



ASSESSMENT OF THE DEVELOPMENT OF THE EUROPEAN RESEARCH AREA IN NON-NUCLEAR ENERGY RESEARCH

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to the EC Research Directorate General (Energy Programme)

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FINAL REPORT

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CONTENTS

	Page
Executive Summary	i
1 Introduction	1
1.1 Introduction to this study	1
1.2 Assessing progress towards the ERA in NNE: Approach	2
1.3 Layout of the remainder of this report	3
1.4 Intended audience for this report	3
2. The European Research Area and non-nuclear energy research	4
2.1 Introduction	5
2.2 The rationale for a European Research Area - RTD generally and in NNE	5
2.3 Progressing towards the ERA - overall and NNE perspectives	7
2.4 Suitability for ERA of research areas within non-nuclear energy	10
2.5 Implications of recent assessments of progress towards ERA	14
2.6 Overall and NNE perspectives on ERA: some conclusions	15
3. Non-nuclear energy: assessment of progress to date towards ERA	16
3.1 Introduction	17
3.2 Preparatory activities for the ERA	17
3.3 Assessments of each RTD field within current NNE activities	18
3.4 Overall assessment: preparatory actions for ERA within NNE	19
3.5 Conclusions - assessment of progress towards ERA	25
4. Barriers to further progress towards ERA	28
4.1 Introduction	29
4.2 Current level of knowledge of ERA and ERA instruments	29
4.3 Fragmentation within NNE areas	30
4.4 Competitiveness/confidentiality issues	31

	Page
4.5 Changes in approach to planning on the part of key RTD actors	31
4.6 Industry participation	32
4.7 SMEs in the ERA	32
4.8 Prenormative research	33
4.9 Mobility of researchers	33
4.10 Evaluation of very large projects	34
4.11 Lack of consistency of procedures across Europe	34
4.12 Lack of involvement of Member States' administrations	35
4.13 The Commission's own role	35
4.14 RTD areas not included within FP6 priorities	37
5. Recommendations	38
5.1 Introduction	39
5.2 Recommendations	39
5.3 Concluding note	44
ANNEXES	
Annex A: List of Principal Activities Examined in the Course of the Assessment	46
Annex B: Internal Interviews with Commission Staff	48
Annex C: Activities by RTD field; Activities from which data were collected; Means of data collection; Summary points from assessment	50
Annex D: Summary assessments of progress made in preparation for ERA - By RTD field	61

Executive Summary

Introduction

This study was initiated by DG RTD (non-nuclear energy) in order to:

- Obtain an independent assessment of the progress being made in that area towards the establishment of the European Research Area.;
- Assess the barriers to further development of the ERA in NNE research;
- Provide recommendations on actions that could be taken to stimulate the process.

The study was carried out during the summer of 2002, through assessment of written materials on 32 present or planned activities involving some form of preparatory actions for the ERA. Interviews were conducted with 21 members of Commission staff in DG RTD, and further information was gathered by questionnaire and/or telephone interview with 22 co-ordinators of relevant activities.

Non-nuclear energy: an assessment of progress

An assessment of each separate area within NNE was undertaken, and the results were synthesised into an overall assessment of non-nuclear energy in relation to establishment of the ERA. Although much of the work remains at an early stage, *good progress* is being made towards mapping centres of excellence; developing shared views of the strategic issues facing the various RTD topics within non-nuclear energy; and development of RTD strategies.

Further progress is needed in planning and undertaking prenormative research, and in benchmarking of RTD programmes, policies and technologies (the Commission should provide guidance here, to ensure that benchmarking in each technology area utilises the most appropriate approaches). The present Commission activity on science and technology references and indicators seems worthwhile and should continue. Further progress is also needed on developing structures for co-ordinating research in specific areas of NNE research. In some areas - for example, fuel cells/hydrogen - good progress has been made already. Elsewhere, there is a need to develop new structures and to ensure that present and future structures can be reconciled in some way.

In common with the ERA generally, *least progress* has been made in mapping national and regional RTD policies, programmes and priorities. Indeed, apart from some specific actions in specific areas, little appears to be being done at present on this. Lack of progress here could jeopardise the whole ERA ideal, and the Commission's present intention to launch a study is particularly welcome.

Barriers to further progress

During the study, views were collected on the barriers to further progress towards establishment of the ERA. These included the following:

- Gaps in present knowledge of the ERA and the instruments in FP6. There remains a lack of clarity among many RTD actors about the full implications of ERA concept, and about the instruments of FP6. This partly stems from gaps within the Commission itself (at the time of this study), and partly from a need for more targeted information provision.
- Fragmentation within NNE areas. The RTD community express concerns that it will be difficult to create suitable projects or networks capable of handling RTD areas where there are many different directions of possible technological advance. There is the danger that

some potential winners will be excluded. There is a particular need at this time for a strong Commission presence to guide existing networks and other activities.

- Present approaches to planning of RTD. RTD actors have to move rapidly towards a much longer term and more strategic approach to planning of RTD. Such activities require consultative, advisory and executive structures within each specific area of research, capable of planning and co-ordinating long term research programmes. In general, existing structures are inadequate because they are too fragmented. The Commission could encourage early action towards the development of suitable structures in each technology field.
- Industry/SME participation. Although in some areas there is already strong industry participation, in others this is a weakness at present. Many observers are concerned that SMEs, in particular, may find themselves effectively excluded from large NNE contracts.
- Mobility and training of researchers. The research community is all too aware of the need for mechanisms to facilitate the free movement of researchers from organisation to organisation, and from country to country, and this is seen as a major barrier. The new instruments in FP6 will place demands on contractors to spread excellence, and careful attention will be needed to ensure that adequate resources are allocated to training.
- Lack of involvement and co-ordination of Member States' administrations. Lack of engagement of Member States administrations in the development of the ERA represents a dangerous barrier to progress. Also, there is still inadequate knowledge of national RTD policies, programmes and priorities; knowledge such as this demands the allocation of adequate Commission resources to amassing it.
- The Commission's own role. There is a lack of clarity as to the Commission's own role in relation to the ERA, now and in the future. How involved should the Commission be, and how proactive? It is the view of this study that the greatest progress has always been made when the Commission has been highly proactive in an area of research, and that this will remain the case in the context of the ERA. There is also a need for the Commission to move firmly towards a more strategic, global view of RTD, with a greater allocation of Commission resources to support this role.

Recommendations

The principal recommendations arising from this study include the following:

- Increase stakeholders' real understanding of the ERA. Any gaps in information on how the new instruments will function now need to be plugged as urgently as possible. An "ERA Update" section on DG RTD's energy website could provide useful information, targeted specifically at the NNE research community. Consideration should also be given to special workshops with key stakeholders, to explore the ERA and its implications.
- Engage at a deep level with Member States' administrations. Targeted actions are recommended, with Commission Services identifying national administrations that are key to progress in each research area, and initiating in-depth dialogue on the implications of the ERA for long term RTD strategy in the given area. High priority should be given to mapping relevant national programmes and policies, with Commission staff undertaking this where existing actions do not address it adequately.

- Establish early foundations for an RTD strategy in each field. The Commission, working with key stakeholders, should contribute to developing outline strategies for each area within NNE RTD. At any rate, they should begin the process of mapping key strategic data and issues on which RTD strategies and plans can be based. This work should be conducted in collaboration with existing activities and structures as far as possible.
- Build on existing RTD structures. There is a need to work towards adequate overarching structures which will facilitate European co-ordination of research in priority areas. These structures should build on existing ones, and should take account of the commitment of organisations to these.
- Target industry/SMEs. There is a need to target industry with accurate information on the ERA, and to engage in meaningful dialogue that will reassure industry that the new instruments can serve their needs. Early and close links with the programme “Specific research activities for SMEs” should be established.
- Ensure adequate coverage of important prenormative research. There is a need to map out the most important and urgent prenormative research in each area, with a view to ensuring that this is adequately addressed as soon as practicable.
- Make sure of ongoing links with areas not included from FP6. Some strategically relevant areas in NNE are not included as priorities in FP6. There is a need to ensure that adequate arrangements and resources are devoted to maintaining meaningful links with these areas, outside of the framework programme.
- Encourage mobility and training of researchers. This is an area that concerns the whole of the ERA and not just NNE. However, at the least there is a need to ensure that links are retained between NNE and schemes such as the Marie Curie Fellowships. The present workshops run on a regular basis for Marie Curie Fellows are a valuable means of keeping contact with these resources, and this should be continued if possible.
- Prepare Commission resources for FP6 and the ERA.
The establishment of the ERA, and the new approaches embodied in FP6, mean a major change for the whole of DG RTD, and the organisation has to respond and adapt to that change. Actions needed include organisation development and training aimed at (a) developing the new work role of Commission Services in developing the ERA and FP6; (b) exploring the changing role of DG RTD as it takes on the ERA; and (c) new skills and different emphases in staff roles in relation to ERA and FP6. It would also be important to ensure that existing expertise and competence in the Commission is not lost in moving to a more hands-off programme administration in FP6; this expertise is needed in order to develop the strategic role which the Commission will need as the ERA develops. Resource planning should take into account the urgent short term need for sufficient resources are kept with an outward focus on the RTD community and RTD actions at the present time, despite the need for substantial resources in preparing FP6. On an ongoing basis, adequate resources are needed to ensure that the Commission is capable of performing an overall strategic and policy function within European non-nuclear energy RTD.

Much has been achieved within the non-nuclear research area so far, in progressing toward the ERA. Some of the gaps and barriers identified here could hold back progress, and there is a need to have an overall plan for transformation both of European research and of the resources in the Commission charged with bringing this transformation about.

1. Introduction

2002 is a year of very considerable change in European RTD. Although the concept of a European Research Area (ERA) is by no means confined to activities within the European Community's RTD framework programme, the reality is that the framework programme represents the central means by which the ERA can be progressed and supported. The launch of the 6th framework programme (FP6) in 2002 therefore represents a critical point in the development and realisation of the ERA.

But both the European Research Area and the approach to FP6 have been a long time in the development. The concept of a European Research Area was being explored in 1999, and was elaborated in some detail in January 2000¹. Likewise, there were internal and external factors influencing the approach to the framework programme in RTD during FP5, and moving it towards the ERA model. Some of these - for example, a proactive approach by Commission staff towards a co-ordinated European strategic planning of RTD; encouragement of larger projects and project clusters; and adoption of a more targeted, pan-European approach towards fields for research - were very much in line with the subsequent thinking on the ERA. Since 1999 and even before, FP5 activities such as studies and thematic networks were being encouraged which would lead key actors in research to work towards a more co-ordinated, integrated and above all strategic approach to European RTD. Thus, when we consider progress towards ERA, we are in fact looking at a broad sweep of movement and actions that go back to the very conception of the ERA and before.

1.1 Introduction to this study

The European Commission wished to obtain an independent assessment of the progress being made towards the establishment of the ERA in the field of NNE research. In May 2002, a study was commissioned which included the following tasks:

- To overview the policies and objectives of the ERA - in particular, how these relate to NNE research;
- To analyse and make a critical assessment of the activities undertaken either by the Commission or Member States with a view to establishing or deepening the ERA in NNE research (this was *not* to include the expressions of interest being compiled and assessed as the study proceeded, although in places the study does refer to some broad issues in relation to the call for expressions of interest, and the responses received);
- To assess the barriers to further development of the ERA in NNE research, including opportunities for a more co-ordinated implementation of national and EU policies and programmes in NNE research.
- To identify gaps in the progress made to date, and to provide recommendations for the future.

¹ COM (2000) 6, 18 January 2000.

The study was carried out during the period May to August 2002.

1.2 Assessing progress towards the ERA in NNE: Approach

At the core of the study was the identification and assessment of a range of existing and new activities such as accompanying measures, thematic networks and projects all of which at least potentially represented some form of orientation towards the concept of ERA in the NNE field. The assessment was only conducted in relation to the activities' relevance to development of the ERA. In addition, documents of relevance to the ERA, and other relevant documentation, were examined. The study involved the following steps:

1. Orientation based on initial and mid-point discussions with managers and key staff within NNE.
2. Collection and in-depth examination of written materials on NNE activities potentially related to development of the ERA, and of materials on the ERA itself. 32 separate activities were examined in depth (see Annex A). Information was obtained from the Commission, and extensive use was made of Commission and project website materials.
3. Face to face discussions with Commission staff concerning relevant activities, and their perceptions of progress towards ERA (see Annex B).
4. Collection of information and views from contractors and external project co-ordinators, by means of an electronically distributed questionnaire and/or telephone discussions. Detailed information was obtained in this way from 22 of the 32 activities (see Annex C). Some co-ordinators could not be contacted due to the timing of the study, and some were in any case only of peripheral relevance to the study.
5. Further face-to-face discussions with key Commission staff.
6. Detailed analysis of the information received, and preparation of the study report.

This study addresses activities administered by DG RTD; other NNE contracts managed by DG TREN are not covered.

1.3 Layout of the remainder of this report

The following section briefly addresses the concept of the ERA and, in particular, how it applies to the area of non-nuclear energy RTD. In doing so, some key 'conditions' for suitability of a research field for ERA are established, and these are applied to each of the principal fields of NNE research currently covered within DG RTD (whether or not they are now included as priorities within FP6).

Section 3 provides overview assessments, for each of the NNE research fields in turn, of the progress being made towards the ERA. These assessments are based on an examination of the different kinds of preparatory actions identified as a prerequisite for the ERA.. Section 3 also provides a summary assessment of the readiness of the NNE field overall.

Section 4 discusses barriers to progress towards ERA, and some of the key issues (internal to the Commission, and external, among the research community and relevant stakeholders) for consideration in progressing further.

Finally, Section 5 presents a set of recommendations based on conclusions drawn from the previous sections.

1.4 Intended audience for this report

Whilst the main audience for this report is intended to be the Commission, it might be worth circulating part or all of it to those who contributed views and information. It might stimulate some discussion of what is required in order to make progress with the ERA.

2. The European Research Area and non-nuclear energy research

Section 2 - Highlights

- Current problems with European RTD as a whole apply equally to the NNE field. Thus, the rationale for the ERA is valid also for NNE.
- In most if not all NNE research fields, structural and market conditions provide an impetus towards participation in the ERA.
- Many of the NNE RTD fields appear to be well suited to the ERA framework.
- Some current activities within NNE represent reasonable analogues - within limits imposed by previous rules and procedures - for the new instruments to be employed in FP6.
- Lack of involvement and mobilisation of Member States and national RTD programmes represents a major failing so far, for non-nuclear energy as in other areas addressed by the framework programmes.

2.1 Introduction

The rationale and concept of the European Research Area are well known within the Commission and elsewhere within the research community, through a wide range of Commission communications. Hence, it is not the primary intention here to describe the ERA in any depth, other than to discuss how the ERA rationale and objectives relate to NNE research. The main objective in this section is to examine the field of NNE research and the extent to which the concept of ERA is directly applicable within this field. A second objective is to assess the readiness of the ERA concept and instruments at this time, since it is this concept and these instruments which NNE staff have to promote to the research community and stakeholders.

In this section, the rationale, concept and operationalising of the ERA are briefly summarised. Next, a set of determinants of suitability for ERA is presented as a means of assessing whether a given research field is likely to fit naturally into the European Research Area concept. This set of determinants is then applied to NNE.

