Evaluation and Impact Assessment of the European Non Nuclear Energy RTD Programme

Development and implementation of a methodology for evaluation and impact assessment of the energy programme of the Fifth and Sixth Framework Programme of the European community for RTD activities

AREA REPORT

AREA 7: Socio-economic and Policy Related Research

Version 1

Date: 15 May 2009

Specific Tender:
BUDG 06/PO/01/Lot3
Under Framework Contract No.
DG BUDG No BUDG06/PO/01/LOT no. 3
ABAC 101908

EPEC

31th December 2008

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1. Executive summary

1.1 Introduction

This area paper forms part of the evaluation of the European Non Nuclear Energy research activities under FP5 and FP6 through the assessment of the socio-economic and policy related research activities. The paper has a special focus on the outputs, outcomes and impacts of the research activities carried out in the thematic area during the eight years of the framework programmes in question (1998-2006).

1.2 Scientific challenges and opportunities

For FP5 and FP6, European-level scientific challenges for the socio-economic and policy related research area – commonly known as strategic energy research – were defined principally by the European Commission in consultation with stakeholders from across the energy policy and research communities.

For FP5 and the later 1990s, the scientific challenges can be split into two groups, segmented by the primary purpose of this proposed research.

In the first case, socio-economic research is cast in the role of support to European-level technological innovation in the energy field. Here the research challenges relate to

- Development of procedures to facilitate a more rounded approach to the definition of research agendas and technology trajectories, to increase the prospects for more positive outcomes
- Development of new knowledge relating to the socio-economic aspects of novel / emerging energy technologies, from questions to do with consumer behaviour to the identification and valuation of risks to the costing of wider implementation

In the second case, we have medium to long term applied research through which to support the evolution of European energy policy. These challenges are expressed in reasonably generic terms in successive programme documents beginning with the idea with such research should principally be concerned with improving European energy policy as regards both its effectiveness and efficiency.

- New conceptual models, with which to better characterise energy systems and responses to differing policy scenarios
- New data sets / time series, with which to strengthen existing energy models
- New operational tools, with which to compare the costs and benefits of competing energy technologies and systems (options appraisal)
- New knowledge about the impacts and cost-effectiveness of given policy interventions

1.3 FP5

Within FP5, the specific Programme on Energy, Environment and Sustainable Development (EESD) was established to focus on a number of pressing environmental and energy concerns. The overall objective of the programme was to contribute to sustainable development by “focusing on key activities crucial for social well-being and economic competitiveness in Europe”. Socio-economic concerns were therefore an integral part of the programme and research activity within it was intended to contribute towards meeting a wide range of social and economic needs and support policies formulated at European and international levels.

The EESD Programme was divided into two sub-programmes covering (i) Energy, and (ii) Environment and Sustainable Development. Within both of these sub-programmes work was
further divided into ‘key actions’ (with groupings of activities directed towards a common European challenge or problem) and a horizontal element.

Within the Energy sub-programme there were two key actions:

(i) **Cleaner energy systems, including renewable energies**: where the overall objective was to minimise the environmental impact of cost-effective production/energy use in Europe.

(ii) **Economic and efficient energy for a competitive Europe**: Of particular relevance to this area report was the work on elaborating scenarios on supply and demand technologies in economy/environment/energy systems and their interactions, and the analysis of cost effectiveness and efficiency of all energy sources.

In addition to the ‘key actions’, the energy sub-programme also contained a horizontal element entitled:

(iii) **Research and technological development of a generic nature**: Activities in this area are of particular relevance to this report, as they were specifically intended to study the socio-economic aspects of energy within the context of sustainable development, with the aim of developing tools for assessing and monitoring the socio-economic impact of energy technologies, systems and services.

1.4 FP6

Within the Sixth Framework Programme (2002-2006), the sustainable development (SUSTDEV) thematic area was comprised of three main sub-areas, including one entitled sustainable energy systems (SES). Non-nuclear energy research within FP6 was mainly funded under this SES thematic sub-priority. The medium and long-term part of the SES thematic sub-priority was itself split into five research areas, as follows:

- The first four related to thematic areas (fuel cells, renewable energy, etc), with socio-economic research related to energy RTD systematically integrated into individual research projects carried out in all of these

- A fifth, cross-cutting, research area of ‘socio-economic tools and concepts for energy strategy’ was also created. This was intended to deal with common and harmonised tools required to tackle the complex social and economic issues of new energy technologies.

It is in this fifth area where the specific socio-economic and policy related energy research projects were undertaken. Although, other socio-economic research was integrated into other, more thematic, projects. The individual Work Programmes identified a number of strategically important areas for ‘socio-economic tools and concepts’:

- **Energy external costs**: focused on the quantification of the social and environmental damages of energy production and consumption, including harmonisation at EU-level.

- **Social issues related to implementation of medium and long term energy technologies**: evaluation of the social and economic aspects of new energy technologies, taking into account consumer preference, need and behaviour, social acceptance and influence of private sector choices.

- **Quantitative and qualitative forecasting methods** for the long (2020-2030) and very-long term (2050-2100) dealing with resource depletion, climate change, radioactive waste management and other issues.

- **Ethics in energy**: with the aim to analyse the implications and propose guidelines for ethical governance in the field of energy policy (2002/2003)

- **Energy total cost**: the evaluation and comparison of the systems costs, including the quantification of the social and environmental damages
1.5 Project portfolio

The project portfolio of the socio-economic and policy related research area comprises of 26 distinct projects that received funding during FP5 and FP6 period.

According to our classification of projects, a total of 20 socio-economic and policy-related research projects were funded under FP5 distributed as follows:

- Key Action area of ‘economic and efficient energy for a competitive Europe’ (11)
- Key Action area of ‘cleaner energy systems, including renewable energies’ (1)
- ‘RTD activities of a generic nature’, including horizontal activities (8)

The projects included a total of 101 participations, from 80 discreet organisations. (Therefore 5 participants on average)

The participations were spread across 25 different countries.

The total cost of the projects: €13.1m, with EC contributions totalling €8.2m (a contribution of 63%), representing approximately 1-2% of the overall EU funding for non-nuclear energy research in FP5.

There were only 6 socio-economic and policy-related research projects funded under FP6. All of these projects fell within the cross-cutting research area of ‘socio-economic tools and concepts for energy strategy’.

- The projects included a total of 122 participations, from 101 discreet organisations. (Therefore, on average 20 participants)
- Participations were spread across 32 different countries.
- The total cost of these projects was €17.9m, with EC contributions totalling €12.1m (or a 68% contribution) which represents the same share as in FP5.

1.6 European added value of FP5 and FP6 socio-economic research

In this area review, the study team struggled to obtain any meaningful contribution from policy makers and other research users on the specific added value of EC-funded research in the energy-related socio-economic field, as compared with the research work being performed nationally or elsewhere.

Comparison of the FP socio-economic research portfolios with project listings maintained by several leading national energy research institutes does suggest a difference in the scope of the empirical work funded at national as compared with European levels.

The pan-European nature of the research projects within FP5 and FP6 has clearly added value in terms of the development of more generally applicable (rather than country specific) energy models and this harmonisation process is also evident in respect to the valuation and assessment methodologies under development. The focus on explicitly EU-level challenges is also a point of difference to work being performed at the member state level.

1.7 Impacts of energy-related socio-economic research

Research impacts are most in evidence when looked at from the perspective of the research projects, with participants consolidating their competences and increasing their confidence around future research and even commercial outcomes in the shape of increased work opportunities and sales. The new tools and methodologies developed through the research
projects are generally held to be relevant to policy interests and most project partners were able to point to some engagement with policy makers and regulators and in a small minority of cases were able to cite specific instances where new techniques, principles and data had been used in a policy setting. None of the projects was able to provide estimates of the nature and extent of the impact of such changed behaviour on policy and on energy systems and environmental performance.

Changing perspective, working from energy policy backwards towards key research breakthroughs, and the most robust assessment documents a series of instances where FP5 projects to develop and refine energy models have shaped EU policy targets on for example the share of electricity derived from renewable sources.

There is a strong path dependency evident in the project portfolios of FP5 and FP6, with many of the FP6 projects having antecedents in FP5 and previous framework programmes. In this sense, the Commission’s programme of socio-economic research is very much a work in progress and we fully expect these instrumental developments to continue to contribute to changed understanding and policy choices over the next decade.

1.8 Opportunities for improvements

Strategic energy research is arguably becoming more important and there might very well be a case for the Commission services to explore ways in which it might do more to bring this portfolio of excellent research to the attention of rather more policy makers and regulators.

In particular, we recommend the Commission consider exploring its options to redouble communication / dialogue activities with policy users around the findings of FP5 and FP6 projects, which would appear to have a great deal of value that remains untapped and where the results remain unseen by many policy makers at European and member state level.

We have not sought to investigate the situation with regard to FP7, however our policy interviews were somewhat underwhelming and suggest that even here more might be done to improve and increase user engagement / awareness of current projects.

Ahead of any future calls, there might also be a case for the Commission services seeking to facilitate a much broader debate between knowledge producers and users in order to arrive at a long list of the most pressing medium to long term challenges.

There might also be some value in the Commission considering the appropriateness and feasibility of introducing one or two new modes of intervention to better bridge the research-policy communities, perhaps through support for the creation of networks of knowledge brokers or specific support for more secondary research. Other ERA instruments might also be brought into play to a greater extent.
2. Introduction

This area paper forms part of the evaluation of the European Non Nuclear Energy research activities under FP5 and FP6 through the assessment of the socio-economic and policy related research activities. The paper has a special focus on the outputs, outcomes and impacts of the research activities carried out in the thematic area during the eight years of the framework programmes in question (1998-2006).

In order to be able to evaluate the results of the project portfolio, the study begins with a short introduction on the challenges and opportunities of the energy related socio-economic research. The description distinguishes between the main challenges from scientific, political, regulatory, economic and environmental aspects and identifies the shift in the challenges between the two consecutive framework programmes.

The study provides an overview on the projects that were funded under the socio-economic and policy related research field in the subsequent chapter. Following the analysis of the rationale and objectives of the different programmes, a comprehensive picture is drawn on the structure and main characteristics of the research activities and the content of the research that was carried out. In line with the separation of the challenges and objectives section, evolution of research activities between the two FPs is introduced.

The main focus of the study is the evaluation of the impacts from the different perspectives of policy, the economy and the environment.

3. Main challenges and opportunities of the Socio-economic and policy-related research area

3.1 Scientific challenges and opportunities

Socio-economic and policy related research activities in the field of energy - commonly known as strategic energy research – play a vital role in providing the scientific basis for energy related policy formulation, especially in assessing targets, quantifying objectives and measuring the impacts of policy interventions or new technologies. For example, the use of strategic energy research is of particular value when setting targets for greenhouse gas emissions or the production of renewable electricity, or when making changes to the system of energy-related taxes and subsidies. It plays an important role in complementing and enhancing the work of more thematic-focused research activities, thus creating a more holistic evidence base for the purposes of decision-making.

More specifically, the importance of evaluation and analysis for energy-related policy-making has long been recognised, in terms of the need to:

- Assess and monitor the impact of options for new and renewable energy technologies, taking into account societal, environmental, economical and employment aspects
- Measure and evaluate energy policy in terms of its impacts and effects
- Analyse strategies for energy supply and demand and elaborate short- and long-term scenarios

The recognition of these needs has led to demand for new and developed tools and methodologies that can provide robust baselines and comprehensive analysis for policy development. This includes a focus on:
• The development of forecasting methods, comparative and alternative scenarios, including baseline comparison, and stochastic approach to model results

• Integration of energy, economy and environmental aspects, including database improvement; benchmarking of tools and methods; establishing context dependency generalisation; analysis of clustering processes and optimising the results in terms of the three policy areas

• Mastering and monitoring policy issues through different (ex-ante, mid-term and ex-post) evaluations and models mixing the use of the energy system models with the macroeconomic models to achieve a complete assessment

• Assessment of the societal factors having influence in the field of energy policy

Database development is often a critical factor in socio-economic and policy-related research, as it provides the basis for the development of accurate economic models. However, the lack of availability of necessary data, the need to extend and revitalise existing basic data and the cost of developing econometric models all present important methodological challenges that have to be faced by strategic energy research.

Strategic energy research is a narrow but evolving area and there is a need to reinforce and improve the available knowledge base within it. Germany, France, Greece and the Netherlands had an early focus in the area, with a small number of research centres (such as the Fraunhofer Gesellschaft, SPRU, the Max Plank Institute, University of Grenoble, TNO, the National Technical University of Athens and the University of Stuttgart) containing high levels of expertise in the field of energy policy research. However, with roughly 90% of relevant researchers located in a small number of European institutions, challenges remain in mobilising the wider social science community to participate in energy related issues.

