC = Associated candidate countries.

Any legal entity established in a Member State or Associated State and which is made up of the requested number of participant may be the sole participant in an indirect action.