2.2 The rationale for a European Research Area - RTD generally and in NNE

The original Communication on the establishment of an ERA presented a comprehensive rationale for such a development² (this is summarised in Table 2.1, with a brief commentary against each in respect of the overall NNE research field³). The reality of European research is that there is no coherent policy covering the Community as a whole. National research policies, where they exist, often overlap and even conflict with the policies of other Member States and with EU research policy. Research priorities frequently change from one year to the next, making continuity or coherence of medium to long term research efforts very difficult in some cases.

As Table 2.1 illustrates, the current problems with European research apply more or less equally to the NNE field. In NNE, national research policies are often ill-defined or subject to rapid change; and many current areas of research do require a co-ordinated European programme - for example, in the development of hydrogen as an energy carrier throughout Europe, and so on.

² COM (2000) 6

³ Derived from a wide variety of written and verbal sources in carrying out this study

<u>Rationale for ERA:</u>	<u>What about non-nuclear energy RTD?</u>
<ul style="list-style-type: none"> • Lower research expenditure in Europe than in major competing countries (e.g. US, Japan) 	<ul style="list-style-type: none"> • European NNE research expenditure much lower in Europe as a whole than in US or Japan, for many important fields (e.g. Fuel Cells, Photovoltaics)
<ul style="list-style-type: none"> • Widening gap in research expenditure between Europe and other major competing countries 	<ul style="list-style-type: none"> • Gap between European and US/Japanese NNE research budgets in many important areas has widened over the last decade (e.g. Clean Coal)
<ul style="list-style-type: none"> • Trade balance in high tech products has shown a large/increasing deficit against Europe over the past decade 	<ul style="list-style-type: none"> • This is true for many fields within NNE (e.g. Photovoltaics), although there are some exceptions
<ul style="list-style-type: none"> • Research and technology account for 25-50% of economic growth, and have a strong influence on competitiveness, employment and quality of life of Europeans 	<ul style="list-style-type: none"> • Energy has an increasingly important place as an area of economic potential. Efficient energy use underlies economic growth and competitiveness. NNE RTD is required to maintain Europe's strategic positioning and competitiveness. Low-emission energy has a direct impact on quality of life and employment prospects, and climate change issues mean that NNE itself represents an area of enormous market potential
<ul style="list-style-type: none"> • Jobs have been best maintained/increased in industries with high R&D intensity 	<ul style="list-style-type: none"> • Energy efficiency is positively linked to employment. Trends towards increased RE, smaller and more distributed power generation sites, leads to greater employment, especially in regions and areas of low employment prospects
<ul style="list-style-type: none"> • Public research expenditure in competing countries has increased over the past decade 	<ul style="list-style-type: none"> • This is true for crucial areas within NNE R&D, while public expenditure in Europe has decreased
<ul style="list-style-type: none"> • Private R&D expenditure is less in Europe than in US and Asia 	<ul style="list-style-type: none"> • This is certainly the case in strategically crucial NNE R&D topics
<ul style="list-style-type: none"> • European research activities are fragmented and the principal reference framework is national 	<ul style="list-style-type: none"> • Very strongly the case for NNE, and in many cases even national NNE RTD programmes do not exist. National NNE priorities, where they do exist, are highly unstable over time (e.g. wave energy)
<ul style="list-style-type: none"> • The scale of R&D problems is increasing in size, complexity, and multi-disciplinarity 	<ul style="list-style-type: none"> • Not only is the scale increasing, but many applications within Europe demand a pan-European approach (e.g. standards and regulations in RE, Distributed Energy Resources, Biofuels, etc)
<p>Table 2.1: Rationale for development of a European Research Area, and relevance of rationale to the NNE research field</p>	

2.3 Progressing towards the European Research Area - overall and NNE perspectives

As the original communication in January 2000 pointed out, “decompartmentalisation and better integration of Europe’s scientific and technological area is an indispensable condition for invigorating research in Europe” (COM (2000) 6, p7). A “more dynamic configuration” is called for, based on measures taken at national, intergovernmental and EU levels, in order to create the necessary critical mass of research resources and to achieve adequate coherence in Europe’s research activities in key fields. COM (2000) 6 also refers to the need to remove barriers such as lack of mobility of researchers and poor information flows. There is also a requirement for collaboration and sharing of resources and facilities. Above all, there is a need for a pan-European research policy, with consensus among key actors on RTD strategies in the major research fields, taking into account available research strengths in Europe, global competition and opportunities, and international research linkages where appropriate.

To progress towards the ERA, the following are suggested in the Communication as necessary early-stage actions (in addition to those mentioned above):

- Networking existing centres of excellence, and creation of ‘virtual centres’;
- Development of a common approach to financing large research facilities;
- Greater coherence in developing and implementing national/European research programmes and activities;
- Research activities which can support the development of global RTD policies and strategies;
- Closer relations between organisations involved in RTD in key fields;
- A common scientific reference framework/system to assist in implementing policies;
- Direct and indirect instruments and resources to encourage research and innovation;
- Measures to facilitate greater mobility of researchers (plus actions to support and encourage women to participate, and stimulation of young people’s interest in scientific research);
- Efforts to increase European cohesion in research, including NAS countries;
- Improving the attractiveness of Europe as a location for researchers;
- Promotion of shared social and ethical values.

Some of the above can be achieved through the RTD framework programme, but this represents only one (albeit major) possible instrument in progressing towards an ERA. Nonetheless, the ERA concept has profound implications for the design and implementation of the framework programme, and specifically for FP6, to be launched in 2003. The instruments to be used to further the ERA within FP6 are well known, and they are merely summarised below,⁴ noting where there are current NNE activities which are similar to the instruments.

⁴ For the latest versions of guidelines for IPs and NoEs, see
<<http://europa.eu.int/comm/research/fp6/networks-ip.html>>.

Integrated projects (IPs): Research projects in strategically critical RTD areas, involving a critical mass of activities and resources needed to achieve ambitious and clearly defined scientific objectives. The primary deliverable is new knowledge, but IPs are also expected to have a structuring effect on European research. IPs will contain a coherent set of research activities within a unified management structure; overall strategic planning for the IP, along with suitable management resources and structures, will be crucial to success. There will be greater flexibility than with previous instruments, in terms of consortium composition through the life of the IP, and in terms of project planning - an outline plan for the project being required, but with a rolling 18-month detailed plan updated and agreed each year.

At the time of this study, some important details of IPs remain to be decided - for example, details of funding for management resources.

Progression towards IPs has taken place throughout FP5 and to some extent within FP4:

- Very large Targeted Demonstration Projects within the THERMIE programme prior to FP5 could be said to represent good examples of large projects co-ordinated at a European level and addressing European as well as national/regional objectives. They required significant management resources in order to manage and co-ordinate the various strands within the projects.
- Within FP5, the progression towards pre- and post- contract negotiation clustering of projects has also represented a step towards larger projects, sharing information between the individual projects, aiming at greater coherence, and attempting to address broader aims than any one of the projects on their own. *The RES-DG (Renewable Energy Sources - Distributed Generation) cluster* of projects represents a good example of this within NNE.
- Also within FP5, some very large individual projects (e.g., *the Hot Dry Rock/Hot Fractured Rock project*, and the *AD-700 series of projects*, within the NNE field) have many of the characteristics of an IP, albeit without the flexibility offered by the new IP instrument. Socio-economic projects such as *ExternE* also closely resemble IPs.

Networks of Excellence (NoEs): Intended primarily to address the fragmentation of European research, and involving the establishment of a network of research teams of the highest standing in a research topic. The primary deliverable is a durable structuring and shaping of the way research is carried out on the topic. NoEs are expected to develop and implement a 'joint programme of activities' (JPA), which will include *integrating activities* aimed at imparting structure to research on the topic; *jointly executed research* serving long-term, possibly multi-disciplinary objectives and developing new research tools and platforms; and activities designed to *spread excellence*. NoEs are expected to have ambitious goals, especially in terms of providing European leadership on a world stage.

At the time of this study, some important details remain to be established - most notably the means of calculating the size of the grant to be paid from the programme towards the cost of the network.

The establishment of Thematic Networks in practically all of the core RTD topics within NNE represents at least a move in the direction of NoEs although, since the NoE instrument has not been available up to now, none of these could be said to be close analogues of the NoE concept. Rather, Thematic Networks established within NNE have focused on putting in place some or all of the *prerequisites* for NoEs. In some research areas, the established networks, together with additional planning and structuring initiatives undertaken by the Commission, have progressed to the point at which a framework is already in process of being established within which a NoE could relatively quickly be formed. Although these are at very early stages, the work to date represents a considerable advance towards ERA. The areas in question include:

- *Fuel Cells and Hydrogen*, in which a Technology Platform and a possible structure for co-ordination of research has been proposed;
 - *Photovoltaics*, again where a Technology Platform is in the drafting stages.
- It would be wrong, however, to see the above or any of the existing thematic networks as anything close to an analogue of the proposed NoEs.

Article 169: Article 169 enables the Community to participate in research programmes undertaken jointly by several Member States, potentially enabling integration of national research programmes within a given topic. However, as matters stand, each proposed Article 169 arrangement would require a proposal/decision process of the same magnitude as the framework programme itself. On the invitation of the Council, the Commission may present a small number of pilot proposals under Article 169. *It is not anticipated currently that any of these will be in the NNE field, during FP6*, although there was discussion during 2001 about the possibility of an Article 169 action in relation to distributed generation in the outermost regions.

Specific targeted research projects (“STREPs”): RDD projects of a more limited scope and ambition, particularly involving smaller research organisations, and participants from candidate countries. STREPs are essentially similar to the shared cost RTD and demonstration projects used in FP5. One of two anticipated measures described as “Stairways of Excellence”, these have been introduced into the mix in order to smooth the transition from the instruments of FP5 to the new instruments designed for FP6. It is thought that the number of STREPs may decrease as FP6 proceeds; however, no decision will be taken on this until an independent evaluation has been undertaken in 2004.

Given that STREPs resemble the FP5 shared cost instruments, there are numerous examples of such projects within NNE.

Co-ordination actions: Another instrument in the “Stairways of excellence”, these are equivalent to the existing concerted actions and thematic networks used in FP5. Once again, there are numerous examples of these within NNE, and they have been used extensively as a means of preparing for the ERA.

Specific support actions: These are the analogue of Accompanying Measures as used in FP5, and they include dissemination activities, studies, analyses, working/expert groups, and operational support. These have been used widely within NNE, and they have a relevance to this study since Accompanying Measures have been used as initial preparatory steps towards ERA.

ERA-NET⁵: The ERA-NET scheme will be operated through the specific programme “Integrating and strengthening the European Research Area”. It is intended to increase co-operation and co-ordination of research activities through networking at national or regional level, and/or the mutual opening of national and regional research programmes. They are expected to start with mutual information exchange, and to lead progressively to stronger forms of co-operation. Participants in ERA-NET activities will be primarily public bodies responsible for managing and financing national or regional research programmes, or bodies operating at a European level which co-ordinate nationally funded research at a European level. ERA-NET activities may include systematic exchange of information and best practice; strategic activities, desirably leading to greater European co-ordination and collaboration; and implementation of joint activities, including transnational research activities.

Within NNE, a number of projects and accompanying measures have set about activities similar to the *potential* work of an ERA-NET - for example:

- The *PV-EC-NET* accompanying measure was established following a Commission initiative with a view to increasing the effectiveness and coherence of the EU and Member State programmes in the field of photovoltaics RTD. Its main activity is exchange of information, but its ultimate aim is a commonly accepted ‘European PV RTD Road Map’.
- The *SENSE* and *PSI* projects both aimed to gather national programme information in the field of energy RTD, as a basis for possible co-operation and collaboration.

2.4 Suitability for ERA of research areas within non-nuclear energy

Some areas of research are more suited than others to the concept of the European Research Area, depending upon factors associated with (a) the stage of progress of R&D in the field; (b) the extent to which there are recognised interdependencies between key European research actors within the field; and (c) the extent to which market forces demand a co-ordinated, integrated approach to research in order for Europe to compete on a world stage.

As part of this study, the principal fields in which NNE currently operates within FP5 were assessed for the adequacy of their ‘match’ with the ERA concept. Expanding on the above three factors, the assessment was carried out on the basis of the following determinants:

⁵ See *Supporting the cooperation and coordination of research activities carried out at national or regional level (the “ERA-NET” scheme)*, Working document, 1st Edn, European Commission DG RTD/B1, 7 May 2002.

1. Is the research field one with major global market potential, the realisation of which calls for a major European R&D effort?
2. Are there currently major European research actors which on their own are below critical strength and/or scope?
3. Are there major competitors (external to Europe), requiring a unified European R&D effort in order to build and/or maintain market position?
4. Does advance in the field require a harmonised pan-European (or global) approach to policy/ infrastructure/standards/regulatory frameworks?
5. Can the research field be said to be currently at a pre-competitive stage (or otherwise of a kind where competition/confidentiality issues might seriously impede collaboration/integration)?
6. Is there an understanding among key European actors in the field that advance requires co-ordination/integration of R&D efforts?
7. Is there an adequate level of trust based on previous or existing R&D collaboration, among a critical mass of key European actors in this field of research, that would enable them to undertake preparatory activities for ERA?
8. Does advance in the field require a mix of activity between public and private institutions (including, for example, public research bodies and industry), and/or a multi-disciplinary research approach?

In table 2.2 (following page), each of the current research areas currently being supported by the Commission within the broad field of NNE is assessed against the above determinants. In general, this assessment suggests that the majority of existing research areas within NNE represent a good to excellent match with the concept of the ERA, although of course some areas seem more suited for development towards ERA than others. Also, in some areas the fragmentation of competing technological approaches could create tensions within ERA which would require careful management - in some cases, this fragmentation has led to a view among some key actors that the area is not well suited to ERA. Those areas which seem well matched include some which are not currently seen as research priorities within FP6 - for example, clean coal technology seems very well matched, even though it cannot be considered other than in conjunction with biomass. Overall, and taking into account also the finding from Table 2.1, it seems that the NNE field is eminently suited to the ERA, and that many of the specific topics within NNE are also well suited.