3.2 Political/regulatory context

The political and regulatory context and the policy-related research activities carried out in relation to energy are closely linked, with regulation both building on the findings of research activities and providing feedback on them. Such a two-sided process enables the research to refine its findings and methods and to offer more accurate assessments and suggestions for the development of policy instruments in the future.

In both Framework Programmes Five and Six, there has been a strong focus on the issue of energy efficiency and (increasingly during FP6) the topic of renewable energy resources. These priorities arise from the increasing emphasis placed on them through wider policy documents, including the following Commission regulations and communications:

• COM (1997) 599 Communication from the Commission: Energy for the future: Renewable Sources of Energy; White Paper for a Community Strategy and an Action Plan - This policy document highlights that there is still great scope for RTD to improve technologies, reduce cost and gain user experience, helping to develop the technologies that enable the more efficient use of renewable energy and contribute towards the achievement of strategic policy goals. It states that the fifth Framework Programme should offer the possibility to finance the necessary RTD efforts in Renewable Energy sources, taking into account this strategy and action plan document, including socio-economic aspects.

• COM (2000) 87, Green Paper on greenhouse gas emissions trading within the European Union, which was published with the intention of launching debate on this issue and its relationship with other related policy fields. It highlights the critical task of defining an equitable burden for sectors or actors included within any such trading scheme, which in turn requires an assessment of the relative abatement costs across different sectors in different Member States. Commission-funded empirical studies, it states, are tackling this issue, the results of which will help to guide policy-makers towards the lowest cost options and assist in fixing the appropriate amount of emissions to be allocated.

1 This list contains a sample of the most relevant documents from the broad range of the directives, Green Papers, communications and other publications and regulations by the European Commission during the Fifth and Sixth Framework Programmes in the field of energy policy.
 Directive 2001/77 EC on the promotion of electricity produced from renewable energy sources in the internal electricity market. This states that the Community recognises the need to promote renewable energy sources as a priority measure and an important part of the package of measures needed to comply with the Kyoto Protocol and any of any policy package to meet further commitments.

 Directive 2003/30/EC on the promotion of the use of biofuels or other renewable fuels for transport to replace diesel or petrol for transport purposes in each Member State. The document highlights the need to promote research and technological development in the field of the sustainability of biofuels, both at the national and European (framework programme) level.

 COM (2005) 265 Green Paper on energy efficiency or Doing More with Less: This Green Paper seeks to identify the bottlenecks that prevent the use of cost-effective, efficient, energy solutions and makes suggestions on key actions. In particular it points to the question of how the Community/Commission could better target funds spent supporting research relating to energy efficiency technologies. It states that the EU has 'horizontal' powers which are currently under-utilised and that it must put energy efficiency at the centre of its concerns, with the tools that have proven their value in other policy areas. In particular, it notes the importance of research and the fact that a number of the concerns highlighted in this Commission communication can only be alleviated through research activities (alongside and in connection with other regulatory and economy based measures). It states that research on energy efficiency under the Framework Programmes complements policy and is particularly vital for further improvements of energy efficiency potential.

 COM (2006) 105 Green Paper on a European strategy for sustainable, competitive and secure energy. The paper identified six key areas where actions are needed to meet the challenges of the 21st century taking into account the aspects of sustainability, competitiveness and security of supply. It states that the full potential of renewable energy will only be realised through a long-term commitment to develop and install renewable energy, including through research initiatives to bring clean and renewable energy sources closer to markets. Energy related research has contributed strongly to energy efficiency and energy diversity, but the paper highlights that the magnitude of the challenges ahead requires increased efforts and that the EU needs to consider ways to finance a more strategic approach to energy research.

 In addition to these documents, which relate broadly to energy policy and energy research, there have also been a number of communications and regulations by the EC relating more specifically to methodological issues (though not necessarily with specific reference to Framework Programmes). For example, these include COM (2002) 276 Communication on Impact Assessment, which describes how the Commission intends to introduce impact assessment as a future tool to ensure the quality and coherence of the policy processes. Such impact assessments can identify the likely positive and negative impacts of proposed policy actions and enable informed political judgements to be made.

 In addition to the European-level issues, such as the possible solutions for linking energy research with other energy-related areas including transport and construction or investigating the trade-offs between policy objectives (security, sustainability, competitiveness and social inclusion), there are also topics at the member state level which require the input of strategic energy research. This might include a new approach on how to integrate and use the lessons learnt from other countries or how to adopt best practises.

 Energy policy has become increasingly important and initiatives and regulations more frequent in-line with the growing need to ensure the security of energy supply, promote energy efficiency and develop new and renewable energy sources. Strategic energy research must therefore operate within this more complex system, taking into account social, economic and environmental aspects and seeking to maximise the efficiency and impact of its new tools, methods and interventions. The need for ongoing development of the research ‘toolkit’ is therefore essential to meet the needs of policy assessment, scenario building, analysis, and ultimately decision-making.
3.3 The environmental challenges

In relation to the environmental context, the topic requiring most attention is that of climate change and the need to find ways to reduce its effects and to prevent forecasted damages and threats. COM (2006) 105 highlights that global warming due to greenhouse gas emissions means that all regions in the world – including the EU – will face serious consequences for their economies and ecosystems if no action is taken. The paper states that effective action to address climate change (particularly through energy efficiency and renewable energy) is therefore urgent and Europe needs to be ambitious and act in an integrated manner. It also finds that, for renewable energy to fulfil its potential and help to tackle the environmental challenges facing Europe, European policy needs to be supportive and provide positive encouragement to enable the viability of different sources of energy.

Research activities are also required specifically to contribute to the achievement of Kyoto targets and mechanisms through providing input to market design and assessing the implications of market imperfections, by providing suggestions on enforcement and sanctions taking into account their effects, and through helping to shape new targets.

3.4 The economic and social challenges

Strategic energy research is needed to offer comprehensive assessment on the opportunities, potentials and threats of distinct energy sources, technologies and related policies. In particular, it needs to combine analysis of the technological progress in energy research with economic, social and political concerns.

In relation to social context, the following main challenges were identified through our discussions with policy makers and other stakeholders:

- Understanding the consumer demand in relation to energy use covering aspects such as public knowledge and general awareness of energy issues
- Assessing the acceptance of the society regarding new technologies and their adoption
- Evaluating the energy networks with neighbouring countries
- Measuring the social impacts of the newly deployed technologies

Whilst in relation to the economic context, the main issues for consideration and clarification by strategic energy research were as follows:

- Valuation of social and environmental costs and socio-environmental damages
- Analysing the potential for the security of supply
- Unfolding the effects of the liberalisation of European energy markets
- Examining the feasibility of new technologies and policy incentives, standards, given the likely social changes and reactions.
- Investigation of the availability and development of new skills within the economy
4. EC-funded research activities in the area

This section provides information and analysis of the projects funded within the socio-economic and policy related area during FP5 and FP6. It begins with some contextual information on the position of socio-economic research within the Framework Programmes and the main objectives and priorities relevant to this area of work. The section then provides details of the socio-economic projects actually funded within each of the Programmes and the characteristics of this research portfolio, before going onto provide an overview and analysis of the content and focus of these research activities. The section ends with a brief analysis of the evolution of socio-economic research within the Framework Programmes, looking at the changes and developments to the objectives, structure and content of the research portfolio from FP5 to FP6.

4.1 Objectives and rationales

During the last two decades European energy related research activities have covered topics that are of public interest at Community level and are not tackled adequately by the private sector. This includes various topics from safety and security questions, through long-term endeavours, to socio-economic issues. Broadly, the socio-economic and policy related research activities within this broader range of activities have aimed to provide the scientific basis for EU energy policy and decision-making and have been focused on two main goals:

- To develop tools that enable the measurement of the effects of (potential) policy and its interventions, including creating baselines for these measurements. Greater emphasis has been placed over time on impact assessments and these have become a frequent tool for use in policy assessments, where these need to have a well-established basis upon which to assess intended objectives.

- Foresight activities to highlight future policy challenges and assess the extent to which policy can help. For example, the Commission Green Paper of 29 November 2000 “Towards a European strategy for the security of energy supply” highlighted the fact that Europe was increasingly importing its energy and that the risk of this increasing external energy dependence needed analysis and potential action.

In addition to these overarching objectives for European research, there are also Framework Programme-specific goals that relate to research activities in the field of strategic energy research. These more specific objectives for activities are discussed below. FP5 and FP6 are covered separately for clarity and to show the evolution of the Programme. However, due to the specialties of the socio-economic / policy area, such as its long-term focus and horizontal nature, the differences within this relatively short, ten-year period are minimal.

4.1.1 FP5 objectives

The structure of the part of the Fifth Framework Programme of relevance to socio-economic and policy-related energy research is shown diagrammatically in Exhibit 1. The following paragraphs explain the structure of this ‘FP5 slice’ further and the relevant objectives and priorities contained within its parts.
Within FP5, the specific Programme on Energy, Environment and Sustainable Development (EESD) was established to focus on a number of pressing environmental and energy concerns. The overall objective of the programme was to contribute to sustainable development by “focusing on key activities crucial for social well-being and economic competitiveness in Europe”. Socio-economic concerns were therefore an integral part of the programme and research activity within it was intended to contribute towards meeting a wide range of social and economic needs and support policies formulated at European and international levels.

The EESD Programme was divided into two sub-programmes covering (i) Energy, and (ii) Environment and Sustainable Development. Within both of these sub-programmes work was further divided into ‘key actions’ (with groupings of activities directed towards a common European challenge or problem) and a horizontal element.

Within the Energy sub-programme there were two key actions, as follows:

(iv) **Cleaner energy systems, including renewable energies**: where the overall objective was to minimise the environmental impact of cost-effective production/energy use in Europe. While there was little explicit mention of socio-economic or policy related issues and objectives in relation to this action area, the work programme did state that it was the intention that work in this area would have socio-economic impacts (e.g. through securing employment and promoting social cohesion, etc.) and that projects should seek to take into account potential economic, environmental and social impacts. Specifically in relation to the integration of new and renewable energy sources, the work programme also identified as a priority the need to overcome non-technical problems, such as public acceptability.

(v) **Economic and efficient energy for a competitive Europe**: which sought to improve efficiency and reduce costs in order to address all stages of the energy cycle (production, distribution and final use). Of particular relevance to this area report was the specific work area on elaborating scenarios on supply and demand technologies in economy/environment/energy systems and their interactions, and the analysis of the cost effectiveness and efficiency of all energy sources. The specific objective here was to develop strategies for the production and use of energy, for the introduction of new energy technologies and for policy development, which reflect the needs and behaviour of consumers and take into account human, natural and economic resources that have an impact on energy. The priorities for RTD in this area therefore focused on scenario analysis of supply and demand, modelling and policy impact analysis, and the overall assessment of energy markets and technology impacts.

In addition to the ‘key actions’, the energy sub-programme also contained a horizontal element entitled:
(vi) **Research and technological development of a generic nature:** Activities in this area are of particular relevance to this report, as they were specifically intended to study the socio-economic aspects of energy within the context of sustainable development, with the aim of developing tools for assessing and monitoring the socio-economic impact of energy technologies, systems and services.

The 1999 EESD Work Programme set out in further detail the main RTD priorities in this generic area (iii) and the key targets to be achieved against each. These are shown in Exhibit 2 below. The first three priorities relate to ‘technology assessment’, whilst the last relates to ‘global systems analysis’.

**Exhibit 2** RTD priorities and targets for research and technological development of a generic nature (FP5, Energy)

<table>
<thead>
<tr>
<th>RTD priorities</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social dimension, including behaviour, acceptance and choices</td>
<td>o To analyse the potential socio-economic impacts of projects or clusters of projects of energy related research activities in the FP</td>
</tr>
<tr>
<td></td>
<td>o To specify harmonised methods for comparative assessment and aggregation</td>
</tr>
<tr>
<td></td>
<td>o To develop decision support systems considering consumer acceptance aspects</td>
</tr>
<tr>
<td>Innovation dimension, including “command and control” measures and impact of other policies</td>
<td>o To assess the impact of instruments (RTD policy, taxation, venture capital, standards) on technological innovation, on market penetration of new and improved energy technologies and on economic activities</td>
</tr>
<tr>
<td></td>
<td>o To develop a methodology for the global assessment of innovation policies in relation to sectoral economy-environment-energy modelling</td>
</tr>
<tr>
<td>Assessment of externalities and their internalisation</td>
<td>o To include new developments in the external costs accounting framework such as costs related to health, damage to buildings</td>
</tr>
<tr>
<td>The relationship between energy, environment, technology &amp; economic growth, taking account of societal values and natural / human resources</td>
<td>o To develop an economy-environment-energy modelling framework for evaluating the impact of energy RTD policies on competitiveness and employment and for supporting the evaluation of long term sustainable development pathways.</td>
</tr>
<tr>
<td></td>
<td>o To develop tools and databases to elaborate sectoral strategies which maximise the introduction of new and advanced energy technologies</td>
</tr>
</tbody>
</table>

All three of these main areas (the two key action areas and the horizontal area) contained socio-economic and policy related projects.