Table 2.2: Potential match between concept of ERA and specific research fields within NNE¹

Determinants of suitability for ERA:	1. Global market potential requiring major European R&D effort?	2. Major European actors, on their own below critical scale?	3. Major competitors requiring unified European R&D effort?	4. Advance requires harmonised European approach to stds, policy, i/structure, etc?	5. Is research field at pre-competitive (or equivalent) stage?	6. Do European actors understand/appreciate need for integrated approach?	7. Adequate trust among actors permitting advance/preparatory action towards ERA?	8. Advance requires complex mix of actors from public/private, and/or multi-disciplinary research?
Research field within NNE:								
Hydrogen	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓	✓✓	✓✓✓
Fuel cells	✓✓✓	✓✓	✓✓✓	✓✓	✓✓	✓	✓	✓✓
Photovoltaics	✓✓✓	✓✓	✓✓✓	✓✓	✓ ⁵	✓	✓	✓✓
DER ²	✓✓✓	✓	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓	✓✓
Bioenergy	✓✓	✓✓	✓	✓✓	✓✓	✓	✓✓	✓✓✓
Wave/ocean	✓✓	✓✓	✓✓✓	✓	✓✓ ⁵		✓	✓
Wind	✓✓		✓	✓		✓?	✓✓	✓✓
HDR/HFR ³	✓✓	✓✓✓	✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓
Oil/Gas	✓✓	✓	✓✓✓	✓		✓	✓	✓✓
Coal/Biomass ⁴	✓✓✓	✓✓✓ ⁶	✓✓✓	?		✓✓	✓✓	✓
CO ₂ capt./seqn.	✓✓	✓	✓✓	✓✓	✓✓✓	✓✓	✓✓	✓
Gas turbines	✓✓✓	✓✓✓	✓✓✓	✓	✓ ⁷	✓✓	✓✓✓	✓✓
Buildings	✓ ⁸	?		✓		?	✓	✓✓
Socio-economic	n/a	✓✓✓	n/a	✓		✓✓✓	✓✓✓	✓✓✓

¹ Note that some fields are not currently considered priority areas within FP6. However, the potential suitability of research fields for ERA is here assessed without consideration of whether or not it is an FP6 priority. Note also that this assessment does **not** pre-judge whether a given research field is yet in an adequate state of *preparedness* for ERA.

² DER: Distributed Energy Resources (includes distributed generation/RES/remote regions/energy storage for RES)

³ HDR/HFR: Hot Dry Rock/Hot Fractured Rock

⁴ Includes Clean Coal and Coal-Biomass co-utilisation

⁵ Competition is very high within PV, but there are some areas for pre-competitive research.

⁶ Advanced Clean Coal progress requires very large projects, beyond any one actor. Some major European research bodies have been down-scaled in recent years.

⁷ In some areas - e.g. combustion, materials, simulation.

⁸ Components and sub-systems.

2.5 Implications of recent assessments of progress towards ERA

A recent Commission paper reviewing overall progress (*not* confined to NNE) towards ERA suggests the following:

- Progress has been variable from field to field (the note provides no indications of which fields are progressing well or badly);
- Progress is a direct function of the degree of involvement of the Member States;
- Generally, Member State involvement is much lower than it could and must be for ERA to come into being;
- Progress towards ERA is excessively dependent on the framework programme as a primary set of instruments;
- Initial mapping exercises have been too much focused on methodological debate, and hampered by bureaucracy.

The paper concludes that a new impetus is required, and that this necessitates:

- Reinforced involvement and mobilisation of Member States and national activities;
- Consolidation of the conceptual and political frameworks on which ERA is based, and through which it will be realised;
- Legal instruments to facilitate mobility of researchers across Europe, and to increase the attractiveness of Europe as a location for R&D;
- Strengthen, redefine and reorient as necessary existing activities such as mapping and benchmarking;
- Greater emphasis on, and more targeted co-ordination of national research programmes and activities;
- Greater involvement of national research advisors, and possibly the creation of a European Research Council;
- Establishment of a structure to facilitate increased co-ordination of research policies across Europe.

Whilst the above comments are made in respect of RTD as a whole, they represent a context within which the assessment of NNE's preparedness for ERA may be viewed. Subsequent sections strongly (and independently) reinforce a number of the points summarised in this section.

2.6 Overall and NNE perspectives on ERA: some conclusions

1. The rationale for creating a European Research Area is as valid for the field of non-nuclear energy as it is for RTD in general. NNE RTD programmes in Europe compare poorly with those in major competitor countries such as USA and Japan. The fragmentation of NNE research in Europe represents a major strategic threat.
2. With some exceptions, non-nuclear energy RTD is characterised in Europe by a lack of coherent or stable research programmes at a national level, making for difficulties in working towards increased co-operation or coherence. Indeed, even data gathering about NNE research activities in Member States is problematic, and rendered worse by a lack of definition of terms and fields of research.
3. Thus, there is a need for progress towards ERA in the NNE field, but there are sizeable problems in achieving this.
4. Nonetheless, there are examples of existing research activities within NNE (FP5 or even FP4) which represent reasonable analogues (within the limits of existing instruments) for the new instruments such as Integrated Projects and, to some extent, the ERA-NET scheme (which of course will not be operated within the Sustainable Energy Systems thematic area, in FP6). The same is true, though to a much lesser extent, for Networks of Excellence.
5. An examination of the main fields of RTD currently within the scope of the Commission's NNE activities suggests that, with many of them, there are structural and market conditions which should create an impetus towards ERA. This is true for some areas not currently considered priority areas for inclusion within the scope of FP6, such as clean coal and gas turbines.
6. Recent internal assessment of progress towards ERA suggest that a major failing to date has been lack of involvement and mobilisation of Member States and national RTD programmes. It is in this area that there seems to have been least progress in NNE also.

3. Non nuclear energy: assessment of progress to date towards the ERA

Section 3 - Highlights

Although many are at an early stage, present or planned actions address quite well the aim of establishing or deepening the ERA.

These actions have been successful in bringing together important coalitions of RTD actors, with significant information gathering and planning being done by these groups.

Although actions in most NNE fields include mapping or benchmarking of national programmes and policies, the work planned so far is inadequate.

With a very few notable exceptions, there has been little progress on co-ordination of, or consultation with, national programmes. As many national programmes lack coherence or stability, this is an important but difficult task.

Generally good progress has been made towards developing shared perspectives on strategic RTD issues, even though this is a huge and ongoing activity.

Some very significant international links have been forged and are currently being further developed.

In general, there is a great deal of work to be done in developing adequate structures to support co-ordinated progress towards the ERA.

In most NNE fields, there is considerable current dissemination activity, but much more will have to be done to develop adequate training activities as required within FP6.

3.1 Introduction

Progress in NNE towards the European Research Area is simply the sum of progress in all of its parts. In this study, each of the main NNE research areas was assessed on its own, and these were synthesised into an assessment of the NNE field as a whole. In order to keep the length of this report within reasonable size limits, the key points and summary assessment in relation to each individual area are given in Annexes C and D of the report. In the main body of the report, the integrated findings are provided only for the area as a whole.

3.2 Preparatory activities for the European Research Area

The various NNE research fields were assessed on the basis of conditions which could be said to represent essential prerequisites for participation in the ERA. These conditions were drawn up from a study of the ERA concept itself, and also from discussions with Commission staff and indeed key research actors outside the Commission. The principal conditions were as follows (some were added for specific fields):

1. Involvement in current European projects/networks of a critical mass of key European actors in NNE research.
2. The existence of past/current networks aimed at preparing in some way for the ERA.
3. Existing infrastructure (e.g. pan-European associations) allowing for European-level communication/co-ordination and at least partly aiming to increase European RTD collaboration and coherence.
4. An existing or emergent 'management' structure of some kind, potentially facilitating co-ordinated RTD within the field in question.
5. Mapping (completed/in progress) of centres of excellence, resources, research facilities.
6. Mapping (completed/in progress) of national RTD policies/programmes in the field in question.
7. Existing co-ordination/consultation between national/regional RTD programmes and projects within the field in question.
8. Benchmarking of technological progress within the field in question.
9. A shared perception among key actors of strategic opportunities and threats facing European RTD in this field.
10. Development of European RTD strategies ('roadmaps') in the field in question.
11. Existence of a co-ordinated approach to planning and conducting prenormative research, including creation or harmonisation of standards, test procedures, quality levels, indicators, and safety/health/environmental issues.
12. Existence and development of appropriate international linkages and working relationships for RTD in this field.
13. Existence of mechanisms used for exchange of information, dissemination, promotion and training beyond the immediate project/network, with a view to development of RTD capabilities in Europe.
14. Inclusion of research community from NAS.

The above list does *not* include all of the desired characteristics of the ERA - for example, a notable exclusion is the sharing or swapping of research staff between actors - because the assessment only examined *preparatory* activities, and not activities which would lie beyond the scope of existing instruments.

3.3 Assessments of each RTD field within current NNE activities

The RTD fields which were assessed in this study were as follows:

1. Fuel cells and Hydrogen
2. Photovoltaics
3. Distributed Energy Resources (RES-DG), including energy storage for RES
4. Bioenergy (including biofuels, biomass, bio-cogeneration)
5. Wave/Ocean
6. Wind
7. Hot Dry Rock/Hot Fractured Rock
8. Oil/Gas
9. Clean coal and coal-biomass co-utilisation
10. CO₂ capture, transport, sequestration
11. Gas turbines
12. Energy in buildings; building components
13. Socio-economic research in NNE (/environment)
14. Horizontal actions: (a). NNE policy studies and Member State data collection across the NNE field as a whole
15. Horizontal actions: (b). Energy technology indicators
16. Horizontal actions: (c) Training and mobility of researchers - Marie Curie Fellowships.

The assessments themselves are based on analysis of printed materials such as contract summaries, work packages, mid-term and final reports (where available), information and views collected via interviews with Commission staff and contract co-ordinators, and via questionnaires. For each RTD field, Annex C details current and planned activities; the sources of information and views, and the means by which information was obtained; and some key points derived from the information gathering process. Annex D provides a summary assessment of each of the areas. In the main body of the report (below), the individual findings are integrated into a set of findings on NNE as a whole.

3.4 Overall assessment: Preparatory actions for ERA within NNE

Overview:

In general, the activities completed, in progress or under negotiation in each area appear to address quite well the aim of establishing or deepening the ERA. The difficulty here is that many are at an early stage, and some are not yet started; so with these it is necessary to assess the actions on the basis of the work plan, progress so far (if any), and/or the stated intentions of co-ordinators. Also, in some areas there is the impression of a slightly random set of activities, some of which appear to overlap, and the totality of which do not necessarily cover the whole field. Presumably this is the inevitable result of a process based on receiving and negotiating proposals often initiated by the RTD community - more specifically, by sections of the community which inevitably have their own priorities and capabilities. It is quite clear in some cases that order has been facilitated by the relevant Commission staff, and virtually always this seems to lead to a more rational framework of activities.

The stated aims of the activities examined reflect well many of the requirements for establishing the ERA - especially in⁶:

- Creating a critical mass of RTD actors, generally across the sectors involved;
- Mapping RTD facilities and resources, and 'Centres of Excellence';
- Developing a shared view of strategic opportunities and threats, strengths and weaknesses in relation to European RTD in each area;
- Working towards some form of strategic roadmap for the area;
- Identification and in some cases establishment/deepening international linkages;
- Development of information dissemination, promotion and educational facilities (although there is considerable variation in this between fields).

Some requirements are less well or incompletely addressed, including:

- Benchmarking of programmes and/or RTD/technological progress (other than activity within DG RTD itself);
- A coherent and comprehensive approach to planning or undertaking necessary prenormative research;
- Facilitation of potential management/co-ordination structures required to advance towards ERA (there are some notable exceptions).

Unsatisfactory progress has generally been made in:

- Mapping national NNE RTD policies and programmes;
- Co-ordination or consultation with national RTD programmes and administrations.

Creation of a critical mass of key European actors in NNE research:

The activities under way or being negotiated currently do seem to have a considerable beneficial effect in bringing together critical groupings of important actors in the various RTD fields. Even where actions such as thematic networks are only just starting their work, the co-ordinators feel that the process of developing the proposals for these actions has been very

⁶ But see below for more critical comments on these activities.

helpful in bringing people together, in developing a more co-operative and collaborative set of relationships, and in building working mechanisms for planning and future collaboration. In many NNE topics, these have led directly to preparation of Expressions of Interest in FP6, and a reasonable level of knowledge (within the limits of what is available currently) on the ERA, FP6 and the proposed instruments within FP6.

It is noteworthy that in many cases existing networks have demonstrated a considerable openness to organisations outside the original consortium, and this has led to a much wider grouping of organisations coming together to discuss and plan possible future directions. Despite this, there remains the impression that in many areas there is a reasonably small inner grouping of bodies knowledgeable and active in planning for progress towards the ERA, a somewhat wider circle of bodies with some knowledge of what is happening, and a very large grouping of organisations with little or no knowledge of developments. However, it is difficult to know what more could realistically be done to avoid this - the key question is whether an appropriate critical mass is being created, and the answer in general seems to be that this is indeed occurring.

Inevitably, the greatest involvement so far is from research institutions such as third level bodies and public research organisations (including the JRC). While there is considerable industry interest and involvement, this is less so in some areas, and there remains a need to harness key industry players in some cases.

It is worrying that in many fields there are few SMEs presently involved. The exceptions to this are fields which are dominated by SMEs - for example, in wave energy. However, it would be desirable to see a much greater involvement of SMEs at this stage - particularly as many SMEs do not presently see much possibility of playing an active part in the larger activities of the ERA., and as a separate element of FP6 will deal specifically with SMEs in the future.

Networks and groupings specifically aiming at preparation for ERA:

What is very encouraging is the fact that in most NNE areas there are groupings (networks, accompanying measures, in some cases representative associations at European level) which are active in developing plans for participation in the ERA. Many of these have only started work during 2002, and in some cases they have not yet started. However, many of these actions are explicitly aimed at preparation for ERA, and even those proposed prior to 2000 (that is, when the concept of the ERA was being developed) have re-pointed their priorities in order to address the short and medium term needs in developing towards ERA.

Where appropriate associations exist, these appear to be actively involved in assessing what is needed for participation in the ERA. Such associations frequently exist in the more mature areas (e.g. wind, oil & gas) which are not included as priorities within FP6, and naturally much of the emphasis at present is in attempting to influence decisions in favour of their topics.

Mapping of Centres of Excellence/research facilities and resources:

In some well established and/or smaller fields, the centres of excellence are already well known (e.g. in Hot Dry Rock research; wind energy; wave energy, socio-economic research). In other areas (including PV, fuel cells, hydrogen, DER/storage, CO₂, gas turbines, bioenergy including bio-cogeneration), this is an aim of current activities; in a few cases, this will be completed within six to twelve months or less. In a few cases (DER; industrial gas turbines), there is the intention also to create a Virtual Centre of Excellence within existing actions.

Mapping and benchmarking of national programmes/policies on NNE RTD:

Many networks claim to be addressing this either explicitly and comprehensively, or as an element in other information gathering; areas where it is being done to some extent include RES generally, PV, gas turbines, CO₂, coal/biomass co-utilisation, bioenergy, wind, wave, DER, fuel cells, hydrogen and PV). However, this may be too sunny a view of what is being achieved here. In some cases, the activity is implicit rather than explicit in the work plans of activities; in others, it is only being done for the Member States represented in the main consortium; and some plans seem not to appreciate the potentially enormous difficulties which such an exercise can pose.

The reality remains that there is very little systematic knowledge or dissemination of national and regional NNE RTD policies and programmes, and this represents a major gap in present knowledge. Previous actions aimed at mapping national programmes and priorities are now out of date or only serve to highlight the complexity of such an exercise, along with the need for dedicated resources and databases to maintain an up to date, accurate and comprehensive set of information. Of course, in many cases national programmes do not exist in any formal or coherent sense, and those that do are subject to frequent changes in priorities and resources. However, the present lack of any real knowledge base here represents a major gap at this stage of development towards the ERA.