It is worth noting that due to a Commission review of the energy related research activities during the course of FP5, a Work Programme Update (for Energy) appeared in August 2001. This re-organised the structure of the sub-programme slightly to distinguish between (i) short-term and (ii) medium and long-term target actions. In addition, it identified (iii) five priorities of strategic importance to the EU, one of which was ‘socio economic research relating to energy technologies and their impact’.

The goals stated within this updated work programme also put emphasis on the following aspects (in addition to the above-described priorities):

- The mapping out of RTD excellence in the EU to promote dissemination
- The promotion of the mobility of human resources and the development of indicators to assess their research performance within the EU
Multidisciplinary research integrating socio-economic research aspects with technological research.

4.1.2 FP6 objectives

The structure of the part of the Sixth Framework Programme of relevance to socio-economic and policy-related energy research is shown diagrammatically in Exhibit 3. The following paragraphs explain the structure of this 'FP6 slice' further and the relevant objectives and priorities contained within its parts.

Exhibit 3 Socio-economic research within the structure of FP6

Within the Sixth Framework Programme (2002-2006) for research, technological development and demonstration (RTD) and under the overall objectives of Integrating and Strengthening the ERA, the sustainable development, global change and ecosystems (SUSTDEV) thematic area was comprised of three main sub-areas, including one entitled sustainable energy systems (SES). Non-nuclear energy research within FP6 was mainly funded under this SES thematic sub-priority.

The Sixth Framework Programme applied a similar structure to energy related research activities as was introduced in the 2001 revision to the FP5 work programme, with the impact of research activities classified as either short and medium term, or medium and longer term.

The medium and long-term part of the SES thematic sub-priority was itself split into five research areas, as follows:

- The first four related to thematic areas (fuel cells, renewable energy, etc), with socio-economic research related to energy RTD systematically integrated into individual research projects carried out in all of these
- A fifth, cross-cutting, research area of 'socio-economic tools and concepts for energy strategy' was also created. This was intended to deal with common and harmonised tools required to tackle the complex social and economic issues of new energy technologies.

It is in this final, 'socio-economic tools' research area that the specific socio-economic and policy related energy research projects were undertaken. Although, as mentioned above, other socio-economic research was integrated into other, more thematic, projects.

The individual Work Programmes identified a number of strategically important areas for 'socio-economic tools and concepts for energy strategy' research to concentrate. These can be summarised as follows (with the relevant work programme in parenthesis):
• **Energy external costs**: focused on the quantification of the social and environmental damages of energy production and consumption, including harmonisation at EU-level. The main objective is to improve the analysis and develop methodologies for externalities. At the launch of the programme, activities were concentrated on the EU, the Accession States and on the Mediterranean area, but after 2003 the scope was broadened to include developing countries (2002/2003)

• **Social issues related to implementation of medium and long term energy technologies** (social acceptability and behaviour in 2004 and 2005): evaluation of the social and economic aspects of new energy technologies, taking into account consumer preference, need and behaviour, social acceptance and influence of private sector choices. The research topic includes sustainable policies and measures at the EU-level and from a world perspective, including developing countries (2002/2003/2004/2005)

• **Quantitative and qualitative forecasting methods**: forecast methods for the long (2020-2030) and very-long term (2050-2100) dealing with resource depletion, climate change, radioactive waste management and other issues. The methods should consider energy, economy and environment aspects, compare various models and scenarios to assess the progress on sustainable development and highlight the role of new technologies (2002/2003/2004/2005)

• **Ethics in energy**: with the aim to analyse the implications and propose guidelines for ethical governance in the field of energy policy (2002/2003)

• **Energy total cost**: the evaluation and comparison of the systems costs, including the quantification of the social and environmental damages

• **Socio-economic impact of sustainable policies**: policy evaluation from an EU and world perspective, with special focus on the New Member States and the Mediterranean Countries (2004/2005)

### 4.2 Structure and main characteristics of research activities

This section provides analysis of the structure of socio-economic and policy-related research projects undertaken in FP5 and FP6, including the main characteristics of the research project portfolio. The two Framework Programmes are covered separately.

#### 4.2.1 Structure and characteristics of the FP5 socio-economic research portfolio

According to our classification of projects, a total of 20 socio-economic and policy-related research projects were funded under FP5. Just over half of these projects (11) fell within the Energy Key Action area of ‘economic and efficient energy for a competitive Europe’, while just one fell within the Key Action area of ‘cleaner energy systems, including renewable energies’. The remaining eight projects were part of the ‘RTD activities of a generic nature’ group of activities that ran horizontally through this sub-programme. In terms of FP5 instruments, just three were covered by these projects. The majority (11) were cost sharing contracts, while a further eight were preparatory, accompanying and support measures. The final project was a thematic network contract.

The projects included a total of 101 participations, from 80 discreet organisations. Therefore on average, there were 5 participants per project, though this varied between 1 and 10 depending on the project. The standard classification of participants by organisation (or ‘activity’) type contains four main categories. The number (and share) of participants for each of the four ‘activity type’ groups in FP5 socio-economic and policy-related projects was as follows:

- Research 39 (39%)
- Education 26 (26%)
- Industry 6 (6%)
- Other 29 (29%)
The participations were spread across 25 different countries, with the highest levels of participation from organisations located in Germany (13), France (10), the UK (9), Belgium (9), the Netherlands (8), Austria (7) and Switzerland (6) – the remaining countries had 5 or less participations each. Because of the small number of participations involved, in most cases individual organisations participated in only one project. However, it is worth noting that there were four participations from both the Paul Scherrer Institut (Switzerland) and Universitaet Stuttgart (Germany), whilst a further two organisations had three participations each and eleven organisations had two each.

The total cost of these projects was €13.1m, with EC contributions totalling €8.2m (a contribution of 63%). Therefore, socio-economic and policy-related research projects received approximately 1-2% of the overall EU funding for non-nuclear energy research in FP5. The average cost of a project was €655k, though this varied between €133k and €1.9m (with EC contributions also varying between 38% and 100%). The average cost per participation was €130k, with an average EC contribution per participation of €82k. Finally, project durations ranged between 12 and 48 months, with an average project duration of just over two years (26 months).

4.2.2 Structure and characteristics of the FP6 socio-economic research portfolio

According to our classification of projects, just 6 socio-economic and policy-related research projects were funded under FP6. All of these projects fell within the cross-cutting research area of ‘socio-economic tools and concepts for energy strategy’, as part of the medium and long-term sustainable energy systems thematic sub-priority. In terms of FP6 instruments, just four were covered by these projects, with three specific targeted research projects, one coordination action, one cost sharing contract and one integrated project.

The projects included a total of 122 participations, from 101 discreet organisations. Therefore, on average, there were 20 participants per project, though this varied between 1 and 65 depending on the project. The number (and share) of participants for each of the four ‘activity type’ groups in FP6 socio-economic and policy-related projects was as follows:

- Research 48 (45%)
- Education 34 (32%)
- Industry 7 (7%)
- Other 18 (17%)

Participations were spread across 32 different countries, with the highest levels of participation from organisations located in Italy (14), Germany (12), France (12), Poland (9), the UK (7) and Switzerland (7) – the remaining countries had 5 or less participations each. Because of the small number of participations involved, in most cases individual organisations participated in only one organisation. However, it is worth noting that there four participations from the Consiglio Nazionale Delle Ricerche (Italy) and three from Universitaet Stuttgart (Germany), whilst a further 16 organisations had two participations each.

The total cost of these projects was €17.9m, with EC contributions totalling €12.1m (or a 68% contribution). Socio-economic and policy-related research therefore received approximately 1-2% of all EU funding for non-nuclear energy research in FP6. The average cost of a project was €93.6m, though this varied between €43.7k and €11.7m (with EC contributions also varying between 56% and 87%). The average cost per participation was €147k, with an average EC contribution per participation of €99k. Finally, project durations ranged between 10 and 48 months, with an average project duration of just over two years (27 months).

4.3 Content of research activities

This section provides further detail regarding the content of the 26 socio-economic and policy related projects introduced above. For FP5 and then FP6 it provides a summary of the main types of activity being undertaken by the projects and a brief overview of the main focus and objectives of these pieces of work. A brief outline of the salient features of each individual project is also provided.
4.3.1 Overview of FP5 Socio-economic and policy-related projects

The overview of projects in this section is split between the three relevant FP5 programme areas: the two key actions and the horizontal element.

(i) Energy Key Action: Economic and Efficient Energy for a Competitive Europe

The eleven projects funded in this area focused on three main types of activity, as follows:

- Data collection and model development (x2):
  - Data collection from tracer technology and assessment of the effect of emissions on global warming
  - Data collection and the development and extension of models to cover non-power technologies and address sustainable development concerns
- The development of methodologies and guidelines for assessment and implementation projects (x4):
  - Development of standardised methodology guidelines for Joint Implementation project assessment
  - Harmonisation and dissemination of cost estimation methodologies
  - Development and dissemination of a user guide for the implementation of renewable energy projects
  - The development of an analytical survey tool
- The provision of training, networking and seminars to disseminate or share information (x5):
  - Organising workshops, conferences and exchange programmes
  - Hosting a workshop and the development of a software tool and guidance tool
  - A series of conferences
  - Establishing a Centre of Excellence and sharing information through conferences, meetings, training and placements
  - A thematic network to identify and address major challenges for the sustainable energy industry

The focus of the work and the ultimate objectives of the projects in this key area broadly focused in three main areas. These were: (i) the better assessment and estimation of energy use, (ii) enabling and accelerating investments in more economic and efficient energy, and (iii) sharing and transferring knowledge and expertise relating to analytical techniques and current state of the art in research and thinking relating to energy.

A brief summary of each of the funded projects within this key action area is provided in the boxes below. Where the information is available, these descriptions focus on providing an overview of the rationale, objectives, method and outputs for each of the projects.

### Assessment of Impact of SF6 and PFCs Reservoir Tracers On Global Warming and Development of Environmentally Friendly Tracer Technology (AEOLOS) - SF6 (sulphur hexafluoride) and PFCs (perfluorocarbons) are gas molecules used as the state-of-the-art tracers in oil exploration technology. These chemicals are used in significant quantities and have high Global Warming Potential and extremely long lifetimes, making them very potent greenhouse gases. They are useful in oil exploration technology, but there is pressure from environmental authorities to reduce or even ban such chemicals. The project therefore sought to assess the impact of the tracers on global warming, by quantifying emission levels of the chemicals under various conditions and evaluating the effect of these...
emissions on global warming. In addition, because much of the work is new and innovative and some of the results generic, the project will have application in other sectors.

**Baselines for Accession States in Europe (BASE)** - Joint implementation (JI) is one mechanism set forth in the Kyoto Protocol to help countries with binding greenhouse gas emission targets meet their obligations. Any such country can invest in emission reduction projects in any other such country as an alternative to reducing emissions domestically. In this way countries can lower the costs of complying with their Kyoto targets by investing in reductions in another country where reductions are cheaper, and then applying the credit for those reductions towards their commitment goal. The objectives of this project were to accelerate JI investment by reducing the barriers and costs associated with baseline definition and the implementation of these projects. Specifically the projects sought to reach consensus on how methodologies should be applied and baselines defined, addressing the various stakeholder needs (e.g. industry and government). The project resulted in guidelines on how to design, develop and approve eligible JI projects using an agreed methodology.

**Promoting and Financing clean Development Mechanism Renewable Energy Projects in the Mediterranean Region (CDMEDI)** - The CDM allows emission-reduction / removal projects in developing countries to earn certified emission reduction (CER) credits, each equivalent to one tonne of CO₂. These can be traded and sold, and used by industrialized countries to meet a part of their emission reduction targets under the Kyoto Protocol. This project sought to elaborate and widely disseminate a CDM user’s guide for the implementation of renewable energy projects in the Mediterranean region.

**Center for research and design in human comfort, energy and environment (CERDECEN)** - The project related to research into energy efficient ventilation systems designed on the basis of integrated building performance simulation and correct modelling of complex room air flow. It sought to extend and improve the capacity of the Centre (Cerdecen) and its links with other EC partner University centres by holding international workshops and a conference for young researchers, plus an exchange of researchers and students.

**Dynamic Analysis and Modelling applied to Energy performance assessment and prediction of Buildings and Components (renewables and rational use) (DAME-BC)** - Several research projects and a thematic network existed in relation to the application of dynamic analysis techniques on energy performance evaluation of buildings and components. This project sought to transfer this expertise to the wider public and research organisations through a workshop, the extension of a software tool, the development of a guidance tool and the launch of an initiative for further cooperation with new partners.

**Dissemination and Discussion of the ExternE Methodology and Results (DIEM)** - Within the ExternE project series funded by the EC a methodology for assessing external costs of energy use had been developed which was widely accepted and used. However, recently a number of improvements were made, of which many of the users were not aware. There also remained uncertain areas for discussion around dose-response functions and monetary values. Through stakeholder discussion, this project sought to harmonise and agree on the best way to estimate external costs and then to disseminate this methodology.

**Energy Marie Curie fellowship holders conference series (EMCC) (EMCSQUARED)** - This project was a continuation of another (SWERF) and sought to organise a further series of conferences in different EU countries for Marie Curie Fellowship Holders in the field of Energy.

**Centre for Materials for Low-Energy Consuming Technologies in Electrotechnics (MALET)** - This project aimed to improve the state of knowledge in the field of electrotechnical materials and technologies by establishing a Centre of Excellence. The project involved sharing the latest scientific achievements in the field amongst scientists and engineers and the transfer of technologies into industry via the organisation of scientific conferences, meetings, training and foreign placements.

**Research & Development Spending, A survey of R&D spending for renewable energies in EU countries (REDS)** - The REDS project involved an analytical survey of the R&D expenditure on renewable energy sources across member states, which provided a tool
for the future coordination of such funding and indicators of effectiveness of support programmes and performance in R&D spending.

Systems Analysis for Progress and Innovation in Energy Technologies for Integrated Assessment (SAPIENTIA) - The project dealt with technology dynamics and the impact of R&D actions on technological developments, building on previous research on power generation technologies and extending these to cover non-power technologies and address sustainable development concerns. The energy models were extended so as to incorporate the whole chain from R&D actions on specific technologies to impacts on indicators such as energy CO2 emissions, climate change, health concerns, pressure on natural resources, transport congestion, measures of social exclusion and regional imbalances. The project involved the identification of candidate technologies and the collection of technical-economic and R&D expenditure data concerning them, before estimating 'learning by experience' and 'learning by research' relations and incorporating these into analytical tools. It provided a rich set of data and analysis on key energy technologies and the interplay involving energy and RTD policy, sustainable development and technological improvement, that could assist policy makers and stakeholders in understanding the potential of R&D in addressing sustainable development concerns within an integrated assessment framework.

The Resource Network facilitating QHSE Development for Sustainable Energy Industry - PART 2 (TRENDS-2) - This Thematic Network brought together European stakeholders, decision makers, operators and suppliers to identify and address major challenges in the fields of quality, health, safety and environment (relating to Hydrocarbon production). Its overall objective was to help in meeting Europe’s future demands and needs for sustainable, secure, safe and clean energy supplies.

(ii) Energy Key Action: Cleaner Energy Systems, including Renewable Energies

Only one project was funded in this area, which focused on assessing the technical, socio-economic and institutional dynamics underlying changes in the architecture of the European electricity infrastructure and markets in order to lay the foundations for a participatory regulatory process (bringing together various stakeholders from around Europe) and impacting on the medium to long-term transformation of electricity systems. A brief summary of the project is provided in the box below, including information on the rationale and objectives, method and outputs (where this information is available).

Policy And Regulatory Roadmaps For The Integration Of Distributed Generation And The Development Of Sustainable Electricity Networks (SUSTELNET) - Liberalisation and internationalisation of the European electricity market have resulted in efforts to harmonise transmission pricing and regulation in the EU. Although technological developments and EU targets for renewable energy penetration and greenhouse gas reduction are decentralising the electricity infrastructure and services, no initiative exists to consider the market opening and regulation of distribution networks. This project therefore provided the analytical background and organisational foundation for a regulatory process to satisfy this need. Specifically the project aimed to (i) analyse the long-term technical, socio-economic and institutional dynamics underlying the changes in the architecture of the European electricity infrastructure and markets; (ii) develop medium-to-long term transition strategies for network regulation and market transformation to facilitate the integration of RES and decentralised electricity systems; and (iii) lay the foundations for a participatory regulatory process on the regulation of distribution networks in the EU. Through the participatory process (bringing together EU and MS electricity regulators and policy makers, distribution and supply companies, as well as representatives from other relevant institutions) the project sought to have a significant impact on the medium-to-long term transformation of electricity systems and the integration of RES and decentralised generation in the EU.
(iii) Energy - Research and technological development of a generic nature

The majority of projects funded within this ‘generic’ part of the energy programme focused on developing, improving and extending assessment and modelling tools relating to energy and the environment. The objectives of these studies and the potential benefits commonly related to improving and expanding the use of, or ability to use modelling in relation to areas such as:

- The economic and environmental impact of energy use
- The design of energy and environment policies for energy efficiency, renewables, climate change and R&D
- The planning for present and future power systems in Europe
- The functioning of liberalised electricity markets
- The assessment of externalities of energy
- The development of sustainable energy in Europe at the local level
- The assessment of RTD issues in relation to current energy-environment policies
- The development of strategies to increase the share of RES-E in the electricity market

In most cases these were intended to be used in order to assist with and support decision making, assessment of options and the development of strategies relating to energy and environmental policy. A brief summary of each of the funded projects within this generic area is provided in the box below, including information on the rationale and objectives, method and outputs (where this information is available).

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**Geographical Extension of the GEM-E3 General Equilibrium Model Database (DAT-GEM-E3)** - The GEM database includes economic data such as national accounts data, input-output tables, trade flow information and R&D data on innovation,plus energy/environment data on energy balances, emission coefficients, emission transport and transformation parameters and damages of major pollutants linked to energy use. The project sought to extend the geographical dimension of the GEM-E3 database to cover most accession countries and model more explicitly other parts of the world.

**The Dynamics of Innovation and Investment and its Impact on Policy Design in Energy and Environment for a Sustainable Growth in Europe (DYN-GEM-E3)** - The project sought to improve the modelling of the dynamics of innovation and investment and to evaluate its impact for the design of energy and environmental policies, particularly in relation to policy options for issues high on the agenda of the EU (energy efficiency, renewable, climate change and R&D). The GEM-E3 model had frequently been used in the past by the project partners for policy-oriented research activities. The new model developments were intended to widen the scope for interesting issues and therefore the range of potentially interested organisations.

**Environmental And Ecological Life Cycle Inventories For Present And Future Power Systems In Europe (ECLIPSE)** - The project sought to overcome existing limitations of the use of Life Cycle Inventories (LCI) for energy modelling and planning and other uses and ultimately increase the credibility, diffusion and exploitation of LCI, by providing potential users with: (i) A methodological framework and guidelines related to the quantification over the life cycle of environmental impacts from power generation in Europe; (ii) A harmonised and methodologically coherent set of data on new and decentralised power systems; and (iii) Explicit user-oriented examples for a correct use of LCI.

**Electricity Market Liberalisation in Europe (EMELIE); Market Imperfections and its Implications on the European economic and environmental situation.** - Market power is one important reason of market imperfections or distortions and therefore this project sought to investigate the different strategic behaviour opportunities of European electricity suppliers. The project aimed to develop a modelling tool that could serve as a decision support tool as well as a tool for analysis of various strategic behaviours of the European electricity market. The intended added value of this modelling exercise was that as a dynamic game theoretic model it could provide useful insights on various aspects concerning...
the functioning of liberalised electricity markets in the context of a transition process from a monopolistic market to a perfectly competitive market.

**Externalities of Energy: Extension of accounting framework and Policy Applications (EXTERNE-POL)** - The project sought to improve the assessment of externalities by providing new methodological elements for integration into the existing accounting framework of external costs (ExternE) that have been successfully applied to support decision making in energy and environmental policy. For example, it aimed to close gaps around uncertainties resulting from a lack of empirical data on the monetary valuation of mortality effects, the omission of impacts on ecosystems due to acidification and eutrophication, or the insufficient knowledge about the impacts of global warming.

**Deriving Optimal Promotion for Increasing the Share of RES-E in a Dynamic European Electricity Market (GREEN-X)** - The project sought to produce a dynamic action plan for the EU and its member states to achieve the objective of continuous and significant increases in the share of RES-E with minimal costs to European citizens under various scenarios of liberalised electricity markets. This was to be done by creating the internet-based toolbox GREEN-X, which allows the extraction of minimum cost strategies (e.g., Tics, Feed-in tariffs, Green Pricing, emissions trading, CO2-taxes) to help stakeholders in deriving efficient strategies for increasing RES-E or integrating RES-E into strategies for the reduction of GHG-emissions.

**Strategic Assessment Framework for the Implementation of Rational Energy - Local Planning (SAFIRE-LP)** - The primary objective of the SAFIRE LP project was to develop a new version of the key E3 (economy-environment-energy) SAFIRE model to provide a local sustainable energy-planning tool, designed by the potential users, to be user-friendly, transparent, and cost-effective. The project also aimed to eliminate a key barrier to the widespread development of sustainable energy in Europe - the lack of communication between developers and local government, combined with a lack of experience/knowledge at a local level - which is preventing and delaying project identification and development.

**Very Long Term Energy Assessment Model - Phase 2: Assessment of Energy RTD strategies for sustainability (VLEEM-2)** - Discussions among EU experts showed the necessity to enlarge the time horizon of prospective studies up to 2100 and to revisit modelling tools for this purpose. The VLEEM project was established to meet these challenges and in its first phase developed an analytical and conceptual framework, a skeleton model and preliminary case studies. This second phase sought to enhance the VLEEM system according to a wider definition of sustainability, develop a fully documented and user-friendly model and assess actual energy RTD issues in relation to current energy-environment policies, highlighting opportunities, challenges and strategies in energy RTD towards sustainability in the very long term.

### 4.3.2 Overview of FP6 Socio-economic and policy-related projects

The six socio-economic and policy-related projects funded during FP6 covered a broad range of topics and areas. However, the majority (5) involved the compilation of data and/or the development and improvement of tools and models relating to the assessment of energy and energy technologies under different scenarios to assist with policy making and policy assessment. The remaining projects constituted a conference, but this was also closely linked to the development of energy policy and strategy.

The focus of the work and the ultimate objectives of the projects commonly related to efforts to improve the policy making process by helping to evaluate different options and scenarios. Specifically, four of the six projects provided tools and models to aid decision makers in:

- Estimating the cost of energy production under different scenarios to assess options for improving efficiency of energy use
- Identifying opportunities for investment and promotion of sustainable energy, and therefore accelerate investment and uptake
- Assessing and evaluating energy policies, to include the adoption and implications of future energy technologies
- Integrating life cycle assessments of energy technologies and monetary valuations of externalities into policy formulation and scenario building

In addition, the remaining two projects sought to (i) measure, promote and improve social acceptance of renewable energy technologies and therefore increase the competitiveness of renewable and reusable energy technologies, and (ii) assist newer European countries in developing their long-term electric power strategies – particularly focusing on the role of renewable energy sources.

A brief summary of each of the funded projects is provided in the box below, including information on the rationale and objectives, method and outputs (where this information is available).

**Sustainable energy systems (SES): Socio-economic tools and concepts for energy strategy**

| Cost assessment for sustainable energy systems (CASES) | This action sought to compile detailed estimates of external and internal costs of energy production in different countries for different energy sources, under energy scenarios to 2030. It then sought to use this data to help evaluate policy options for improving the efficiency of energy use, and then to disseminate the findings to the energy sector (producers, users and policy makers). The project is also relevant to the Kyoto Protocol, as a detailed knowledge of the full cost structure of energy production is crucial to reach efficient decisions on emission reduction plans. |
| Cultural Influences on Renewable Energy Acceptance and Tools for the development of communication strategies to promote ACCEPTANCE among key actor groups (CREATE ACCEPTANCE) | This project sought to increase the competitiveness of renewable and reusable energy technologies by developing a tool to measure, promote and improve social acceptance of these. The tool was to be validated and deployed in a select few demonstration projects and made publicly available. |
| Electric Power Supply Strategy in the 21st Century - the Renewable Energy Sources Option (EPS 2003 - RES) | This conference was designed to assist European countries (particularly new/accession states) in developing their long-term electric power strategy, particularly focusing on assessing the potential role of renewable energy sources (RES) and on the exchange of experiences between European countries in this area. The programme of the conference allowed the exchanging of creative information between the countries concerned, familiarizing them with the relevant attitude of the EC and in reviewing methods of comparing electric power options. |
| **Local New Energy Technology Implementation (LETIT)** – Europe is facing increasing difficulties in meeting the ambitious renewable energy, energy efficiency and climate change targets set over the past decade. This is despite the instigation of numerous Community and Member State projects, programmes and legislative drivers. One of the key reasons for these difficulties stems from the fact that much of the responsibility for or the-ground approval, licensing and implementation of initiatives rests at a local level, with local authorities and local investors, whose levels of awareness and priorities are diverse and governed by another set of drivers. Local authorities typically lack the essential tools and capabilities to identify opportunities for investment or for promoting investment in sustainable energy. The project aimed to address these needs by bringing together experts and developing a framework and tools for identifying and valuing local assets and for accelerating the investment and uptake of sustainable energy in ways that can be relocated throughout Europe. |
| **Modelling of Energy Technologies Prospective in a General and Partial Equilibrium Framework (MENGTECH)** - The EU’s ambitious targets regarding sustainable development will require a major shift of resources towards the development of new energy supply and network infrastructure, yet existing models are not sufficiently developed for the adoption and implications of future energy technologies. This project therefore sought to develop the modelling framework and provide a set of completely updated models for a better assessment of energy policies that will contribute to appropriate policy evaluation. |
4.4 Evolution of research activities between FP5 and FP6

4.4.1 Evolution of objectives between FP5 and FP6

Both the Energy sub-programme in FP5 and the Sustainable Energy Systems sub-area of FP6 were designed to strengthen an integrated and coherent approach to energy research, and both focused to some degree on the need for socio-economic and policy related research that would enable benefits through the formulation of future energy and environment policies. However, the structure of the two programmes, and more particularly the specific nature of socio-economic and policy-related research, can make it difficult to trace the evolution of objectives in relation to this area.