A number of actions claim to be undertaking benchmarking of national NNE RTD programmes. However, it is unclear that there is any shared understanding of what this actually means, and there certainly do not appear to be any shared methodologies for achieving this. There could be scope for a Commission-driven exercise to bring together actors in the NNE field who are undertaking such processes, with a view to developing shared perspectives.

Co-ordination of and consultation with national/regional programmes:

This is probably the single area where least has been done or is planned. In some cases, there have already been meaningful linkages with national programmes - for example, Hot Dry Rock, hydrogen/fuel cells (at the outset in 2000). In others - including bio-cogeneration, CHP, CO₂, wind, coal/biomass co-generation - there is a stated aim to engage in some level of consultation, but in many of these cases progress is likely to be quite limited. In the case of hydrogen, there are current plans which would lead to a high level of consultation.

The lack of real engagement with Member State programmes and administrations represents a major issue in the case of topics where there is a fundamental need for co-ordination and commitment to collaboration on the part of national administrations. In some of the more important areas of NNE research, progress towards a true operation of ERA, and an integrated European research effort required to build or maintain strategic strengths, will be held back by a lack of progress in this area.

Development of a shared perspective on strategic issues, leading to development of coherent medium to long term RTD strategies (roadmaps)

Virtually all of the areas examined have activities aiming towards some form of RTD strategy. In some cases this amounts to a prioritisation of RTD needs with a view to developing proposals for NoEs or IPs; in other cases, the activity is more broadly focused on comprehensive strategic planning. All of the actions claim that even to date much progress has been made towards a shared understanding of strategic issues.

For many NNE areas, though, this is an enormous task, with many competing and vested interests. Indeed, too sharp a focus on prioritisation in some cases could be unproductive and even disastrous; and some key actors do not favour such an approach because they feel the risks of excluding efforts on presently marginal technologies may be too high: it could lead to an exclusion of some technologies which may in the longer run emerge as ‘winning’ technologies. The fact remains, though, that there needs to be progress in strategic analysis and planning of technological research in order to be able to propose sensible actions within FP6.

Understandably, in the case of RTD topics excluded from FP6 priorities, much of the ‘strategic’ effort in the field is directed towards trying to maximise Commission support for future R&D. This is perfectly understandable, especially since some of these fields have enjoyed considerable support in the past, both in funding and in hand-holding by the Commission. Progress in the strategic planning of RTD in these fields requires open discussion of the options, between the Commission and representatives in the field. Efforts need to be made to explore the options for participation in ERA, outside of participation via FP6. There seems to be little acknowledgement of the possibility of continuing Commission support outside of the framework programme; it may be that new mechanisms and arrangements are needed to assist progress towards ERA for actions which are no longer supported within the FP itself.

One of the most significant developments in support of RTD planning and priority-setting is the Commission’s own work on technology indicators. Whilst this is incomplete at present, it represents a real attempt to create a set of quantitative indicators and RTD goals which could truly inform RTD planning, and allow for monitoring of progress. It seems highly desirable that the Commission should have such data for its own use, and also for use and discussion by researchers in the field. Indeed, what is required is a dialogue between the Commission and researchers on the indicators themselves. This creates a potential means of discussing

research needs and priorities, based on consensus as to progress to date, and barriers to be overcome by research in the short to medium term.

Development of a co-ordinated approach to required prenormative research

Most, if not all, of the NNE fields state that some aspects of prenormative research are essential to advances in RTD. The needs include development of shared standards for products, shared standards and procedures for testing and quality control, and development of harmonised regulatory and control procedures on European and even global bases. In virtually all areas, current activities include planning - and in some cases execution - of prenormative research⁷. In one case (CO₂ capture and sequestration), a current action had planned to include essential work on standards, but this has been delayed due to a reduced budget.

While there seems to be a reasonable level of work going on here, the overall impression is of a rather sketchy approach in some fields - of work going on in some aspects of the field, but of other needs which are still being neglected. It may be that there is a need for further planning of prenormative research needs in each area, in order to ensure that it is being addressed as comprehensively as possible.

Development of appropriate international links:

There are now implementing agreements via IEA in the fields of wave energy, hot dry rock research, and gas turbines. In the case of HDR, there is an input to the major project in this area from the US, and the implementing agreement involves Europe with the US and Japan. In wave energy, a new implementing agreement involves the US, Japan, Australia and Canada. In gas turbines, a new collaboration MoU has been signed with the US, and a major US (DoE)/EU conference on gas turbines is planned for this October, together with a number of shared projects and other initiatives.

Other fields of RTD have existing international links of some sort, or propose to establish new links within current actions.

Overall, it appears that significant international links are being forged presently, and that in general this is happening in parallel with the formation of new links within Europe itself.

Involvement of NAS countries:

Involvement of NAS countries would appear to be variable, but there are existing or developing mechanisms for meaningful relationships in the fields of buildings, gas turbines,

⁷ Solid biofuels: work with CEN to develop standards for physical testing. PV: work by JRC, but more needed as regulations vary from country to country. Hydrogen: work on harmonised world-wide standards for electric vehicles, infrastructure, sub-systems and components. Fuel cells: work on test procedures within IEA. Energy storage: standardisation research. DER: regulatory roadmap; standards, test, certification. Wind: test/certification. Oil & Gas: quality, health, safety, environment, leading to ISO. Coal: prenorm research on materials, codes of practice. CO₂: assessing best practice, leading to standards. Gas turbines: standards at national/international levels. Buildings: shared test procedures; standards for components.

oil & gas, DER, PV, Bioenergy, and socio-economic research. There appears to be considerable desire among actors in the various fields to include NAS countries as much as possible. A number of actors complain that there is still a lack of funding for NAS countries to be involved as much as they might be, but this is changing with the new NAS-focused thematic networks under negotiation.

Emergent 'management/co-ordination' structures to facilitate ERA:

Perhaps the most evolved management structure exists within the Hot Dry Rock topic, established to implement the HDR/HFR project. The structure includes a Policy Group with inputs from the funding agencies; an independent multinational expert panel, and an EEIG established with its own dedicated management resource to implement the project itself. Different participants take responsibility for specific aspects of the project. This structure would be suited to operation of a large IP within the ERA.

The Hydrogen/Fuel Cell Technology Platform proposes a suitable structure which would involve all existing networks and projects in these fields. This structure would be eminently suitable for steering the topic towards the ERA, though there will be considerable work in linking existing activities into a new research programme within the ERA; bridging the gap between existing and new groups and structures may well pose problems for the most evolved areas of RTD across NNE. One of the current actions (FHIRST) includes in its programme development of a suitable structure. In PV, the proposed Technology Platform would lead to a similar structure to that proposed for Fuel Cells/Hydrogen, but this remains at an early stage. In gas turbines, EuMIGT states that it has already proposed a management model to the Commission. Progress is being made towards possible management structures in the DER field. In other areas, such as oil & gas and wind energy, existing associations (EUROGIF, EWEA) could represent an appropriate umbrella structure within which progress could be made.

In short, although there is a very long way to go, some progress is being made towards developing appropriate structures within which advances towards the ERA could be achieved, but it must be considered that this is in the very early stages, as might be expected.

Sharing of information, training, research facilities, staff:

Most of the fields have established public websites of varying quality and content. Most of these could really only be said to be general promotional devices, although a few are used to recruit further members to networks and groups.

A number of areas are very active in organising workshops and conferences, and the Commission has been very active in supporting and encouraging such actions. These have been extremely useful in bringing additional participants into the planning for shared/integrated research. Less is going on in actual training and education, but some areas do have regular training events open to anyone working in the topic.

Training and development of researchers is one of the key tasks which NoEs will be expected to undertake. This will need considerable attention from the Commission, as it not really clear why NoEs would wish to undertake what could be seen as charitable work; much of the present dissemination/promotion/educational effort carried on gives the impression that it is done mainly because it is in the work programme.

The very beginnings of facilities sharing are to be seen in some fields, but this must be said to be at a very early stage. In relation to sharing/swapping of staff, this seems to be virtually non-existent (not surprisingly, since there are still no real mechanisms within which this is likely to happen), and perhaps the most common barrier to the ERA mentioned across all fields is the problem of achieving true mobility of researchers between Member States.

Activities internal to the Commission:

Internal Commission preparations for ERA will be discussed more fully in the next section. Here, it should just be stated that there are significant gaps in what has been accomplished to date. For example, it is still not clear how research ‘grants’ will be quantified for IPs; the exact level of funding for management and co-ordination of large IPs and NoEs seems to be unclear (at any rate, many researchers in the field are unclear, based on their reading of all available documentation). This is an increasingly urgent matter.

Another matter that will be discussed further in the next section is the issue of training, resource planning and organisation development. It is clear that the roles of most of the Scientific Officers will change substantially, although of course there will be a considerable overhang from FP5 projects, and perhaps from STREPs, etc., concluded in FP6. However, the very culture of the DG will change, with increased flexibility in contracting; decreased numbers of contracts to manage; vastly increased complexity and time requirements for negotiation of large contracts; and above all a need for a truly strategic approach to overseeing fields of RTD. These changes are very positive from the point of view of creating jobs which are less administrative (ideally) and more strategic in nature. However, it represents an enormous change, and there seems to be great uncertainty as to how this will function. Although evidently some training and other development is planned for the autumn - and there have been some meetings to discuss implications in the past - it is not clear that sufficient has been done to date in order to ‘ready’ the Commission itself for the ERA.

3.5 Conclusions - assessment of progress towards ERA

As will be clear from the comments in the previous section, much progress is being made in all of the RTD fields within NNE in developing towards the ERA. Much of the work is at a very early stage, with some exceptions, and a future assessment of current actions (including a number still under negotiation) may not take such a positive view. However, despite the impression that some actions are not particularly well integrated in a field, and in some cases that there are gaps in what is being done (in terms of coverage of a full RTD topic), the

activities either planned or underway seem to include many of the prerequisites for progress towards the ERA.

No discernible progress has been made towards sharing of resources, facilities and staff. This probably should not be expected at this stage, but the fact that so many see this as a real barrier does not augur well for progress being made on these fronts within the instruments of ERA.

Apart from that, *least* progress is made in mapping national and regional RTD policies, programmes and priorities. Although some actions are intended to advance this, it is a complex issue, and it may well require a greater level of co-ordination from the Commission. Indeed, it is surprising that the Commission itself does not have dedicated resources to ensure that it has and maintains adequate knowledge of these areas; this kind of knowledge will be very badly needed if the Commission is to be able to move into a more strategic, more catalytic role in European RTD. A similar - perhaps greater - lack of work has been done on co-ordinating national programmes and priorities. Indeed, in general this seems to be an area which nobody is going near at present. Given that the ERA is intended to lead to much greater co-ordination across Europe of RTD programmes and policies, it seems that this represents an area where the lack of progress could be said to jeopardise the very essence of the ERA. Although this may follow in due course, in reality the lack of progress could reduce the instruments in FP6 to the status of revised project and network rules of operation, rather than allowing them to operate within the necessary co-ordination of policies which should be central to the ERA.

More progress is needed in planning and undertaking needed prenormative research, and in benchmarking of RTD programmes and policies, and of technologies. Indeed, there is a need for greater clarity on what precisely is required in terms of actions and methodologies in these areas. Pilot work is under way in areas outside of NNE; at this stage, there may well be a need for increased Commission activity to catalyse and encourage shared development of approaches to this area of knowledge development. More progress is also needed in developing a shared set of quantitative technology indicators and targets. Again, this is an area where the Commission itself might be expected to lead the way. The present technology indicator work seems well worthwhile; it would be good to see a greater impetus towards using this activity to gain a real consensus in the field as to current progress and priority goals.

More progress is also needed in developing appropriate structures for co-ordinating research in specific NNE fields of research. Of course, IPs and especially NoEs can fulfil this purpose within the broad fields of activity they are concerned with; but there will remain a need for over-arching structures to co-ordinate research work spanning a number of IPs or NoEs. In short, these larger actions may well require a further set of co-ordination in the same way as existing projects benefit from clustering. In some fields, there has been good progress; in others, there is almost none. In all fields, there will be urgent need for resolution of existing activities (many of which will continue for some years) and new ones established in FP6.

Good progress towards mapping of centres of excellence, developing shared views of strategic issues facing the various RTD topics, and development of RTD strategies, *appears* to be being made presently. However, much of this is at a very early stage; the work of achieving consensus may well be much more difficult than the consortia imagine; and many current efforts could well falter.

Overall, there has been striking progress made so far, but many activities remain at a very early stage. It may well be that progress made by the end of some of these activities will be disappointing - indeed, without being unduly pessimistic, some activities may be much more complex than is currently acknowledged. It also may be that close co-ordination from the Commission will be required in the immediate and short term.

In the following section, issues and barriers to progress identified during the course of this study will be examined.

4. Barriers to further progress towards ERA

Section 4 - Highlights

- There are still significant gaps in knowledge among the RTD community about the implications of ERA and the operation of FP6 instruments.
- What is needed is not just *information* but also *discussion* of the issues.
- There is a current need for a very strong Commission presence within existing preparatory actions.
- The Commission could and should facilitate a coming-together of important interests within a given RTD field - over and beyond existing actions and structures.
- Ensuring an adequate industry participation may require special targeted activities to promote the ERA.
- An adequate participation by SMEs could be problematic, and NNE should develop and retain close *direct* links with SME actions.
- Gaps in prenormative research could hold up progress in some important areas of NNE RTD.
- NNE suffers from lack of mobility of researchers, as in other fields. This is an issue felt very strongly within the NNE research community.
- Early thought is needed about the evaluation of very large projects within FP6.
- Unless an adequate engagement can be achieved with Member States' RTD programmes, this could jeopardise the whole ERA project.
- The Commission's own readiness for the ERA needs to be addressed. The shift to ERA will mean a significant change, at the level of the organisation (DG) and at the level of individual staff members. This requires an adequate developmental response - in the Commission this should be no less than the steps which a large private sector organisation would be expected to take.

4.1 Introduction

This is the time in the development of the ERA when obstacles emerge. It is a huge project, and not one that is easy to define in concrete terms; introduction of instruments such as Integrated Projects and Networks of Excellence displaces others; significant aspects of the whole project remain to be finalised; and transformation of European RTD leads to changing emphases and the realisation that there will be winners and losers. Not surprisingly, then, during the course of discussions with Commission staff and with other key actors in the RTD field in Europe, many issues and barriers were presented. The main areas of concern lie in the following areas (by no means in order of magnitude):

1. Current level of knowledge of ERA and ERA instruments;
2. Fragmentation of NNE RTD areas, the dangers of exclusion and the problems of co-ordination;
3. Competitiveness issues;
4. Changes in approach to planning needed on the part of key RTD actors;
5. Industry participation;
6. SMEs in the ERA;
7. Prenormative research;
8. Mobility of researchers;
9. Evaluation of very large projects;
10. Lack of consistency of procedures across Europe;
11. Lack of involvement of Member States' administrations;
12. The Commission's own role;
13. RTD areas not included within FP6 priorities.

Each of these is briefly discussed below.