In both programmes, it was often intended that socio-economic considerations be integrated across energy projects to support and enhance more thematic work. However, the specific objectives of such ‘integrated’ socio-economic work were often not clear. It is only in the ‘economic and efficient energy for a competitive Europe’ key action in the 1999 work programme that there are some specific priorities identified in relation to scenario analysis, modelling and impact assessment in order to support policy development and the wider production/use of energy.

Where the objectives and priorities are clearer is the horizontal or cross cutting parts of the FP5 and FP6 programmes. The specific ‘RTD of a generic nature’ part of the energy programme in FP5 and the ‘socio-economic tools and concepts’ part of FP6 both had the same broad overall aim of developing tools for assessing, monitoring or tackling social and economic issues and impacts relating to energy technologies. In FP5 this focused more broadly on energy technologies, systems and services, whereas in FP6 the objective related more specifically to new energy technologies.

Under the general aims of these horizontal parts of the two programmes, a number of priorities for action were identified. Some of these have remained over the two programmes, whilst others have been lost or newly introduced. Exhibit 4 below attempts to show these alignments between priorities for socio-economic and policy related research in non-nuclear energy under FP5 and under FP6. It suggests that the main areas of priority have remained broadly similar across the two periods, though with slight changes in focus. In addition, the FP6 priorities expanded to include specific priority areas for forecasting and ethics.

Exhibit 4  Key priority areas of the Framework Programme Five and Six in the field of socio-economic and policy related research in non-nuclear energy

<table>
<thead>
<tr>
<th>Key priority areas FP5</th>
<th>Key priority areas FP6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social dimension, including behaviour, acceptance and choices</td>
<td>Social issues related to implementation of medium and long term energy technologies</td>
</tr>
<tr>
<td>Innovation dimension, including “command and control” measures and impact of other policies</td>
<td></td>
</tr>
<tr>
<td>Assessment of externalities and their internalisation</td>
<td>Energy external costs and total costs</td>
</tr>
<tr>
<td>The relationship between energy, environment, technologies and economic growth taking into account the societal values and the natural and human resources</td>
<td>Socio-economic impact of sustainable policies</td>
</tr>
<tr>
<td></td>
<td>Quantitative and qualitative forecasting methods</td>
</tr>
<tr>
<td></td>
<td>Ethics in energy</td>
</tr>
</tbody>
</table>

New Energy Externalities Development for Sustainability (NEEDS) - The NEEDS project sought to evaluate the full costs and benefits of energy policies and of future energy systems, particularly in relation to (i) life cycle assessment of energy technologies, (ii) monetary valuation of externalities from energy production, transport, conversion and use, and (iii) integration of this information into policy formulation and scenario building.
4.4.2 Evolution of structure and content between FP5 and FP6

Exhibit 5 below provides a comparison between FP5 and FP6 of the main characteristics of the structure of socio-economic and policy-related research projects. It shows that whilst the number of projects in this area fell dramatically from 20 in FP5 to 6 in FP6, these projects were on average much bigger in terms of the number of partners (more than 4 times their previous size), resulting in a 21% increase in the total number of participations in the projects. The number of unique organisations involved also increased by a quarter, with the number of countries involved also rising from 25 to 32.

The number of unique organisations involved also increased by a quarter, with the number of countries involved also rising from 25 to 32.

The average cost of a project (+37%) and EC contribution per project (+47%) saw significant increases between the two programmes. This largely reflects the greater size of these project in terms of participants, with average project costs more than quadrupling, but the cost and EC contribution per participant also saw significant increase (of 13% and 21% respectively).

Exhibit 5 Main characteristics of projects, FP5 and FP6

<table>
<thead>
<tr>
<th>Key priority areas</th>
<th>FP5 Projects</th>
<th>FP6 Projects</th>
<th>Change (FP5 – FP6)</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projects</td>
<td>20</td>
<td>6</td>
<td>-14</td>
<td>-70%</td>
</tr>
<tr>
<td>Participations</td>
<td>101</td>
<td>122</td>
<td>+21</td>
<td>21%</td>
</tr>
<tr>
<td>- per project</td>
<td>5</td>
<td>20</td>
<td>+15</td>
<td>300%</td>
</tr>
<tr>
<td>Organisations</td>
<td>80</td>
<td>101</td>
<td>+21</td>
<td>26%</td>
</tr>
<tr>
<td>Total cost (€k)</td>
<td>13,105</td>
<td>17,907</td>
<td>+4,802</td>
<td>37%</td>
</tr>
<tr>
<td>- per project</td>
<td>655</td>
<td>2,984</td>
<td>+2,329</td>
<td>356%</td>
</tr>
<tr>
<td>- per participation</td>
<td>130</td>
<td>147</td>
<td>+17</td>
<td>13%</td>
</tr>
<tr>
<td>EC contribution (€k)</td>
<td>8,239</td>
<td>12,129</td>
<td>+3,890</td>
<td>47%</td>
</tr>
<tr>
<td>- per project</td>
<td>412</td>
<td>2,021</td>
<td>+1,609</td>
<td>391%</td>
</tr>
<tr>
<td>- per participation</td>
<td>82</td>
<td>99</td>
<td>+17</td>
<td>21%</td>
</tr>
</tbody>
</table>

Because of the very different project numbers and sizes it is difficult to identify any broad trends in the content of socio-economic research between FP5 and FP6. In both programmes, the focus of activity has been on tool and model developments, alongside a smaller number of actions focusing specifically on data collection and analysis and the development of methodologies and guides. Most projects are also aimed primarily at improving the ability of decision makers (particularly public policy makers) to assess options, make decisions and plan strategies. The energy ‘topic’ in question varies from project to project, with no discernable differences between those funded under FP5 and those funded under FP6.
5. Scientific achievements

This section provides information on the scientific outputs and results of the socio-economic and policy related projects funded during FP5 and FP6. This and following sections draw on interviews with participants and other stakeholders, as well as the results of an online survey of all participants. Therefore, as background to these sections, a brief introduction to the survey is presented below.

The initial contact base for the survey of all FP5 and FP6 energy projects contained 2,869 participations. Responses to the survey totalled 462, representing a response rate of 16%. For the socio-economic and policy-related projects only, from an initial sample of 223 participations in 26 FP5 & FP6 projects, responses were received from 34 participations (15%) in 14 projects (54%). This was slightly below the average response rate across all NNE areas. Of the responses, 13 referred to 9 FP5 projects and 21 to 5 FP6 projects.

Of those responding, the majority (76%) indicated that the participation of their organisation in the project in question was primarily as a ‘research performer’. This is above the average for all NNE respondents of 65%. The remaining respondents reported participating ‘both as a research performer and user’ of project results. Just 59% of those responding reported that their project had completed, the remainder were ongoing. The majority of those that had completed were, unsurprisingly, FP5 projects. The high proportion of non-completed projects has implications for the survey findings, much of which sought information on the results, outcomes and impacts of the projects. It should therefore be borne in mind that these are only preliminary results in many cases and that some projects will continue to deliver additional results in the future.

5.1 Outputs and results

Output variables describe the direct results of research and it is expected that these outputs will lead to results for the direct beneficiaries of the programme and, hopefully, that they will lead in future to an impact on society / the economy / the environment at large. All respondents to the online survey were provided with a list of 18 potential outputs from their project. For each output, respondents were asked to indicate whether it had been produced by them or by other members of their own organisation as a direct result of the project. It is important to highlight again that nearly half of the projects had not yet completed – these respondents were therefore stating the extent to which outputs had been produced so far, rather than the final achievements of the projects. The full list of outputs and the proportion of respondents who reported having produced each is shown in Exhibit 6 below (both for socio-economic participants and all NNE participants).

This table shows that the most commonly reported outputs by socio-economic participants were:

- Different types of events,
- Publications,
- New or improved models and simulations

In each case, at least three-quarters of respondents indicated that they had produced the output listed. Whilst these were also some of the most commonly reported outputs across all NNE projects, the rate of regularity with which socio-economic participants reported producing them was above the average in each case, suggesting that they are a particularly important feature in this area.

The incidence of socio-economic participants reporting a number of other outputs from projects (including new or improved tools, methods or techniques, R&D strategies and newly qualified personnel) was also high (over half of respondents cited these in each case). However, rates of these outputs was slightly below that reported across the NNE area overall.
For some of the other potential project outputs, the proportion of socio-economic participants reporting the output was significantly lower than was the case overall for NNE participants. In particular, the production of patent applications, copyrights, norms or standards and improved products, processes, services or demonstrators were much less commonly an output of socio-economic projects than was the case overall in NNE projects.

Exhibit 6 Outputs produced as a direct result of the project

<table>
<thead>
<tr>
<th>Outputs Produced</th>
<th>Socio-economic</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conferences, seminars and other events</td>
<td>90%</td>
<td>88%</td>
</tr>
<tr>
<td>Other publications</td>
<td>90%</td>
<td>78%</td>
</tr>
<tr>
<td>Publications in refereed journals or books</td>
<td>83%</td>
<td>77%</td>
</tr>
<tr>
<td>New or improved models and simulations</td>
<td>75%</td>
<td>67%</td>
</tr>
<tr>
<td>New or improved tools, methods or techniques</td>
<td>72%</td>
<td>83%</td>
</tr>
<tr>
<td>New R&amp;D strategy</td>
<td>54%</td>
<td>63%</td>
</tr>
<tr>
<td>Newly qualified personnel (e.g. MSc, PhD, etc)</td>
<td>52%</td>
<td>67%</td>
</tr>
<tr>
<td>Software or codes</td>
<td>33%</td>
<td>31%</td>
</tr>
<tr>
<td>New jobs</td>
<td>31%</td>
<td>46%</td>
</tr>
<tr>
<td>New or improved demonstrators, prototypes or pilots</td>
<td>19%</td>
<td>55%</td>
</tr>
<tr>
<td>New or improved services</td>
<td>19%</td>
<td>42%</td>
</tr>
<tr>
<td>New or improved processes</td>
<td>15%</td>
<td>56%</td>
</tr>
<tr>
<td>New or improved products</td>
<td>15%</td>
<td>45%</td>
</tr>
<tr>
<td>New or improved norms or standards</td>
<td>12%</td>
<td>25%</td>
</tr>
<tr>
<td>Spin-off companies</td>
<td>8%</td>
<td>7%</td>
</tr>
<tr>
<td>Patent applications</td>
<td>0%</td>
<td>24%</td>
</tr>
<tr>
<td>Copyrights</td>
<td>0%</td>
<td>20%</td>
</tr>
<tr>
<td>Licenses sold</td>
<td>0%</td>
<td>7%</td>
</tr>
<tr>
<td>Other outputs</td>
<td>9%</td>
<td>30%</td>
</tr>
<tr>
<td>Total number of respondents</td>
<td>34</td>
<td>462</td>
</tr>
</tbody>
</table>

Respondents were further asked to estimate the number of outputs produced in each case. From these figures, it has been possible to calculate the average number of each output produced by any participant (shown in Exhibit 7 below). The table therefore represents an estimated picture of the ‘average’ socio-economic participation, which according to these results tends to result for example in two to three events, two new improved tools, methods or techniques, two publications in refereed journals, etc. etc.