4.2 Current level of knowledge of ERA and ERA instruments

The view was expressed in Section 2 that many of the key actors in European NNE research appear to be well informed about the ERA and about FP6 and its instruments. This is no doubt due partly to the fact that, as co-ordinators of actions linked in some way to preparation for the ERA, it is their function to be as well informed as possible. It is also influenced by the fact that most have been involved in preparing Expressions of Interest in response to the earlier Call. However, many of them expressed concerns that:

- The definition of ERA and elucidation as to how it will operate in practice remains unclear. Whilst the broad concept is understood, the real implications are by no means understood, and many of these could have profound positive or negative consequences for European research.
- The information currently available on the instruments to be employed still has important gaps. A number of people referred to lack of clarity on determining grant levels within IPs, for example. Also, there is widespread confusion and concern as to the levels of funding to be available for co-ordination and management: it is well understood that this

will represent a very large expense in IPs and NoEs, and the means of funding it is not well understood.

- It is felt that Member States' administrations remain very distant from the ERA and its instruments, and that insufficient efforts have been made to inform or involve them.
- It is felt that there is a vast "out-group" across Europe - those not involved in activities which are in some way preparatory for the ERA - which knows virtually nothing about the ERA at this stage, or about FP6. One respondent stated that it is always "the old incumbent participants who dominate the discussion!". It is felt that it is now very late in the day to be attempting to bridge the knowledge gap.
- There are concerns that the published information may not accurately reflect the way that selection of proposals will be made. As an example which arose on a number of occasions, there are concerns that assessment of proposals for NoEs will be strongly influenced by the number of partners and researchers to be involved - a view that 'bigger is better' - despite the statement in the current guidelines that "[o]f course, networks may be of a much more limited size [than involving several hundreds of researchers], but the necessary ambition and critical mass must be there⁸."
- There is a belief among some in industry that the scope of activities such as NoEs or IPs may be so broad that it will not attract key industrial players. It is felt that some activities may be expected to cover an enormous range of topics, many of which are of no interest to any single partner.

In short, there is a widespread feeling that much greater effort needs to be made to develop a full set of information on the ERA and its instruments. Further than that, there is a need not alone for information, but for *discussion*, which would help to really inform the research community about the concept and how it will function. This discussion needs to be two-way, so as to learn the real concerns of the research community, and to address these where appropriate. Time is now very short for this kind of activity, given the imminent launch of FP6 itself.

4.3 Fragmentation within NNE areas

Co-ordinators from a number of areas expressed concern about fragmentation of technologies and RTD in their fields. The dangers as they saw it include:

- Where the "right" technology has not yet emerged, there could be the danger of excluding potential 'winners'.
- There is a need to encourage small research teams working on topics which may currently be seen as peripheral and which might not be included in 'mainline' actions.
- Where there are many different strands to RTD in a field, if a project or network is to include all strands then there is the danger of dilution, and also the possibility that the focus is so widely spread that no one topic will receive sufficient attention.

It is felt that there is a need for a very strong Commission presence in existing thematic network and other activities at this time. This may be difficult for the Commission, as increasing time and attention will be paid to developing and launching FP6; however, it is seen as essential. It may also require a very strong Commission input to help guide and encourage appropriate proposals for projects and networks. Of course there are limits to what the Commission can rightfully do within the Call for Proposal process. However, some form of evolved pre-proposal dialogue is likely to be necessary in order to ensure the appropriate breadth of proposed activities.

4.4 Competitiveness/confidentiality issues

In reality, not many interviewees felt that competitiveness issues were very significant in the functioning of their existing actions: it seems that these issues tend to die away as participants come to know one another, and work out a suitable *modus operandi*. Nonetheless, it was felt by some that there is a need to address issues of potential competition/confidentiality between participants in the same consortia, particularly if these are addressing broad agendas which could result in selection of one technology or solution over another, or which could mean disclosure of business secrets to competitors.

It may be that there is a need for a suite of tools and approaches which could help consortia to address issues that could arise between competing partners. One existing action (ELEDRIVE) developed a number of such tools⁹ - including clear initial definition of a typology of confidentiality; use of confidentiality agreements between partners; use of the 'give and take' principle; and use of a 'common interest matrix' in forming sub-groups. The Commission might be able to suggest a suite of approaches to potential partnerships which would facilitate them in forming consortia that included competitors.

4.5 Changes in approach to planning on the part of key RTD actors

The view was expressed by a number of interviewees that many of the RTD actors in Europe do not yet fully appreciate the rapid changes that are expected of them, in progressing towards ERA. These changes include a need to identify and implement new RTD structures within the different areas of research. As pointed out in Section 2, such changes are taking place; however, in many areas there is the problem that structures exist already, to which key actors have commitment. Indeed, in many cases such structures are in place to implement existing activities supported from FP5. There is a need to develop towards new structures suited to the ERA, and to reconcile these with the investment which key actors have already made in existing structures.

⁸ Introduction to the instruments available for implementing the FP6 priority thematic areas: speaking notes", European Commission DG RTD/B2, 7 May 2002, p12.

⁹ Though in practice it seems that they did not experience any real need to use these tools.

Another kind of change identified was the need to develop and commit to very long term plans for RTD - plans that would lead ultimately to activities beyond merely satisfying Brussels in order to obtain funding. That is, key RTD actors need to start developing plans for their areas with a vision which is very long term, and which transcends that which is needed merely to participate in FP6 (seen as synonymous with ERA in many cases).

The *question* arises as to where the locus of control should lie here: is it with the research community itself, or is it something driven and dictated by the Commission? The *problem* is that the research community may see the requirements of FP6 and the ERA in general as dictating the kinds of plans and structures required, and that planning within the research community may be primarily expedient, in order to ensure participation in the new instruments. The *answer* may be that the Commission needs to facilitate as much as possible a coming-together of interests within a given area, to form (perhaps temporary) structures which could support development of a long term strategic vision for the area. An example of this would be the Technology Platform envisaged for the fuel cell/hydrogen area, and (less well developed at this stage) for the PV area. This is a difficult field of endeavour, but it may be that the Commission will have to act as a catalyst in bringing together key groupings within a given area of RTD, and in seeking a coherent long term vision for the area which all actors can more or less commit to.

4.6 Industry participation

In some NNE areas, there is already a strong involvement of key industrial actors. However, in others (for example, PV), it is felt that there is still insufficient industry involvement.

This could be a critical issue for such areas, since there is a vital need to link RTD activities with potential market needs - to the users of new technologies. Research has a strong emphasis on 'technology push', and there is thus a need for careful assessment of the interaction between energy policy instruments, the needs and behaviour of market players, and technology development. This requires that major RTD programmes be grounded in the reality of business and the marketplace.

In areas where it is felt that industry is not yet sufficiently involved, there may be a need for the Commission to take initiatives to increase this involvement - perhaps through workshops which focus on alternative research strategies and on industry's long term needs and concerns.

4.7 SMEs in the ERA

The ability of SMEs to play a significant role within the instruments of the ERA in general, and of FP6 in particular, has been questioned. In some specific areas - for example, wave energy - SMEs dominate the field. In others, there are many active SMEs along with much

larger research organisations. Some interviewees feel that the expense and difficulty for SMEs to participate in significant activities could hold back progress.

There seems to be little presently by way of a link between the priority thematic areas of research and the programme “specific research activities for SMEs”, and the issue of SME involvement in FP6 thematic activities does not seem to attract much attention at present. A number of interviewees feel strongly that there needs to be specific support for SMEs aiming to be involved in projects and networks of a large scale, and it was suggested on a couple of occasions that a prerequisite for proposals might be the inclusion of SMEs. This would probably be impractical, though some form of encouragement of SME participation might be desirable. At any rate, there may be a need for further discussion of possible measures to encourage the participation of SMEs, and dissemination of the Commission’s plans for such encouragement.

4.8 Prenormative research

As indicated in Section 2, most areas do have a current programme of prenormative research. However:

- (a) in some areas there is the impression of a rather scattered approach to this, with the possibility that there may be gaps;
- (b) in a few cases, RTD actors felt that insufficient priority has been given to planning and undertaking prenormative research, particularly as many of the present actions looking at this area are merely mapping the needs, and not actually doing research;
- (c) in some areas, it is felt that progress towards technology introduction may well be held up by a lack of harmonisation of standards, test procedures, etc.

In some areas, it may be advantageous for the Commission to examine current prenormative research activity - including current planning activities - to ensure that all of the needs are being met.

4.9 Mobility of researchers

The mobility of researchers represents the one of the biggest concerns among interviewees, both in the Commission and among other research bodies. It is felt that there are still enormous barriers to free movement of researchers from one Member State, or from one research employer, to another. Given that sharing and exchange of research staff is one of the central aims in bringing the ERA into being, this is felt to be a critical area in which little work has been done.

Of course, this is a huge area, cutting across all thematic areas, and requiring a co-ordinated effort not alone by the Commission but by Member States. It is not an issue that will be addressed within the NNE element of the programme. But it is clearly seen as a major obstacle that will need to be addressed if the ERA is to be fully realised.

4.10 Evaluation of very large projects

The present guidelines for Integrated projects suggest a scheme of output monitoring which may involve annual and mid-term reviews, and a comprehensive end-of-term review. For Networks of Excellence, some dimensions of such reviews are also suggested.

Given the long term nature of these instruments, and the potentially very large expenditure on them, there is the problem of assessing effectiveness and potential impact before it is too late to avoid wasted time and resources. There is some concern that assessment of such activities will be vital, but that the means of doing so is very unclear at present. There really needs to be a front-end process by which a set of agreed criteria for assessment can be put in place. It may be that this will be addressed in the work programme for FP6. At any rate, the approach to assessment needs careful thought at the outset, rather than leaving it until activities have already started.

4.11 Lack of consistency of procedures across Europe

Research actors presently working in consortia on large projects (e.g. the HDR/HFR project) have encountered the problem that different Member States' programmes approach costing differently from one another, and differently from the approach used by the Commission. This is potentially a major problem for the financial administration of a project receiving funding from a variety of Member States and programmes. The HDR/HFR project tackled and resolved this, putting in place an agreed costing approach (similar to the Commission's own model) to be used in the Member States of the partners; this has simplified considerably the administration of the project.

Similarly, there are inconsistencies between the rules and procedures of various Member States' RTD programmes, and between these programmes and the FP. This can lead to obvious difficulties in assembling a project with support from more than one funding programme.

Finally, comparison of technological alternatives is sometimes hampered by a lack of common approaches to evaluation of costs such as welfare costs. This can lead to difficulties and inconsistencies in the assessments and findings of different projects.

In relation to inconsistencies in programme rules, the fact that the HDR/HFR project found a way of producing a single agreed approach suggests that it is at least possible. This is perhaps an issue that could be addressed at the very outset of any future projects that will involve funding from more than one source.

In relation to developing common approaches to cost evaluation of alternative technical approaches, this could be an issue to be addressed in the same way as the planning and execution of prenormative research: there is a need to identify and address the needs for shared and agreed methodologies and approaches within a given area of RTD.

4.12 Lack of involvement of Member States' administrations

An earlier section found that there is still a great lack of involvement of Member States. It is also felt very widely among co-ordinators of actions that much closer engagement of Member States' administrations is needed in the development of the ERA, and in planning for FP6. It is felt that there remains a lack of knowledge of, and commitment to, the aims and issues in bringing about the ERA. Some Member States appear to be ambivalent to the very concept; others simply have not yet engaged with the implications of the ERA for their own programmes or for researchers within their jurisdictions. The problem of co-ordination of Member States' RTD programmes at a European level is very great, and one that potentially jeopardises the whole ERA project.

The ERA-NET scheme should be useful in bringing together national administrations and/or their representative agencies. It seems unclear at present how this scheme, to be operated within the specific programme "Integrating and strengthening the European Research Area", will be co-ordinated with the priority thematic areas of research such as NNE. There is a need to bring the ERA-NET on-stream as soon as possible, and to ensure an adequate level of input from the thematic areas of research into the operation of the scheme.

There is a need for much greater knowledge of national policies, programmes and priorities in relation to NNE RTD. This needs to be carried out on an ongoing basis, as there appears to be very considerable instability in Member States' programmes, in many areas of NNE RTD support. It requires dedicated resources within the Commission.

Finally, the emphasis within Programme Committees in the past has been very much on approval of work programmes and of proposal evaluations and allocation of funds. There is a need for a much higher level of engagement of Member States' representatives in long term European RTD strategy. Whether or not this can be brought about may determine the success of the whole ERA project.

4.13 The Commission's own role

There are a number of vitally important issues within the Commission itself, which have a bearing on how successful the progression towards the ERA will be.

First, the Commission's own role in relation to the ERA, now and in the future, is not yet clear. How involved should the Commission be in the establishment and running of

important projects and networks? How proactive should the Commission be in planning for appropriate activities which will become the focus of proposals made in response to Open Calls, and which will be subject to proposal evaluation? What should be the nature of the Commission's role in ongoing networks? There seems to be relatively little discussion of these questions, other than that carried on between staff members. There is a need for much more, and much more organised, discussion of such matters ahead of the introduction of the new instruments.

Second, the Commission's role is likely to shift from that of contract administrator to that of strategic planner and catalyst, in key areas of RTD. In the past, much of the thrust of EC programmes was to open them to all comers; now, the success of the ERA is likely to require that the Commission be at the centre of developing strategic priorities and structures within which long term RTD can be planned and carried out. Thus, Commission Services will need to operate at a high strategic level within a global perspective, and to be capable of communicating not alone in the arena of RTD but also in political and business arenas. The emphasis will be on strategy and facilitation, rather than on numbers and project administration. This is going to mean not only a considerably change in the jobs of Commission staff, but also a change in the knowledge and skill base of staff. It also implies a change in the managerial priorities within DG RTD, and a change in the culture of the organisation.

Whilst there has apparently been some training and development in preparation for this, so far it seems to fall short of what is required by such a change. Such changes in the private sector would be accompanied by comprehensive staff, management and organisational development actions, planned and executed ahead of the changes themselves. It is not evident that there has been sufficient attention to this within the Commission, to date.

Third, there is a need right away for the Commission to engage closely with key actors and actions aimed at preparation for ERA. At the same time, it is clear that the time and attention of Commission staff will increasingly be allocated to preparations for FP6. There is likely to be a considerable conflict between these two demands. No doubt this arises at the beginning of each new programme. But the need for careful hand-holding of the 'RTD market' is greater with the shift towards the instruments of ERA than previously. At the same time, the demands in terms of planning the new FP6 are likely to be larger than with previous programmes. This requires careful planning of resource allocation, the establishment of priorities, and ensuring that sufficient resources remain outward looking at the marketplace.

Fourth, given that the Commission is moving towards a more strategic, global vision of RTD, there is a need as never before for comprehensive knowledge and understanding of markets for RTD technology; of what is being done in Member States' programmes; of key players in each technology area; and of global factors influencing RTD and RTD strategy. There is a need for comprehensive databases of statistics and other information, and for resources capable of converting such information into useful knowledge as a basis for management of strategic RTD. There is also a need for adequate socio-economic research, not only to inform

NNE policy, but also to inform strategic decisions regarding RTD directions and strategy. The existence of the technology indicators activity is welcome. However, there is a need for much more, and a need for allocation of Commission resources to manage this whole area. In short, the Commission needs its own R&D facility, with links to the Scientific Officers in each area, to enable it to direct and manage research programmes at an adequate level.