The ‘average’ socio-economic participation is broadly similar to the average NNE participation, although the average number of each output produced is lower in most cases than for the whole NNE area. The one exception is new or improved models and simulations, where a very slightly higher number of outputs are estimated for a socio-economic participation compared to the overall picture. Indeed, all but two of the socio-economic projects represented by respondents reported at least one new or improved model or simulation having been produced already as a result of their participation in their project.
Exhibit 7 Estimated average outputs produced by the individual or their organisation

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Socio-economic</th>
<th>NNE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conferences, seminars and other events</td>
<td>2.4</td>
<td>2.7</td>
</tr>
<tr>
<td>New or improved tools, methods or techniques</td>
<td>2.0</td>
<td>2.2</td>
</tr>
<tr>
<td>Publications in refereed journals or books</td>
<td>2.0</td>
<td>2.1</td>
</tr>
<tr>
<td>New or improved models and simulations</td>
<td>1.7</td>
<td>1.4</td>
</tr>
<tr>
<td>Other publications</td>
<td>1.6</td>
<td>2.1</td>
</tr>
<tr>
<td>Newly qualified personnel (e.g. MSc, PhD, etc)</td>
<td>1.0</td>
<td>1.6</td>
</tr>
<tr>
<td>New R&amp;D strategy</td>
<td>0.9</td>
<td>1.1</td>
</tr>
<tr>
<td>New jobs</td>
<td>0.4</td>
<td>0.9</td>
</tr>
<tr>
<td>Software or codes</td>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>New or improved products</td>
<td>0.3</td>
<td>0.9</td>
</tr>
<tr>
<td>New or improved services</td>
<td>0.3</td>
<td>0.8</td>
</tr>
<tr>
<td>New or improved demonstrators, prototypes or pilots</td>
<td>0.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Other outputs</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>New or improved norms or standards</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>New or improved processes</td>
<td>0.1</td>
<td>1.2</td>
</tr>
<tr>
<td>Spin-off companies</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Copyrights</td>
<td>-</td>
<td>0.4</td>
</tr>
<tr>
<td>Patent applications</td>
<td>-</td>
<td>0.3</td>
</tr>
<tr>
<td>Licences sold</td>
<td>-</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Fifth Framework Programme

In addition to the overview of project results provided through responses to the on-line survey, the telephone interviews with project participants, national policy makers and stakeholders have provided further qualitative descriptions of project outputs and results. Interviewees discussed a wide range of outputs from FP5 socio-economic projects, especially direct results such as conferences, publications, new or improved tools and models developed, and methodological guidelines. The focus of discussions on outputs was therefore very much in line with the main ‘output’ areas from socio-economic research revealed in the table above.

As was discussed in section 4, the socio-economic projects within FP5 can be clustered into three different types of activity, as follows:

- Data collection and model development
- The development of methodologies, tools and guidelines for assessment and implementation projects
- Training, networking and seminars to disseminate or share information

To highlight the main scientific outputs and achievements from the socio-economic projects, it is therefore appropriate to differentiate between these three areas of activity and to pick specific examples of projects within each to exemplify the relevant project results in that area.

In the area of data collection and model development the DAT-GEM-E3 project provides a useful example of the type of outputs produced. It involved the geographical extension of the GEM-E3 General Equilibrium Model Database and this was the main output from the project. The database includes economic data such as national accounts data, input-output tables, trade flow information and R&D data on innovation, plus energy/environment data on energy balances, emission coefficients, emission transport and transformation parameters and damages of major pollutants linked to energy use. The project gathered this information from most of the EU accession countries and from other parts of the world and incorporated this within the database and model in order to increase it’s potential use.

As an example of the development of methodologies, tools and guidelines, the key project outputs from the Baselines for Accession States in Europe (BASE) project included:

- Country Reports for the participating countries (Austria, Czech Republic, Estonia, Finland, Hungary, Poland, Slovenia and the United Kingdom)
- Guidelines for Baseline Development
- A Final Report of the BASE project
- National Baseline Report and Database Report
National Criteria for JI Projects
Report on Marrakech Issues

These results were made publicly available via the BASE website, including the new methodology and guidance for preparing and assessing project proposals, and could be used by relevant government agencies and ministries in assessing and agreeing new project proposals.

The DIEM project provides an example of a project that focuses on dissemination/training/networking activities. This project sought to disseminate and discuss the methodology and results from the ExternE project. The specific outputs included:

- Expert workshops organised with the aim to discuss and review the major sources of uncertainty
- Dissemination of the ExternE methodology and results through workshops highlighting the new developments
- Harmonisation of the methods used and dissemination of these to the users of the methodology
- A new website created, the ExternE Internet page: http://www.externe.info that contains all information about methodology and results.
- Various fora established to provide discussion space on the methodology and on the results for a wider range of stakeholders and policy makers

Sixth Framework Programme

The largest FP6 project in the field of socio-economic and policy related research, both in terms of funding and the number of participants, was the New Energy Externalities Development for Sustainability (NEEDS). The project is based on the results and the methodology of the former ExternE project, funded during FP5. The follow-up project aimed at refining the methodology and the figures provided by ExternE and extend the geographical coverage of the former project. The most important output and results for the project included the following:

- Databases including life cycle inventories for all emerging energy technologies analysed within NEEDS, a technology repository including reference cases, a stakeholder database in addition to specific datasets on the specially targeted countries
- Software tools including web based tools, modelling platforms
- The results of the project manifested in a large number of publications from methodological reports through technical papers to publications on the project results aimed at their dissemination. The following list provides some examples from the publications:
  - A series of reports on the technical specifications of future energy technologies, regarding the life cycle assessment of these technologies
  - A methodological report the valuation of externalities regarding the loss of biodiversity
  - Country specifications regarding the countries covered by the NEEDS project
  - Reports and technical papers on a variety of innovative issues, including air pollution from indoor sources, advancements in the monetary valuation of mortality or hydrogen as an energy carrier.

5.2 Contribution to ERA strengthening and international collaboration

The participants in socio-economic projects during FP5 and FP6 were spread across a broad geographical area:
In FP5, participants represented 25 different countries, with the highest levels of participation from organisations located in Germany (13), France (10), the UK (9), Belgium (9), the Netherlands (8), Austria (7) and Switzerland (6) – the remaining countries had 5 or less participations each.

In FP6 participations were spread across 32 different countries, with the highest levels of participation from organisations located in Italy (14), Germany (12), France (12), Poland (9), the UK (7) and Switzerland (7) – the remaining countries had 5 or less participations each.

As such, international collaboration was clearly a key feature of many of the projects in this area and has been explored further through the interviews and survey.

Respondents to the survey were initially asked to assess the extent to which their project had provided opportunities to enhance their cooperation with partner research groups. The responses allow us to understand the extent to which participants were working with different types of partners in their project, in terms of their prior knowledge of these organisations and their experience of working together. The majority of respondents in socio-economic projects reported that they had worked in the project with at least one partner that:

- They did not know before (85%)
- They knew but had not worked with previously (93%)
- They already worked with to a limited extent (84%)
- They were already one of their traditional partners (88%)

Therefore, in the majority of cases projects brought together a range of partners that covered the full spectrum from ‘previously completely unknown’ to ‘already close collaborators’.

As such, a follow-up survey question on the impact of involvement in a socio-economic project on the participants themselves, in terms of enhancing their cooperation with other organisations, showed significant improvements to the development of working links and contacts (Exhibit 8). In particular, all but one of the respondents to the survey reported that their involvement in the project had resulted in new or enhanced links to EU contacts. In addition, around half of respondents reported that the project had led to new or enhanced links to non-EU contacts (54%) or new or enhanced university-industry links (49%).

Survey respondents were also asked to indicate the impact of the project on cooperation for their organisation more broadly. The results (presented in Exhibit 9 below) show that for all but one of the projects there was an impact on enhancing the cooperation between their organisation and partners in EU countries – and that in nearly a third of cases (30%) this impact was ‘large’. The proportion reporting enhanced cooperation with non-EU partners is lower, but over half (52%) of respondents still reported an impact in this area.

The extent of enhanced cooperation as a result of the project is also reflected in responses to a follow-on question as to whether the participants expect new partnerships formed to be long lasting. Almost all of the socio-economic respondents anticipated at least one new partnership
formed through their project to be long lasting. Where the project involved new partnerships with organisations outside of the EU, the results were less clear. However, two-thirds of these respondents indicated that it was possible that these partnerships would be long lasting.

Interviewees confirmed that project participation had resulted in extensions and enhancements to the international cooperation activities of those involved via enhancement of the overall status and credibility of their organisation as well as acceptance of their work mostly by the research/academic community and, to a lesser extent, by the policy communities in some EU countries. Many pointed to the enhancement and development of new relationships with organisations within the European Union, though a few highlighted new and improved links in neighbouring regions and other parts of the world.

The NEEDS project covered a particularly large geographical area in terms of the partners in the project, with 66 different participants from 26 countries, composed as follows:

- 12 Member States from the EU-15,
- 9 new EU Member States,
- 3 Mediterranean countries, and
- 2 countries from other parts of the world

According to participants within this project, the collaboration has been very successful and the widening of the scientific relationships an important by-product of the project. Although there is no continuation of the project yet planned in FP7, there were definite plans amongst some participants to work together with other NEEDS partners, at least in smaller sub-groups, in the future.

At the other end of the scale, participants in one of the smallest FP6 socio-economic projects reported that as a result of their involvement in the project they had seen extended cooperation with organisations within the region of focus.

Similarly, interviewees who participated in small FP5 projects explained that the projects had only involved relatively local partners from within the EU, but that they had little or no knowledge of these partners before. As a result of the project, they reported that closer relationships had been established, their levels of EU cooperation had been enhanced and their image within Europe had improved. This particular participant saw these benefits as some of the most important impacts emerging from participation.

5.2.1 Collaboration with ICPC – added value and limitations

Four of the respondents to the survey were coordinators of projects with participants from ICPC countries. They were therefore asked further about these partners in the survey.

ICPC partners were included in the project for a range of reasons, but most commonly amongst these four projects to:

- Give access to specific skills and savoir-faire otherwise unavailable (3)
- Increase the expected impact on the development of new research collaborations (3)
- Give access to a specific field of investigation (2)

When asked to give an overall cost-benefit assessment of the inclusion of ICPC partners in their project, coordinators gave a wide range of results across the four projects (on a scale that ran from -3 to +3). The scores given and supporting information provided is shown below:

- +3 The benefits outweighed the costs. ‘The overall budget was rather small and the part dedicated to the ICPC partner was very limited, yet the results were very positive.’ The respondent also ranked the quality of the inputs of the ICPC partner across four different criteria as ‘internationally competitive’
- +1 The benefits outweighed the costs slightly. ‘The ICPC partner was of high quality’ – mainly referring to their scientific or technological knowledge
- 0 The costs equalled the benefits. The respondent provided no further information
The costs outweighed the benefits slightly. ‘It is probably still early to say, but the possible work opportunity feedback from these countries is uncertain’. The respondent also ranked the quality of the research inputs and day-to-day collaboration of the ICPC partner as ‘unsatisfactory’ in this case.
6. Policy impacts

6.1 Assessment of policy impacts

The participant survey recorded 'large policy impacts' for four of the 14 projects where we obtained responses, which would be an impressive success rate (28%) were it to apply for the socio-economic research portfolio overall. The four 'large-impact' projects were, in alphabetic order: BASE; ExternE-POL; MENGTECH; and NEEDS. In two cases, current success builds on former FP research (e.g. ExternE project).

Overall, 85% of respondents indicated that there had been some level of impact, as follows:

- No impact (15%)
- Small impact (15%)
- Medium impact (45%)
- Large impact (24%)

Interviews with participants provided a better sense of the nature and extent of these policy impacts, and the following case examples illustrate the types of impacts realised or foreseen by each of these projects.

The FP5 project Baselines for Accession States in Europe (BASE) sought to increase the rate at which the Accession States were able to move forward with their deployment of clean energy strategies, thereby contributing to the realisation of emissions targets, by developing transparent and efficient procedures through which to secure international investment in clean technologies. This was connected to the Joint Implementation process defined in the Kyoto Protocol, and the project produced a set of baseline tools and methodologies that were used in several cases in the one or two years after the project concluded. The impact on investment volumes and subsequent emissions levels is believed to have been positive, but could not be quantified. Unfortunately, exploitation of the guidelines proved to be somewhat short-lived as climate change policy has moved away from the use of the Joint Implementation mechanism and the problem and its solution (the BASE toolkit) were no longer relevant.

The FP6 project, Local New Energy Technology Implementation (LETIT), was intended to facilitate Europe's realisation of its ambitious emissions and energy efficiency targets. It sought to make this contribution to these overarching goals through the development of an improved investment appraisal methodology for use by local authorities. The project logic centres on the fact that local authorities control numerous assets, from government offices to schools to waste incinerators, with significant potential for energy efficiency improvements in general and deployment of renewable energy solutions. The argument goes that many of these improvement opportunities go unexploited, as local authorities lack the resources to identify, evaluate and implement appropriate energy-development projects. The primary objectives of the LETIT project were to develop a robust investment appraisal framework suitable to use by local authorities so they might identify improvement opportunities more readily, and to develop a series of implementation modules to reduce the commercial and technical risk of implementing novel technologies. The project has only recently concluded and so it has yet to realise its full potential, however there are positive early signs where the close involvement within the project of local authorities in six EU member states has led to several instances where the new framework and toolkits have come into use. For example, the project experience has informed the content of the Regional Energy Action Plan for South Bohemia as well as a more practicable implementation within a regional energy auditing and energy saving programme.

The FP6 project, New Energy Externalities Development for Sustainability (NEEDS), anticipates very significant impact on energy policy, energy systems and CO2 emissions as a result of its further refinement of a Europe-wide energy model and in particular its breakthrough work on defining, monetising and aggregating the external costs (economic, environmental, social) associated with most classes of currently available energy technologies. The work was commissioned and carried out with a view to facilitating more
robust evaluation of policy options and energy technologies. The project held its final conference in February 2009, so it has yet to make an impact within policy circles, however the work has been followed with interest by large numbers of stakeholders through contributions to surveys and attendance at Policy Fora. Ultimately, the project team believes it has produced a much better basis (and toolkit) by which policy makers might seek to reveal the real and full cost of different energy production scenarios thereby influencing energy prices and improving market efficiencies. There is a presumption that such a development in pricing would have a strongly positive impact on the rate of development and implementation of renewable energy technologies too, which struggle to compete on simple economic grounds (cost / Kwh) with conventional power generation technologies, from nuclear to coal to gas.

A few project participants found it difficult to identify and quantify specific impacts of individual projects on policy. Nonetheless, interviews suggest that policy initiatives in Tunisia and Morocco for the promotion of wind and solar power, for instance, were shaped by FP5 projects, most notably CDMEDI. Similarly, AEOLOS project results were used by the Norwegian Environmental Protection Agency for pre-normative research that, reportedly, fed into pollution control regulatory process.

While policy impacts are evident at two distinct levels, national or European, there appears to be a rather better view of the programme amongst European officials than there is at the member state level.

Overall, the interviews with national policy makers suggest there is currently little attention paid to the Framework Programme’s socio-economic and policy related research activities in the non nuclear energy field, even in those countries that play a leading role in energy research more generally. National issues and/or challenges requiring immediate attention appear to continue to dominate thinking. In addition, policy making largely remains more reactive, rather than proactive, as resources for strategic thinking about drivers and longer-term policy design and decisions are rather limited. Nonetheless, politicians in the EU Members, according to an interview, largely take into consideration FP research evidence and externalities.

Indeed, in several cases, national policy makers stated that they were not even aware of the existence of the EU’s strategic energy research. In one case, having had the portfolio of work brought to their attention, the individual concerned expressed delight at the apparent relevance of a long list of projects to their local interests and evidentiary needs.

“The department has very great interest in socio-economic research related to energy. Almost every one of the department’s major areas of activity is fraught with uncertainty and a source of dilemmas where further research could very well be helpful”

Whatever the reason for the present low share of mind amongst national policy makers, with energy rising up the policy agenda, and often involving choices between two or more challenging and partially undesirable scenarios, there would seem to be a prima facie case for more programme and project dissemination activities.

In addition, interviews revealed limited engagement by stakeholders and national policy makers from the New Member States. Their involvement with the programme played out in most of the cases through participation in a single project workshop or event.

In marked contrast, there was greater awareness of the socio-economic research amongst the Commission Services, perhaps reflecting the programme’s primary focus and the pan-European construction of its research activities. There are also some benefits from the proximity between the programme administration and user communities in the Commission. For instance, interviews with Commission staff suggest that interaction and exchange of information, both formal and informal, between DG Environment and DG Research and DG Energy and Transport on issues concerning climate change or climate change adaptation and renewables, respectively, have facilitated the identification of the needs of, and opportunities for benefits from FP socio-economic research for, DG Environment.

In any event, interviews with Commission representatives and review of EC publications draw a colourful picture on the usage and impacts of the projects under discussion. Examples for the utilisation of the project results include:

- SAFIRE and GREEN-X projects contributed to set up the targets and to promote electricity from renewable energy resources
• GEM-E3 one of the macro economics models developed from FP funding was used to illustrate the health related benefits of EU environmental policies

• Community guidelines on state aid for environmental protection - Based partly on the research project of externalities, it used the ExternE accounting framework.

Some Commission officials interviewed pointed out the impacts of FP NNE activities on policy but found it somewhat difficult to link these impacts to specific projects, or project achievements. Overall, there was agreement that projects developing roadmaps, methodologies and models have had direct inputs to policy in some user DGs, including Environment. Thus, estimates of technology learning and analysis of resource availability and modelling tools, including the PRIMES model for energy systems and the GEM-E3 model developed under three consecutive Framework Programmes, shaped to a considerable extent, initiatives in the areas of energy and climate change, proposed by the Commission. These include the energy and climate change package (of 2007), the proposed new Directive on Renewable Energy (2008) and the proposals on energy and climate change (January 2009) aimed at facilitating the achievement of an international agreement on climate change in Copenhagen at the end of the year.

6.2 Diffusion and dissemination of project results to policy arena

The desk research and survey confirmed that all FP5 and all FP6 projects had delivered wide-ranging communication and dissemination programmes, encompassing academic, industrial and policy audiences as deemed appropriate. In the great majority of cases, these communication programmes included both broadband channels, such as project web sites and newsletters, and narrowband channels, such as more deliberative workshops and dialogue events. The survey revealed that individual participants had on average taken part in around three events: a conference, seminar or similar event.

The public-facing web sites of the projects are quite comprehensive in terms of their disclosure of deliverables (e.g. contract research reports) and adopt broadly similar communications strategies, preferring simply to broadcast standard project content to all and sundry rather than providing targeted information tailored to specific audiences and piggy-backing intermediate sites. In most cases, the approach tends not to support interaction and dialogue with visitors / users. We understand from our interviews with participants that the inward facing element of the project web sites are more sophisticated and make greater use of what has come to be known as Web 2.0 modalities.

Turning to more traditional forms of communication and user engagement, the interviews suggest that in

• Most cases, policy makers and other stakeholders were invited to attend conferences and workshops that were run throughout the life of the project in question

• Many cases, policy makers and other stakeholders were consulted / contributed to the framing of study objectives and the study design

• A minority of cases, policy makers and other stakeholders were active participants within the project itself

• In a very small minority of cases, policy makers and other stakeholders were reported to have made subsequent commissions or launched studies as a result of the work

There were several examples of good practice evident. In case of the BASE project for example, the inclusion of national governments as partners in the project gave the project team rather more weight, and a higher profile, in the eyes of officials and policy interests. The decision to hold major stakeholder events in each of the five accession countries participating in the project, increased project visibility amongst prospective user communities and facilitated access to stakeholder inputs (interviews, focus groups, etc). The inclusion of briefing sessions on Joint Implementation more generally, and not just the project methodology and objectives, meant that stakeholders learned from the project as well as being informed about it. The LETIT project also included users within the wider circle of project participants and interesting focused some of its experimental development work on these individual local authorities, producing specific case material, deeper insight amongst users as
to the relevance and tractability of tools and methods under development and tools that were arguable more ‘fit for purpose’ than would have been the case otherwise. The NEEDS project included a separate policy strand within its communication strategy, and held one-day events, entitled policy fora.

On balance, while there are examples of good practice, we conclude that greater weight ought to be placed on user engagement and dissemination and that this should be pursued across the life of a project, from conception through to implementation. Indeed, in other fields, a research project to support policy will encompass both the classical research and the early stages of the implementation work: in a policy environment, this kind of ‘action research approach’ does not conflict with state aid rules and does not obviously risk distorting markets.

We recognise this is a familiar exhortation and that improving user engagement is non-trivial, when the particularities of even strategic applied research can be a very long way removed from the world of policy making. Policy operates with a much faster metabolic rate than is appropriate to research, and must make choices that balance many factors to arrive at (optimal) compromises that provide the least worst outcomes. There are solutions to this conundrum regarding the ‘inter-operability’ of research and policy, which encompass such ideas as the increased use of

- Communication and packaging techniques that digest and popularise insights (e.g. Harvard Business Review)
- Research synthesis and meta analysis, to document and learn from the status of knowledge but from a sharply focused user perspective
- Knowledge brokers and intermediaries, people with the time and hybrid skills that means they can be both ‘intelligent customers’ for the research community, able to articulate policy needs in terms of the scientific process, and ‘research champions’ able to access and communicate with policy teams at key moments and in language they recognise

Perhaps the single best solution is to work harder at finding, serving and engaging the many hundreds of professional analysts and scientists embedded in policy making environments throughout the EU.

We have only a partial view of user engagement at the programme level, and in particular the deliberation, prioritisation and framing of the research agenda, however our sense is that there remains something of a gap between policy and research, and that more work might be done to bridge the two communities and move beyond the situation where the majority of current and future investments will be driven bottom up by the research community pursuing legitimate increments to the knowledge base.
7. Economic and social impacts

7.1 Assessment of economic and social impacts

Our stakeholder interviews produced no examples of socio-economic projects having produced directly attributable economic benefits, which was not expected given the programme objectives and primary purpose.

By contrast, the participant survey revealed a broad range of economic impacts attributable in part at least to the FP 5 or FP6 project in question. The results are shown in Exhibit 10.

The development of new business opportunities was the most widely reported economic benefit, with more than 50% of all respondents stating that their involvement in the FP project had delivered a gain of some measure to their employer.

- 40% of respondents stated that the project had led to an improvement in the competitiveness or international standing of their employer and
- 30% of respondents stated that the project had led to an improvement in employment
- 20% of respondents stated that the project had led to an improvement in one or more of several other classes of benefit, from turnover to profitability
- In most cases, the impacts realised were reported to have been small to medium

Exhibit 10  Distribution of economic impacts on participants (n = 30)

<table>
<thead>
<tr>
<th></th>
<th>Not applicable / no impact</th>
<th>Small impact</th>
<th>Medium impact</th>
<th>Large impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of new business opportunities</td>
<td>47%</td>
<td>37%</td>
<td>13%</td>
<td>3%</td>
</tr>
<tr>
<td>Increased employment</td>
<td>70%</td>
<td>20%</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>Enhanced productivity</td>
<td>77%</td>
<td>17%</td>
<td>7%</td>
<td>0%</td>
</tr>
<tr>
<td>Access to new markets</td>
<td>77%</td>
<td>13%</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>Enhanced competitiveness</td>
<td>61%</td>
<td>19%</td>
<td>13%</td>
<td>6%</td>
</tr>
<tr>
<td>Increased turnover</td>
<td>83%</td>
<td>10%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Increased profitability</td>
<td>80%</td>
<td>10%</td>
<td>10%</td>
<td>0%</td>
</tr>
</tbody>
</table>

The evaluation produced no good view of the extent to which the projects had had any material impact in the social realm, whether that might relate to public awareness of issues or improved educational curricula or other social / health gain (e.g. with respect to fuel poverty).

7.2 Diffusion and dissemination of scientific results to economic and social arena

In the case of the energy-related socio-economic research, the principal focus of the communication strategies has been policy audiences and other researchers, including private sector technologists and expert consultants, with industry and other stakeholders being addressed in a slightly less systematic fashion. Other research areas have sought to make much stronger connections with the economic realm. There are exceptions for example, in the minority of cases where projects had an industrial focus in part at least:

- The Resource Network facilitating QHSE Development for Sustainable Energy Industry - PART 2 (TRENDS-2)
- Policy And Regulatory Roadmaps For The Integration Of Distributed Generation And The Development Of Sustainable Electricity Networks (SUSTELNET)

In all other cases, project web sites are open to all types of stakeholder and in the majority of cases, end-of-project conferences and other major events, would have had some small participation from regulators, and industry.
On balance, it is not clear that this aspect of the programme produced any novel approaches to dissemination or engagement in the economic arena.
8. Environmental impacts

Our stakeholder interviews produced no examples of socio-economic projects having produced measurable improvements in either energy efficiency or CO2 emissions, which were explicit if very high-level ambitions for most if not all of the projects under both FP5 and FP6. Our inability to identify specific environmental impacts does not mean that impacts have not or will not occur. The null result is quite likely to be the product of the complex relationship between research, and particularly individual research projects, and wider social or environmental impacts. While the research might be absolutely critical to an environmental gain, it is rarely the case that one project will quickly and unequivocally produce a stream of new benefits. For the most part, research works in concert with other factors and benefits will tend to accrue some years in the future and possibly in rather diffuse ways all of which makes it hard to measure (and attribute) a part of any environmental gain to a specific public investment in research.

As if to support this contention that the absence of measurable impacts is at least in part the result of the measurement challenge, the participant survey revealed a broad range of adjudged environmental impacts attributable to the FP5 or FP6 project in question. The results are shown in Exhibit 11 below.

It is clear that, overall, the 14 projects in question are judged to have been most consequential in the areas of ‘reduced environmental impacts from energy use’ and the ‘development of renewable energy sources.’ These two classes of impact are linked inasmuch as improved energy models and investment appraisal methodologies are expected to produce more equitable pricing of energy and a changing energy balance in favour of renewables, with their intrinsically better environmental performance. The work has been less relevant to energy efficiency and demand side issues more generally, it has similarly done little in the area of security of supply or more narrowly technical issues like improved carbon capture.