The above issues suggest an urgent and important need for in-depth study on Commission functions, roles, and resources, and the requirements in these areas in progressing towards the ERA. Of course the Commission is well able to adapt to what is required in establishing the ERA; however, successful and timely adaptation requires planning, and there is no time to be lost on this.

4.14 RTD areas not included within FP6 priorities

There are a number of important NNE areas of research which it seems are not included within FP6 priorities. These include areas such as Clean Coal, Gas Turbines, Oil and Gas. They are areas where the Commission has been proactive for a long time in developing a truly European RTD strategy, and it is very clear from discussions with key RTD actors that the Commission's role and expertise are highly valued.

Of course the framework programme does not represent the totality of the ERA. However, it is not clear exactly how the Commission will continue to interact with areas such as the above (other than in a peripheral way in sub-areas which are included in FP6, such as coal/biomass co-utilisation, or CO₂ capture and sequestration). There is a need to develop a clearer sense of what the Commission will do within these areas, and outside of the framework programme itself.

5. Recommendations

Section 5 - Highlights

- Any remaining gaps in information on FP6 instruments should be plugged as soon as possible.
- The Commission Services itself should plan to engage directly with national administrations - selecting in particular those administrations which are key in each RTD field.
- Commission Services should also undertake its own strategic mapping and planning activity in each NNE field of research, working in collaboration with existing actions, as appropriate. The Commission needs to develop its *own* view of the strategic issues to be addressed in the short to medium term.
- The Commission should develop a view on how to 'marry' existing structures into a suitable overarching structure (perhaps temporary), for planning and co-ordination purposes within each RTD field.
- There is a need to target industry, and to develop *early* links with the SME programme.
- The Commission should develop alternative ways of maintaining ongoing links with those areas of NNE research excluded from FP6.
- Strong links should be retained between NNE and schemes such as the Marie Curie Fellowships; this should not simply be administered from elsewhere within the Commission.
- The Commission should develop comprehensive plans to prepare for the new roles that will be needed by staff in progressing towards the ERA, along with the new skills and emphases needed by staff.

5.1 Introduction

It is clear from the foregoing sections that a great deal is happening presently to prepare for the ERA in the field of non-nuclear energy research. Of course there remain many barriers, and some of these can only be addressed outside of NNE itself - for example, there is a need for more complete information at this stage on the instruments within FP6, and this is now urgent. There are other barriers where NNE could take action itself, and these are the subject of the recommendations below.

At the outset, it should be acknowledged that this is a time when the Commission is busy with preparations for FP6. It is likely that this will occupy an increasing amount of time over the coming months. The timetable for launching FP6 may well occupy so much time and attention that there will be little space for anything else. Yet - as the recommendations below suggest - this is a time for *increased contact with and attention to* the RTD marketplace. It is also a time in which the Commission should prepare *itself* for the new role, and even the new culture, that the ERA project implies. How to find the time for these activities is perhaps the biggest problem of all; failure to do so could slow down movement towards the ERA, and could considerably reduce the effectiveness of the Commission and the quality of RTD strategies and structures needed for satisfactory development of the ERA.

5.2 Recommendations

a). Increase stakeholders' real understanding of ERA:

Although the principal actors in preparatory actions seem quite well-informed about the ERA and the thrust and instruments of FP6, there remain areas where there is a lack of clarity or knowledge. Furthermore, it seems that there are large constituencies with little real knowledge of the ERA or its implications. Even Member States' administrations may well lack detailed knowledge either of the rationale and strategic importance of the ERA or of many of the details of its proposed operation. Certainly there seems to be a lack of appreciation of its implications.

There is an urgent need to complete any gaps in information on how the instruments in FP6 will operate in practice. Any such gaps - for example, funding guidelines for Integrated projects - should be identified very quickly, and this information should be transmitted without delay to as wide an audience as possible. NNE should consider the possibility of regular "ERA updates" aimed at as wide an audience in NNE research as possible - including national administration and national energy agencies. There is a need to inform the research community about the strategic underpinnings of the ERA; to convey that plans for ERA and FP6 are progressing well; and to provide explanations of how the instruments in FP6 will function. This could be done as a frequent news briefing aimed at the NNE research community. There should be a concerted effort to reach organisations not presently included

in preparatory actions; this could undoubtedly be done via existing thematic networks, representative bodies, and the like.

There is also a need to explore the implications of the ERA with key stakeholders, including research bodies but especially industry (including SMEs) and national administrations. Consideration should be given to workshops designed for specific constituent groupings - with a carefully chosen and invited participation - with a view to explaining the ERA and its instruments in some depth, and to initiating a two-way discussion of the implications. The aim of such workshops would be two-fold: first, to deepen people's real understanding of the ERA, and second, to identify issues and to begin to resolve them.

(b). Engage at a deep level with Member States' administrations:

There is a widespread view that national administrations are not fully engaged with the ERA project. Indications are that some administrations are not fully convinced of the rationale for the ERA; and that others are simply poorly informed and perhaps not fully engaged with the implications of the ERA and FP6 for their own programmes and priorities. Engagement with Member States' programmes is problematic in some cases, as their own NNE RTD programmes are unstable over time, and in some cases are not fully coherent.

It has already been recommended that there should be urgent workshops designed for representatives of national administrations, during which the fundamentals and the implications of the ERA could be explored.

Attitudes of Member States towards RTD strategy varies from field to field: a Member State may care deeply about emergent RTD policy on DER, for instance, but little about bioenergy. It is recommended that each Scientific Officer overseeing a specific NNE research field should identify those national administrations where there is the greatest need for a full understanding of, and engagement with, the ERA, FP6 and the FP6 instruments. Targeted efforts might then be planned, to engage in in-depth dialogue with representatives of national administrations - perhaps with those directly involved in developing and implementing national RTD programmes in that field of research. This might be done by bringing a small group of representatives from one administration together for a day, to explain and explore the ERA and its instruments, and in particular the implications of these for future national RTD programmes.

Some work is in progress aimed at mapping national policies and programmes in specific areas of NNE research. However, this is only happening in some areas, and even here there is some doubt as to how successful these mapping efforts will be. Where there *are* such activities underway, it would be desirable to ensure that sufficient priority is being given to the task, and that the outputs of these exercises will meet the Commission's needs. It might be feasible to bring together representatives of these activities at a meeting in which the work and the methodologies are reviewed and discussed. Where such activities are *not* underway,

it would be even more important for the relevant Scientific Officer(s) to identify the critical issues (as outlined above).

The Commission should consider initiating an exercise to explore the feasibility of a harmonised set of procedures governing cost reporting in programmes, overhead allocation, and the like. It has been demonstrated that this can be achieved in some areas, and it would be highly desirable to achieve a harmonised approach to these aspects of programme and project administration. This might be a longer term exercise, but it would be worthwhile even to scope the task at this stage.

There may be the possibility of establishing a working group of the Programme Committee charged with identifying ways of engaging Member States more fully with the aims and approaches of the ERA. However, it must be said that many of the interviewees from the research and industry communities do not feel that the Programme Committee is engaged with the ERA at a sufficiently European level.

(c). Establish early foundations for an RTD strategy in each field

Most if not all of the research areas within NNE are in the process of producing a medium to long term strategy for RTD. In many cases, networks and other actions are in progress on this task, and in some cases the results will not be delivered for some time. In others, draft reports are either available now or will be shortly.

It is very desirable indeed that the Commission should develop a strategic blueprint for RTD in each area, including the strategically important issues to be resolved by RTD in the short, medium and longer terms, and the strategic challenges which RTD must face. This would include a brief assessment of global opportunities and threats, and identification of the research goals to be reached. Most Scientific Officers already have a clear view of the strategic issues in their areas of work; it would be highly desirable that in each area these should be assembled into a draft strategy¹⁰, including the immediate issues that need to be addressed at this time. This could be done in collaboration with any existing strategic mapping tasks underway at present - and in the understanding that this represents a point-in-time blueprint that can be shaped by the outputs from existing mapping activities.

The aim should be for the Commission *itself* to develop a view of the strategic issues that must be addressed in the short term, and in the context both of FP6 and the ERA.

The technology indicators being developed within the Commission can serve as a valuable means of engaging RTD actors in discussion as to the research priorities to be met. It would be highly desirable to see a continuation of this work, and to ensure that existing thematic

¹⁰ Of course, this has already been done in some areas.

networks be used as a means of obtaining feedback. This could initiate a valuable two-way dialogue.

(d). Ensure adequate coverage of important lines of prenormative research

There is a need to map the short and longer term priorities for prenormative research in each area, and to ensure wherever possible that work on these starts as soon as possible. It would be valuable for each Scientific Officer to scan their areas of RTD with a view to ensuring that these priorities are being addressed - if not now, then as soon as possible within FP6.

(e). Build on existing RTD structures:

In most NNE research fields, there are existing structures of some form, often created by current activities such as thematic networks, clustered projects, etc. It is by no means clear how these structures - to which key RTD actors are more or less committed by virtue of the fact that they are part of ongoing contracted work - will be linked to future actions within FP6 or within the ERA generally.

It would be very desirable that the Commission should examine existing structures, and begin to form a view as to how these could form part or all of a future structure that would support the ERA. The Technology Platform proposed for the fuel cell/hydrogen area is an example of how existing structures can be mapped and an over-arching structure proposed. This will not be easy in many cases, and the actual structures that will emerge may be very different from what is visualised now. However, there is a need to begin to grapple with the question of how existing and future structures will be 'married', and work on this should commence.

(f). Target industry; develop early links with the SME programme:

Although there seems to be a reasonable industry presence in some areas, in others there is still insufficient representation from industry. A strong industry presence is essential in order to ensure that research is firmly linked to market needs, and to ensure that is directed adequately towards raising strategic competitiveness. Further, there is a need to facilitate the inclusion of SMEs within the instruments of FP6.

A number of large companies expressed concerns about the FP6 instruments, believing that large integrated projects might be drawn so broadly that their management teams would not be prepared to join them. Companies need to be reassured that projects - particularly large and long-term projects - are adequately focused such that the research work will target their specific needs. Another difficulty raised was the cost and effort required for co-ordination and management of large actions; companies are unwilling to spend large amounts of money and resources in putting complex management structures in place. SMEs in particular express

grave concerns about the administrative burdens which large, complex projects might entail. Some SMEs would like to act as project or network administrators, but they have concerns that the funding would be inadequate (and it seems likely that they may not yet fully understand the financial rules envisaged in FP6). Finally, some companies appear to have genuine concerns that some lines of research might find themselves excluded from work programmes in large projects; they feel they may retain greater levels of control by staying away from such large consortia.

Attracting industry is by no means easy. However, it is vital. There is a need for information on the ERA targeted specifically at industry, and at meeting the possible concerns of industry. The regular ERA newsletter recommended above might serve as a suitable vehicle. High-level material might also be developed for targeting industry management at the highest levels, dealing with long term strategic aspects of the ERA; involving top management in industry is necessary to ensure an appropriate level of engagement by industry with the ERA.

There is a need to explore the possibilities for encouraging SMEs within NNE actions. There is a need to develop as many early links as possible between the sustainable energy thematic priority and the programme “Specific research activities for SMEs”.

(g). Make sure of ongoing links with areas excluded from FP6:

Some of the more important areas within NNE research - areas which have received a great deal of attention in the past - are excluded from FP6. There is a need to develop alternative means of retaining an ongoing working link with these areas, outside of the framework programme.

(h). Encourage mobility and training of researchers:

It is unclear why NoEs within FP6 would devote much time or resources to training and education of third parties, in order to develop general R&D excellence in Europe. Many existing dissemination and promotion activities concentrate solely on passive provision of information, without actively aiming to offer a training/educational service. There is a need to ensure that this function of NoEs in particular is adequately addressed in proposals.

Mobility of researchers is a major concern among the research community. Researchers need to be able to move between organisations and locations without losing out on benefits. This is something beyond NNE alone, but it is a key issue which the Commission urgently should address.

It is recommended that as strong a link as possible be retained between NNE and schemes such as the Marie Curie Fellowship programme. At present, it seems unclear what, if any,

links will exist to this scheme. It is highly desirable that NNE should retain adequate contact with young researchers in the NNE field.

(i). Prepare Commission resources for FP6 and the ERA:

There is a need for ongoing collection and synthesis of information needed to permit the Commission to adopt a suitable strategic vision for energy RTD. It is recommended that at least some full-time resources be allocated to gathering needed statistics and information on European, national and international NNE RTD policies and strategies, to enable informed strategic decisions to be made.

There is an urgent need for organisation development and training activities aimed at (a) developing the new role of Commission staff in the context of the ERA and FP6; (b) exploring the changing role of DG RTD as a whole (or, at any rate, of NNE) as it takes on ERA; and (c) new skills and directions in staff jobs, in relation to ERA and FP6. If the ERA is truly to be realised, then the organisational changes within DG RTD will be quite profound - as significant as many major changes in private sector organisations which are accompanied by large-scale staff and organisation development interventions. There is no reason why the Commission should need less of this than a private sector body. Lack of attention in this area will reduce the effectiveness of the organisation in dealing with the new dispensation represented by the ERA.

There is an urgent need for realistic resource planning, bearing in mind the resource needs both in establishing the new framework programme (and all of the procedures and administration that it entails), and in maintaining strong and ongoing links with the research community. If the Commission is to be entirely focused internally on development of its own procedures and administrative arrangements, then the risk is that the research community will be ignored at a time when contact should be increasing.

Finally, it would be highly desirable for NNE to establish a set of (say) five or six “key success criteria” with which to guide and measure the process of implementation of the ERA. What are the things that would really have to happen, in order to be able to say that satisfactory progress had been made.

5.3 Concluding note

Non nuclear energy research represents but one element in a much bigger picture of changing emphasis and approaches to RTD at a European level. There are many challenges which can only be tackled across DG RTD as a whole. With these, all that NNE can do is to take what steps it can to ensure that it has adequate and early links with other programmes and resources needed to progress smoothly and effectively towards the ERA.

In other areas, NNE can take actions - albeit sometimes limited action - to address possible barriers to progress. The big difficulty here is that this is a time of increasing workload, when the addition of further activities is to increase pressures on management and staff. Yet this is a period when attention needs to be paid both to the RTD community and to the Commission's own resources. To ignore these, or to defer them, is to risk reduced effectiveness in the longer run.

Much has been done within NNE towards establishment of the ERA. The next year will be a testing time. There is a need to identify the real priorities - in the RTD community working with NNE, and within the Commission itself - and to ensure that everything possible is done to develop these two sets of resources.