Exhibit 11 Impact on energy and the environment (n = 30)

<table>
<thead>
<tr>
<th>Impact on energy and the environment</th>
<th>Not applicable / no impact</th>
<th>Small impact</th>
<th>Medium impact</th>
<th>Large impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of clean energy systems</td>
<td>40%</td>
<td>3%</td>
<td>40%</td>
<td>17%</td>
</tr>
<tr>
<td>Development of renewable energy sources</td>
<td>37%</td>
<td>17%</td>
<td>30%</td>
<td>17%</td>
</tr>
<tr>
<td>Increased efficiency of energy production</td>
<td>57%</td>
<td>20%</td>
<td>20%</td>
<td>3%</td>
</tr>
<tr>
<td>Increased efficiency of energy storage and distribution</td>
<td>63%</td>
<td>27%</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>Increased efficiency of energy use</td>
<td>57%</td>
<td>23%</td>
<td>17%</td>
<td>3%</td>
</tr>
<tr>
<td>Improved techniques for carbon capture and storage</td>
<td>83%</td>
<td>10%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Reduced costs of sustainable energy technologies</td>
<td>53%</td>
<td>20%</td>
<td>20%</td>
<td>7%</td>
</tr>
<tr>
<td>Increased security of energy supply</td>
<td>60%</td>
<td>10%</td>
<td>13%</td>
<td>17%</td>
</tr>
<tr>
<td>Development of improved markets for sustainable energy</td>
<td>30%</td>
<td>30%</td>
<td>21%</td>
<td>9%</td>
</tr>
<tr>
<td>Reduced dependence on fossil fuels</td>
<td>63%</td>
<td>10%</td>
<td>13%</td>
<td>13%</td>
</tr>
<tr>
<td>Reduced demand for energy</td>
<td>60%</td>
<td>27%</td>
<td>10%</td>
<td>3%</td>
</tr>
<tr>
<td>Reduced environmental impacts from energy production / use</td>
<td>37%</td>
<td>23%</td>
<td>26%</td>
<td>20%</td>
</tr>
</tbody>
</table>

Exhibit 12 summarises the main areas of energy/environment related impact of the nine FP5 projects for which we obtained survey responses, while Exhibit 13 summarises the main areas of impact of the five FP6 projects. The table show no marked difference in the profiles of adjudged outcomes between FP5 and FP6 projects.
### Exhibit 12  Main areas of impact on energy and the environment from FP5 projects

<table>
<thead>
<tr>
<th>Area</th>
<th>BASE</th>
<th>CDMEDI</th>
<th>DAME-BC</th>
<th>DAT-GEM-E3</th>
<th>DYN-GEM-E3</th>
<th>EXTERNE-POL</th>
<th>MALET</th>
<th>SAFIRE-LP</th>
<th>SAPENTIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of new environmental legislation / policy</td>
<td>XXX</td>
<td>XX</td>
<td>XX</td>
<td>XXX</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>XX</td>
<td></td>
</tr>
<tr>
<td>Reduced environmental impacts from energy production / use</td>
<td>XX</td>
<td>XX</td>
<td>X</td>
<td>XXX</td>
<td>XXX</td>
<td>XX</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of improved markets for sustainable energy</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>X</td>
<td>X</td>
<td>XX</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of clean energy systems</td>
<td>X</td>
<td>XX</td>
<td>XXX</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of renewable energy sources</td>
<td>X</td>
<td>XX</td>
<td>X</td>
<td>XXX</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced dependence on fossil fuels</td>
<td>XXX</td>
<td>XXX</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved techniques for carbon capture and storage</td>
<td>XX</td>
<td>X</td>
<td>XXX</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased efficiency of energy use</td>
<td>X</td>
<td>XX</td>
<td>XXX</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased security of energy supply</td>
<td>XXX</td>
<td>XX</td>
<td>XXX</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced costs of sustainable energy technologies</td>
<td>X</td>
<td>XX</td>
<td>XXX</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased efficiency of energy production</td>
<td>XXX</td>
<td>XX</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased efficiency of energy storage and distribution</td>
<td>XX</td>
<td>XX</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced demand for energy</td>
<td>X</td>
<td>X</td>
<td>XX</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Number of impact areas: 5 5 4 2 13 3 13 5 2
Average intensity of impact: 1.8 2 1 2 2.1 3 2.1 1.4 2

### Exhibit 13  Main areas of impact on energy and the environment from FP6 projects

<table>
<thead>
<tr>
<th>Area</th>
<th>CASES</th>
<th>CREATE</th>
<th>ACCEPTAN</th>
<th>CE</th>
<th>LETT</th>
<th>MENGETEC</th>
<th>H</th>
<th>NEEDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of new environmental legislation / policy</td>
<td>XXX</td>
<td>XX</td>
<td>XXX</td>
<td>XX</td>
<td>XXX</td>
<td>XX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of renewable energy sources</td>
<td>XX</td>
<td>XX</td>
<td>XXX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of clean energy systems</td>
<td>XX</td>
<td>XXX</td>
<td>XX</td>
<td>XX</td>
<td>XXX</td>
<td>XX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of improved markets for sustainable energy</td>
<td>X</td>
<td>X</td>
<td>XXX</td>
<td>XX</td>
<td>XXX</td>
<td>XX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased security of energy supply</td>
<td>XXX</td>
<td>XXX</td>
<td>X</td>
<td>XX</td>
<td>XXX</td>
<td>XX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced environmental impacts from energy production / use</td>
<td>XXX</td>
<td>XX</td>
<td>X</td>
<td>XX</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced dependence on fossil fuels</td>
<td>XX</td>
<td>XX</td>
<td>X</td>
<td>XX</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced demand for energy</td>
<td>XX</td>
<td>XX</td>
<td>X</td>
<td>XX</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased efficiency of energy production</td>
<td>XX</td>
<td>XX</td>
<td>X</td>
<td>XX</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased efficiency of energy use</td>
<td>X</td>
<td>XX</td>
<td>XXX</td>
<td>XX</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced costs of sustainable energy technologies</td>
<td>XX</td>
<td>X</td>
<td>XXX</td>
<td>XX</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased efficiency of energy storage and distribution</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>XX</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved techniques for carbon capture and storage</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9. Conclusion: added value of EC-funded research

9.1 Scientific challenges and opportunities

For FP5 and FP6, European-level scientific challenges for the socio-economic and policy related research area – commonly known as strategic energy research – were defined principally by the European Commission in consultation with stakeholders from across the energy policy and research communities.

For FP5 and the later 1990s, the scientific challenges can be split into two groups, segmented by the primary purpose of this proposed research.

In the first case, socio-economic research is cast in the role of support to European-level technological innovation in the energy field. Here the research challenges relate to:

- Development of procedures to facilitate a more rounded approach to the definition of research agendas and technology trajectories, to increase the prospects for more positive outcomes
- Development of new knowledge relating to the socio-economic aspects of novel / emerging energy technologies, from questions to do with consumer behaviour to the identification and valuation of risks to the costing of wider implementation

In the second case, we have medium to long term applied research through which to support the evolution of European energy policy. These challenges are expressed in reasonably generic terms in successive programme documents beginning with the idea with such research should principally be concerned with improving European energy policy as regards both its effectiveness and efficiency.

- New conceptual models, with which to better characterise energy systems and responses to differing policy scenarios
- New data sets / time series, with which to strengthen existing energy models
- New operational tools, with which to compare the costs and benefits of competing energy technologies and systems (options appraisal)
- New knowledge about the impacts and cost-effectiveness of given policy interventions

The presentation of scientific challenges mostly concerned the second group. There is very little discussion of specific European challenges, however there appears to be a presumption that an ‘intelligent customer’ exists in both cases, European technology projects and European policy development value, and that proposals are likely to come forward and should be selected only where there is a clear European added value.

This has an appealing, pragmatic quality, however it is not immediately clear that it can work well in practice, where on the one hand technology projects might be expected to be unpersuaded by and possibly even unconscious of the potential value of a broader interdisciplinary approach to their development work. Similarly, on the policy side, it is well know that the highly specific, contingent and long-run qualities of strategic applied research – technical or socio-economic – can be challenging for policy teams that must make decisions quickly that apply to broad socio-technical systems with wide-ranging and often uneven consequences.

The former ‘market failure’ might tend to require public bodies to take a lead in reframing development methodologies, while the later tension is perhaps best addressed through a more segmented strategy, wherein short-term evidentiary requirements are tackled through for example research synthesis and meta analyses, with supervisory inputs from senior representatives of policy teams, while the bigger questions are addressed through more fundamental research programmes, which are closely targeted against policy significance and tractability through explicit deliberation between users and producers of knowledge.
9.2 European added value

In this area review, the study team struggled to obtain any meaningful contribution from policy makers and other research users on the specific added value of EC-funded research in the energy-related socio-economic field, as compared with the research work being performed nationally or elsewhere.

This null result is more likely to be the product of the low visibility of the socio-economic research portfolio at the member-state level, due to its smallness and focus on more explicitly European questions.

Comparison of the FP socio-economic research portfolios with project listings maintained by several leading national energy research institutes does suggest a difference in the scope of the empirical work funded at national as compared with European levels.

Pan-European nature of the research projects within FP5 and FP6 has clearly added value in terms of the development of more generally applicable (rather than country specific) energy models and this harmonisation process is also evident in respect to the valuation and assessment methodologies under development. The focus on explicitly EU-level challenges is also a point of difference to work being performed at the member state level.

It is not clear that the work supported through FP5 or FP6 has been materially different in respect to either its deployed competencies or its scale, as compared with work in progress in some of the more active member states such as Germany and Italy. The NEEDS project is perhaps the one exception where the budget and partnership were both substantially larger than socio-economic research grants being made at the member state level.

9.3 Impacts of energy-related socio-economic research

Research impacts are more in evidence when looked at from the perspective of the research projects, with participants consolidating their competences and increasing their confidence around future research and even commercial outcomes in the shape of increased work opportunities and sales. The new tools and methodologies developed through the research projects are generally held to be relevant to policy interests and most project partners were able to point to some engagement with policy makers and regulators and in a small minority of cases were able to cite specific instances where new techniques, principles and data had been used in a policy setting. None of the projects was able to provide estimates of the nature and extent of the impact of such changed behaviour on policy and on energy systems and environmental performance.

Changing perspective, working from energy policy backwards towards key research breakthroughs, proved to be more problematic, and the most robust assessment is set out in the journal article written by Domenico Rosetti di Valdabero, which documents a series of instances where FP5 projects to develop and refine energy models have shaped EU policy targets on for example the share of electricity derived from renewable sources.

There is a strong path dependency evident in the project portfolios of FP5 and FP6, with many of the FP6 projects having antecedents in FP5 and previous framework programmes. In this sense, the Commission’s programme of socio-economic research is very much a work in progress with models and valuation methods continuing to be refined and producing positive knock-on effects in other models and tools in use nationally and internationally. We fully expect these instrumental developments to continue to contribute to changed understanding and policy choices over the next decade.

9.4 Opportunities for improvements

Given this area of energy research is clearly a work in progress – and FP7 is still very much in train – it is arguably somewhat premature to talk about opportunities for improvement.

However, strategic energy research is arguably becoming more important and there might very well be a case for the Commission services to explore ways in which it might do more to bring this portfolio of excellent research to the attention of rather more policy makers and regulators.
In particular, we recommend the Commission consider exploring its options to redouble communication / dialogue activities with policy users around the findings of FP5 and FP6 projects, which would appear to have a great deal of value that remains untapped and even unseen by many policy makers at European and member state level.

We have not sought to investigate the situation with regard to FP7, however our policy interviews were somewhat underwhelming and suggest that even here more might be done to improve and increase user engagement / awareness of current projects.

Policy interests amongst many EU member states are clearly hungry for more and better insight, data and evidence around issues that were addressed in part by FP6, on for example, externalities, consumer behaviour and policy mix. Ahead of any future calls, there might also be a case for the Commission services seeking to facilitate a much broader debate between knowledge producers and users in order to arrive at a long list of the most pressing medium to long term challenges.

There might also be some value in the Commission considering the appropriateness and feasibility of introducing one or two new modes of intervention to better bridge the research-policy communities, perhaps through support for the creation of networks of knowledge brokers (communities of practice to share and develop competences amongst the many hundreds of specialist scientists, economists and statisticians embedded within public bodies) or specific support for more secondary research (status of knowledge reviews, meta analyses, research syntheses, etc). Other ERA instruments might also be brought into play to a greater extent, with the ERANET scheme being perhaps the most obvious in light of the two previous suggestions.