ANNEX A

LIST OF PRINCIPAL ACTIVITIES EXAMINED IN THE COURSE OF THE ASSESSMENT

Fuel Cells/Hydrogen

- Fuel Cell/Hydrogen Technology Platform
- FHIRST - AM on ERA in Fuel Cells
- HYNET - TN on Hydrogen Economy
- ELEDRIVE - TN on Fuel Cell Vehicles
- FCTESTNET - Fuel Cell Testing and Standardisation Network
- SOFCNET - TN on Solid Oxide Fuel Cell Technology

Photovoltaics

- PV-EC-NET - TN on Coherence in European and National RTD on PV Solar Energy
- PVNET - TN on Development of a Roadmap for European PV RTD
- PV Technology Platform

Distributed Energy Resources (DER)

- RES+DG Cluster - Clustered projects in DER (DISPOWER, INVESTIRE, ENIRDGnet, SUSTELNET, MICROGRIDS, CRISP)
- ENIRDGnet - TN on European Network for Integration of Renewable Sources and Distributed Generation
- ERA_ISLA - AM on New and RES, Electricity and Water in Outermost Regions

Wave energy

- WAVENET - TN on Wave Energy

Wind energy

- TN on Wind Energy

Hot Dry Rock

- HDR/HFR - Large project on HDR/HFR

Bioenergy

- ERA Bioenergy - AM on Short term measures to develop the ERA for Bioenergy RTD
- BIOCOGEN - AM on Biomass Cogeneration
- BIONORM - Project on Prenormative work on sampling/testing of solid biofuels for development of QM

Oil & Gas

- EUROGIF - European Oil and Gas Innovation Forum
- TRENDS2 - Quality, Health, Safety, Environment Aspects of Hydrocarbon Production

CO₂ capture, transport, sequestration

- CO₂NET - AM on CO₂ capture and sequestration
- CO₂NET2 - TN on CO₂ capture and sequestration

Clean Coal; Coal/Biomass co-utilisation

- POWERCLEAN - TN in coal/biomass co-utilisation sector
- AD700-2 - Large project on Advanced 700° Pulverised Fuel Power Plant, ph 2

Gas turbines

- CAME-GT - TN on Cleaner and More Efficient Gas Turbines
- CHAPNET - TN on CHP
- CE-IGT - CA on Centres of Excellence in Industrial Gas Turbines

Buildings

- ENERBUILD - TN on Buildings and Building Components
- IQ-TEST - Testing of building components
- DAME -BC - ERA in Building Components

Socio-Economic research in energy

- ExternE - Project on External Costs of Energy
- NEWEXT - Project on New Elements for Assessment of External Costs from Energy
- ENER - TN on Energy Economics

National RTD policy surveys

- SENSER - Project on Synergies Between European and Member States' Energy RTD
- PSI (SENSER 2) - Project: Priority Setting Initiative

Renewable energy

- REDS - Project - R&D Spending on RE in EU Countries
- Benchmarking - Project - Benchmarking of test procedures in RES

Training

- SWERF - Workshop Series for Energie Research Fellowship Holders

Technology

- Technology Indicators (internal EC task)

ANNEX B

PEOPLE INTERVIEWED/RESPONDENTS TO QUESTIONNAIRES

1. Commission staff:

BORTHWICK	William
DECHAMPS	Pierre
DIAMANTARAS	Komninos
EVANS	Glyn
FERNANDEZ RUIZ	Pablo
GIUI	Garbiñe
JARVILHETO	Pekka
KARAPIPERIS	Leonodas
LANGLOIS d'ESTAINOT	Thierry
Mariën	Frederick
MARTIN HOBDEY	Alejandro
O'BRIEN	Denis
PAPARELLA	Antonio
PEREZ SAINZ	Angel
PILAVACHI	Petros
POIREAU	Michel
ROBERTSON	Barry
ROSETTI DI VALDALBERO	Domenico
SÁNCHEZ JIMÉNÉZ	Manuel
SCHILD	Philippe
SCHUPPERS	Jeroen

2. Co-ordinators of relevant actions

<u>ACTION:</u>	<u>RESPONDENT/INTERVIEWEE:</u>
SOFCNET	Bert Rietveld, ECN
FCTESTNET	Eleni Konstantinidou (Mrs), VDI
POWERCLEAN	John McMullan, Un of Ulster
C02NET2	Annette Cutler (Ms), Technology Initiatives
ERA BIOENERGY	Josef Spitzer/Heinrike Bayer, Joanneum Research Institute
BIOCOGEN	Calliope Panoutsis (Mrs), CRES
BIONORM	Michela Hein (Mrs), Inst for Energy & Environment
BENCHMARKING	Dirk Uwe Sauer, Fraunhofer Institute
FHIRST	Lars Sjunneson, Sydkraft
HYNET	Ulrich Buenger, L B Systemtechnik
ELEDRIIVE	Frédéric Vergela, EERVA
HDR/HFR	Roy Baria, Jörg Baumgärten, BESTEC
REDS	Arturo Lorenzoni, Un. of Bocconi
WAVENET	Richard Boud, Future Energy Solutions
ENIRDGnet	Angel Diaz, LABEIN
DISPOWER	Frits Oostvoorn, ECN (resp. for DISPOWER/SUSTELNET)
SUSTELNET	Frits Oostvoorn, ECN
INVESTIRE	Philippe Malbranche, CEA
ERA_ISLA	Maria da Gracia (Prof)
CAME-GT	David Pollard, Alstom
CE-IGT	Christer Björkvist, EuMIGT
EuMIGT	Christer Björkvist, EuMIGT
PV-EC-NET	Job Swens, Novem
PVNET	Arnulf Jäger-Waldau, JRC-Ispra

ANNEX C

ACTIVITIES BY RTD FIELD; ACTIVITIES FROM WHICH DATA WERE COLLECTED; MEANS OF DATA COLLECTION; SUMMARY POINTS FROM ASSESSMENT

RTD field Fuel cells/Hydrogen

Actions examined; means of gathering information/views

Action	Means of data collection			
	Printed materials	Website info	Q'aire	Interview
Fuel Cell/H2 Technol Platform	✓			✓ (EC)
HYNET	✓	✓		✓
FHIRST	✓	✓		✓
ELEDRIIVE	✓		✓	
FCTESTNET	✓	✓	✓	
SOFCNET	✓	✓	✓	
<p>Summary points from assessment:</p> <ul style="list-style-type: none"> • Many of the major actors already involved, though there remain significant gaps. • Need for greater involvement of industry in the fuel cells area. • Existing networks have created good awareness of the issues involved in progressing towards ERA. • With some key actors in the hydrogen field, the focus is more on identifying possible business opportunities than on exploring specific RTD priorities. • The Commission's proposal for a Technology Platform potentially creates a good operational structure for co-ordinating RTD strategy and actions in this area. • Pan-European organisations - such as the European Hydrogen Association, the Chemical Industry Council CEFIC - provide means by which major RTD players can be co-ordinated. • Mapping of centres of excellence, research facilities and strengths and weaknesses is in progress covering most of the fuel cell/hydrogen field, including technology mapping, test facilities and solid oxide fuel cells. • Some benchmarking of European technology against the US and Japan is being done. • There are strong links between Europe and the US (though in some topics - for example, vehicle fuel cells) co-operative links are lacking other than links between one Member State or company and the US. • Some work is under way on planning and conducting prenormative research, including work towards harmonised world-wide regulations for most aspects of hydrogen. Further work is required both in fuel cells and hydrogen. • Limited consultation with Member States (a meeting between the Commission and Member States created the impetus for many of the current initiatives). An aim of the "ERA in Fuel Cells" TN (FHIRST) is to consult and exchange information with Member States' programmes. However, there is a need for much more involvement of Member States. • Limited involvement of NAS countries, and a need for much more. • Commission has been highly proactive in stimulating co-operation, and the many of the components are in place for operationalising the proposed Technology Platform. 				

RTD field: Photovoltaics (PV)

Actions examined; means of gathering information/views

Action	Means of data collection			
	Printed materials	Website info	Q'aire	Interview
PV-EC-NET	✓	✓		✓
PVNET	✓	✓	✓	
PV Technol Platform	✓			✓ (EC)
<p>Summary points from assessment:</p> <ul style="list-style-type: none"> • Many key actors already involved in preparatory actions (one thematic network, one accompanying measure, a network for NAS countries under negotiation, a clustered set of projects and a thematic group on PV in the area of buildings). • Workshops held in 2002 attracted 40 participants from 12 countries (including three NAS countries). There is still a need for greater industry involvement, and this is a difficult task in the PV area. • Mapping of national RTD programmes in PV is in progress. However, this is a formidable task. The mapping includes benchmarking of national programmes, which is a sensitive issue for some Member States and could impede progress on mapping. • A web-based European PV Information Office will be useful in disseminating information on national PV programmes. • Some work is in progress on prenormative research (e.g. within JRC-Ispra), and a workshop in mid-2002 focused on needs for standards and harmonisation. However, this is a problematic area in PV. • Work is in progress on strategic roadmaps, and a draft is expected in early 2003. • The Commission has been highly proactive in this field. A Technology Platform has been proposed in outline; if successful, this would guide the development of RTD in PV, but there may be major barriers in progressing this with full participation across Europe. 				

RTD field Distributed Energy Resources (DER)

Actions examined; means of gathering information/views

Action	Means of data collection			
	Printed materials	Website info	Q'aire	Interview
ENIRDGnet	✓		✓	
ERA_ISLA	✓		✓	
DISPOWER	✓		✓	
SUSTELNET	✓		✓	
INVESTIRE	✓			✓
MICROGRIDS	✓			
CRISP	✓			

Summary points from assessment:

- A number of networks are presently running, undertaking actions needed in order to develop readiness for ERA. A further action aiming at ERA in new/renewable energy for electricity and water in outermost regions
- In early 2002, a number of projects, including one very large project (itself a combination of two projects) and some networks were formed into a single cluster (RES+DG Cluster), which creates much greater clarity and structure, and an opportunity for much broader communication between actors.
- Present activities include a large number of key actors from a variety of sectors, including research bodies, national/regional agencies, utilities and manufacturers. The utilities involved currently account for in excess of 100 million clients across the EU.
- Research agencies involved include those implementing national RTD programmes in this field, creating a reasonable link to national programmes.
- Organisational issues - finding potential leaders acceptable to all actors - has been a major element in the work to date. More work will be required in order to create a structure capable of advancing this field in an integrated/co-ordinated way; it seems unlikely that any one NoE or IP will be capable on its own of bridging the whole field.
- Work is in progress on mapping of Centres of Excellence, both in DER generally and in specific areas such as energy storage. It is the intention of one of the networks (ENIRDGnet) to establish a Virtual Centre of Excellence.
- Benchmarking is also under way of national programmes, policies and projects. One network (SUSTELNET) is benchmarking Member States' regulatory systems and practices - a vital issue in this field.
- On prenormative research, a range of activity is in progress, including an assessment of requirements and approaches to standardisation, testing and certification; policies and regulatory needs; safety and quality requirements in DG networks; standardisation requirements for energy storage, and test procedures for benchmarking components in RES/energy storage (BENCHMARKING project).
- Links have been established with the US and elsewhere. The RES+DG cluster is monitoring international RTD work.
- As with other areas, information exchange and dissemination is being approached by means of websites of the various actions.
- Some NAS countries (Poland, Hungary, Lithuania, Romania) are included in the activities, along with some other Mediterranean countries (in the MED-2010 action). There is a need to extend this further in the future.

RTD field Bioenergy

Actions examined; means of gathering information/views

Action	Means of data collection			
	Printed materials	Website info	Q'aire	Interview
ERA Bioenergy	✓		✓	
BIOCOGEN	✓	✓	✓	
BIONORM	✓	✓		✓
<p>Summary points from assessment:</p> <ul style="list-style-type: none"> • A number of activities are in progress, including an accompanying measure focusing on short term measures to develop the ERA for bioenergy RTD. All of these activities commenced in 2002, and so are at a relatively early stage. • Many key actors are already involved, although some remain to be included, and the agricultural and socio-economic elements are still missing. • However, activity towards co-ordination of RTD in the biomass field is at a very early stage: many elements in the chain do not even consider RTD as an issue, and so there remains a large task in promotion and awareness. • The Commission organised a data collection exercise to gather information on what is going on. So far there are biomass programmes in only four Member States, and the field is very much more fragmented in the others. Thus, pan-European co-ordination of Member State programmes is a long way off. • The “ERA Bioenergy” action is in process of mapping national policies as well as programmes. This includes examination of policies and programmes in order to identify best practice. In biomass cogeneration, the BIOCOGEN action has completed a mapping exercise of applications in Europe and also in NAS countries. • The field presents a special problem in that in most areas (except perhaps liquid biofuels) it is dominated by SMEs, which can have special difficulties in joining in with co-ordination actions, and in particular may have difficulties in joining ERA instruments such as NoEs and IPs - hence, there are problems in ensuring that smaller actors see the relevance of preparation for ERA. • Rather than mapping centres of excellence, the ERA Bioenergy action is examining where these may be needed, as a first step towards the possible creation of such a centre(s). • As will probably be clear from the above, there is still no emergent management or co-ordination structure, and indeed this is not being examined currently. It may be considered too early to propose such a structure. In the BIONORM project, the management structure includes an Advisory Board (in existence primarily because of the project’s link to CEN). This has not yet met, as there has been no need for it to do so at this stage of implementation. However, the existence of an Advisory Board is welcome and could stimulate interest in over-arching management/ advisory structures elsewhere in the field. • The bulk of work on prenormative research is going on with the area of solid biofuels, via the BIONORM project; this project is developing a series of standards for solid biofuels, with a close working link with the CEN Working Group (CEN TC 335 Solid Biofuels). • Links exist with the IEA bioenergy research network, and an implementing agreement is in place. The BIOCOGEN action includes monitoring of international activities, and again it has links with IEA. • Work is in progress towards identification of strategic opportunities in the broad bioenergy field, and parallel work is also in progress to identify strategic strengths, weaknesses and opportunities within the bio-cogeneration field. • Good links exist with NAS countries, with a reasonable membership of current actions from these countries. There are explicit objectives in the bio-cogeneration field to develop closer links between EU activities and those in C&E Europe. • The Commission has been highly proactive in the advances that have been seen to date. Indeed, proposals were made for a team of national representatives in the bioenergy field, at the end of 2000 and again at the end of 2001, even though it was not until end 2001 that co-ordinating actions got underway. 				

RTD field Ocean energy

Actions examined; means of gathering information/views

Action	Means of data collection			
	Printed materials	Website info	Q'aire	Interview
WAVENET	✓	✓		✓
<p>Summary points from assessment:</p> <ul style="list-style-type: none"> • A thematic network on wave energy was established in 2000. Among its objectives were identification of the current status of wave and tidal device development, and the development of a strategy and action plan for R&D in this field. Draft reports on R&D strategy and cost analyses of technology options are expected in October 2002. • The network has succeeded in bringing together key players in European wave energy RTD, including research institutions, some SMEs actively involved in the development and promotion of wave energy devices, and some co-ordinators of national programmes. Whilst the network was not directly established with a view to preparing for ERA, nonetheless its members recognise that it represents an important vehicles for the development of expressions of interest and possibly proposals for IPs or NoEs within FP6. • It is well recognised that there is considerable duplication in equipment - for example, wave tanks and test facilities. The network appears to be facilitating greater co-operation in sharing of facilities, and there appears to be an emerging view that a network of complementary/ shared 'real world' centres for development and testing of devices could be developed - though this in itself would require a separate study in its own right. The main point here is that the existing activity does seem to be leading towards greater European co-operation. • There is also recognition that there is a need for common standards - e.g. rated energy of devices. While this was a task for the existing network, the fact that it cannot in itself carry out research means that these kinds of prenormative activity would need to be carried out within a future group. Again, however, the need for shared efforts on prenormative research is now recognised. • Europe currently enjoys a dominant position in this field. However, most of the key players are small institutions/SMEs, and there is a need for some form of overall co-ordination structure to help in directing further European efforts. This has not been a task of existing actions, and the problem of establishing and resourcing an overall management structure could create a barrier to real participation in ERA. • European R&D in this field currently tends to be carried out in some isolation from developments in the rest of the world, with much of the expertise needed being available in Europe. A new implementing agreement will involve not only European Member States such as Denmark, Portugal and UK, but also Australia, Canada, Japan and the US. • The Commission has been proactive in the establishment of a networking activity within FP5. 				

RTD field Wind energy

Actions examined; means of gathering information/views

Action	Means of data collection			
	Printed materials	Website info	Q'aire	Interview
TN on Wind Energy	✓	✓		
Summary points from assessment: There were no detailed discussions during the course of this study with actors directly involved in preparatory activities in the field of wind energy, and the observations in the main report are based on a review of available documentation.				

RTD field Hot Dry Rock/Hot Fractured Rock

Actions examined; means of gathering information/views

Action	Means of data collection			
	Printed materials	Website info	Q'aire	Interview
HDR/HFR	✓		✓	
Summary points from assessment: <ul style="list-style-type: none"> • RTD co-operation in this field started in 1987 as a French-German activity with support from the European Commission. Since then the co-operation has developed, and now includes researchers from France, Germany, UK, Italy, Netherlands and Switzerland. • There is also long-standing co-operation with the US under an IEA implementing agreement, and informal co-operation with Japan and with Swedish groups. • RTD efforts in Europe are centred on a very large project (Hot Dry Rock/Hot Fractured Rock, HDR/HFR), of which the first three-year phase (2001-2004) is in progress. • The HDR/HFR project has a three-tier management structure in place, involving a Policy Group with representatives from the funding agencies; an Industrial Consortium (formed into an EEIG), responsible for the day-to-day management, finance management, etc.; and a scientific grouping called the European Hot dry Rock Association (EHDRA). The EHDRA proposes scientific activities to the Industrial Consortium, and co-ordinates scientific activities. • A breakthrough in this grouping has been the development of a common structure for reporting and financial accounting accepted by the national funding agencies and the Commission. • Procedures have been developed on data acquisition/dissemination, rights of individual organisations, and safeguards on publications. 				

RTD field Oil & Gas

Actions examined; means of gathering information/views

Action	Means of data collection			
	Printed materials	Website info	Q'aire	Interview
EUROGIF	✓	✓		
TRENDS-2	✓	✓		

RTD field Clean coal; Coal/biomass co-utilisation

Actions examined; means of gathering information/views

Action	Means of data collection			
	Printed materials	Website info	Q'aire	Interview
POWERCLEAN	✓			✓
AD700-2	✓			

Summary points from assessment:

- RTD in coal has a long history within the Framework Programmes, and Europe holds a leading position in the world in coal technology. This position may be under threat in some areas (e.g. gasification, co-utilisation) given that coal research has been run down across Europe and that major funding is being directed into this field within the US.
- A large project running within FP5 (AD700-2) represents the second phase of development of a high temperature pulverised fuel plant. This project operates with a well developed management structure, with a project co-ordination committee overseeing a project management group, and the RTD activity divided into three separate groups. AD700-2 builds on an initial feasibility phase operated within FP4, and further phases are intended to lead to a demonstration plant.
- The AD700-2 project closely resembles an Integrated Project in its scale and operation. Indeed, implementation of AD700-2 has brought the project to the limits of current instruments, and demonstrates the need for the increased flexibility in planning, consortium changes and disbursement of budgets envisaged within the IP instrument.
- However, coal RTD will not be included in FP6, and indeed with the ending of the Coal and Steel Treaty a new fund has been established to provide separate funding for ongoing research.
- However, there remain areas in which coal technology RTD may continue within FP6, including coal/biomass co-utilisation. Coal/biomass co-utilisation may well be the area proposed for activity within FP6 and the ERA.
- A thematic network (POWERCLEAN) on coal/biomass co-utilisation is under negotiation; this was preceded by a nine month accompanying measure whose purpose was to formulate a proposal for the TN.
- The TN involves a group of key RTD actors in the coal/biomass co-utilisation field.
- Mapping of national policies and programmes will be a key task of the TN. National programmes and policies are not closely aligned, because each has different priorities and objectives. The NAS countries, many of whom are heavily dependent on coal, and there is no convergence at this point on preferred technologies.
- The POWERCLEAN network is also intended to stimulate discussion on strategic issues related to coal/biomass, and to develop RTD strategies in the topics of combustion, gasification, power generation equipment and materials.

RTD field CO₂ capture, transport and sequestration

Actions examined; means of gathering information/views

Action	Means of data collection			
	Printed materials	Website info	Q'aire	Interview
CO2NET	✓	✓		
CO2NET2	✓	✓		✓

Summary points from assessment:

- An 18-month accompanying measure (CO₂NET), initiated under the umbrella of EUROGIF, has been completed, with a considerable amount of work accomplished within this time period. This action covered all aspects of CO₂ other than ocean storage. The action included two RTD projects, SACS and GESTCO, the IEA GHG R&D programme. It ended up with some 29 members from 9 countries, and led to a proposal for a thematic network (CO₂NET2), to run from 2002 to 2004. All existing CO₂ projects were involved in this exercise, which concluded with a workshop run in April 2002.
- The CO₂NET2 network will have over 40 members in 2002, with the possibility of more during its life. Membership of the network includes almost all key actors, although a couple of companies and countries are missing still from the activity.
- The new TN has a good structure, with a Steering Committee, a Technical Committee and a number of Working Groups. Additional infrastructure is needed, particularly if transport is included within the same field.
- Mapping of centres of excellence is one of the tasks envisaged, leading also to the creation of a Virtual Centre of Excellence.
- The TN will also map national programmes, and it is intended that Member State representatives will attend some of the meetings, although progress towards involvement of Member States is reported to be slow at present.
- The original work programme aimed to address both risk assessment and standards. However, cuts in budgets has led to a delay in work on standards, though work on risk assessment has been 'fast-tracked'.
- CO₂NET2 will also assess and define strategies for RTD in this field, as well as assessing best practice as a foundation for benchmarking.
- Promotion, education and general awareness-raising are important issues, and are to be addressed via website, training materials and educational activities.
- It is reported that exchange of materials (e.g. equipment) is starting to happen among the members of the network.

RTD field Gas turbines

Actions examined; means of gathering information/views

Action	Means of data collection			
	Printed materials	Website info	Q'aire	Interview
CAME-GT	✓	✓		✓
CHAPNET	✓	✓		
CE-IGT	✓	✓	✓	
EuMIGT		✓	✓	

Summary points from assessment:

- This is an area not supported by FP6, other than perhaps in relation to CO₂ removal and sequestration. Nonetheless, this field has received consistent stimulation from the Commission over a considerable period, and it is a very active area.
- A thematic network (CAME-GT: Cleaner and More Efficient Gas Turbines) has functioned since October 2000, and continues till end 2003. This network has accomplished a great deal since it started. The network functioned as a means of co-ordinating and increasing added value from 11 (soon to be 14) DG RTD projects and 4 DG TREN projects on gas turbines approved in FP5.
- Other network or preparatory actions have started in the field since the beginning of 2002, including a network on CHP, a concerted action on industrial gas turbines (<50MW), and a network including NAS countries, who will also attend CAME-GT meetings and workshops. There is also an action to create a European Virtual Institute for gas turbine instrumentation under way within the GROWTH programme, and an action also on aero engines.
- Virtually all the major players in gas turbines are involved in the above actions, including all of the universities and research institutions involved in gas turbine RTD, and almost all significant companies.
- CAME-GT has been very active, with a series of workshops organised since February 2001 achieving a great deal both in creating synergies between gas turbine RTD projects and in generating a shared view on gas turbine RTD strategy.
- CE-IGT will organise its first workshop in October 2002. The aim of this action is to create a European Virtual Institute on industrial gas turbines.
- There are active European associations whose role is to co-ordinate RTD in the field. The European Manufacturers of Industrial Gas Turbines association (EuMIGT) was established in late 1997 as an industry initiative, but with very strong encouragement from the European Commission. COGEN, an association for CHP, was formed as an initiative of DG TREN's SAVE programme. Such associations represent important infrastructural means of co-ordinating RTD efforts.; EuMIGT has also presented the Commission with a suggested model for organisation, funding and management of RTD in the industrial gas turbine field.
- The activities involve mapping Centres of Excellence across all of the areas of gas turbines, and in the area of industrial gas turbines, establishment of a virtual CoE.
- Some work is being undertaken on mapping national programmes and policies. In the field of CHP, an explicit task in each cluster is consultation with national programmes.
- Considerable work is underway on identifying strategic strengths and weaknesses, threats and opportunities. The work will lead to development of strategies for the future direction of RTD, with a 10-15 year horizon (in CHP, of 20 years).
- Again, many of the actions are developing plans for prenormative research: CAME-GT has just commenced a task to co-ordinate and bring together research in standards at international and national level. This is also being addressed in the CHP area.
- The CAME-GT network is also looking at international programmes. An MoU for a collaboration agreement has just been signed, and a joint EU/DoE Conference is being planned for autumn 2002 - this will share information on key projects in Europe and the US, and ongoing collaboration will include shared projects and further meetings to explore collaboration in specific fields such as materials. A further conference is also planned for Spring 2003.
- NAS countries are involved in the principal European actions already, and the NASINT-GT network will increase participation of organisations from these countries.

RTD field Buildings and building components

Actions examined; means of gathering information/views

Action	Means of data collection			
	Printed materials	Website info	Q'aire	Interview
DAME-BC	✓	✓		
IQ-TEST	✓			
ENERBUILD	✓	✓		
Summary points from assessment: It proved to be impossible to gather information and views via face to face discussions in this field, within the time frame of this study, and an assessment has been made on the basis of written materials which were gathered from networks' websites.				

RTD field Socio-economic research in NNE (/environment)

Actions examined; means of gathering information/views

Action	Means of data collection			
	Printed materials	Website info	Q'aire	Interview
ExternE	✓			
NEWEXT	✓			

RTD field Horizontal actions (a). NNE policy studies and Member State data collection across the NNE field as a whole

Actions examined; means of gathering information/views

Action	Means of data collection			
	Printed materials	Website info	Q'aire	Interview
SENER	✓	✓		
PSI	✓	✓		
REDS	✓		✓	

RTD field Horizontal actions (b). Energy technology indicators

Actions examined; means of gathering information/views

Action	Means of data collection			
	Printed materials	Website info	Q'aire	Interview
Energy Technology Indicators	✓			✓

RTD field Horizontal actions (c). Training and mobility of researchers - Marie Curie Fellowships

Actions examined; means of gathering information/views

Action	Means of data collection			
	Printed materials	Website info	Q'aire	Interview
SWERF	✓	✓		✓ (EC)

ANNEX D

SUMMARY ASSESSMENTS OF PROGRESS MADE IN PREPARATION FOR ERA - BY RTD FIELD

RTD field

Summary assessment of progress made in field

1. Fuel Cells and Hydrogen

Much progress has been made in this field in a relatively short time. The Commission has given a lead in the area, and leadership continues to be needed in order to make further progress. Many major players are already involved, though there are significant gaps. The existing networks and the proposal for a Technology Platform have created good awareness of the issues in progressing towards the ERA, and a possible co-ordinating structure. Co-ordination and consultation with Member States needs to be accelerated, and this represents a very significant need considering the policy decisions required at the highest levels, the needs for harmonisation of standards, regulations, etc., and the needs for pan-European infrastructures. There is an urgent need for a high level, very well informed expert advisory group which could help to co-ordinate and involve all actors, including national programmes. Policy and research have to proceed hand in hand.

2. Photovoltaics (PV)

Good progress has been made in this difficult and highly competitive area. The networks outlined above, together with clustering of projects, contractors meetings, and workshops organised by the networks, have served to bring together the principal actors in European PV RTD. Good progress is being made towards a proposed RTD strategy ('roadmap'), and the proposed Technology Platform would go a long way towards helping to further develop and implement RTD strategies. It is excellent, though ambitious, that attempts are being made to map and benchmark national programmes in PV RTD. However, the task of co-ordinating national programmes in this area is enormous and may not be capable of really satisfactory progress in the short term - this is not a criticism of the work currently being done, but rather a comment on the fragmentation and instability of national priorities given to this field. If Europe is to compete internationally in the PV area, much greater efforts will be required to co-ordinate research at national level. The Technology Platform should help this, though building real support for this may itself be very difficult; however, it is important and should be progressed.

There is probably an urgent need for major efforts to disseminate and discuss the findings of current activities as widely as possible, and particularly among those involved in developing and implementing national RTD programmes.

Given the competition in photovoltaics, it may well be that progress towards the ERA will involve proposals in rather restricted areas. However, that in itself would represent a good start, and the Technology Platform would ensure that such initiatives lay within a broader RTD strategy for PV, even if there were not complete buy-in for an overall strategy.

The presently running PV-EC-NET may be well suited to form an ERA-NET within FP6.

3. Distributed Energy Resources (incl. energy storage for RES)

DER is an area which is acknowledged by all actors as being so diverse and so broad in scope that no single actor or Member State could tackle it alone. Thus, the need for a well co-ordinated approach with as much integration of research as possible creates a powerful driver towards organising within the ERA. Very good progress has been made so far, with excellent representation from most Member States, some NAS countries, other countries bordering on the Mediterranean, and organisations spanning

all interest groups. The deep involvement of utilities is essential and well progressed. The field requires a strong emphasis on multi-disciplinary research, and it demands parallel progress on technical RTD and on prenormative research and development of harmonised regulations and standards.

Although there are existing links to national programmes, there is probably a requirement also for more explicit and direct links with national administrations, in order to make significant advances in DER in Europe.

4. Bioenergy

Good progress is being made in bringing knowledgeable actors together in this highly fragmented field, although the field is at a relatively early stage in preparing for ERA. More accurately, it may be said that the bioenergy field faces special barriers in moving towards ERA. The absence of coherent national programmes in many cases; the diversity of the field, and especially the diversity in fuels and approaches from country to country (depending on policies and on available fuels); the presence in the field of many SMEs; and the general lack of awareness (and, among the general public, distrust of developments in some areas) all represent specific difficulties. There is still an absence of major industrial players from direct participation in preparatory actions, though the work has included contact with a significant number of industrial players.

Although national programmes are reached through existing activities, there is a need for much closer engagement on an ongoing basis at national, regional and local levels with those involved in policy and programme development and implementation.

The mapping exercises, along with the identification of strategic RTD opportunities, should perhaps best be seen as valuable first steps towards a coherent RTD strategy. Development of a broad strategy addressing all interrelated aspects of the field, and covering all elements in the chain of production, is a formidable task, and perhaps lies beyond any one preparatory action. Progress towards a Technology Platform - following the lines of the fuel cell and hydrogen initiative - could help to address this, but the preparatory and networking structures may not yet be sufficiently well developed. It may be that this can be addressed via an early NoE, but such a move would probably require considerable further work on the part of the Commission.

5. Wave/ocean

There is certainly a realisation and a desire for collaboration and integration where possible, among the key actors in wave energy in Europe. Europe currently has a leading position in this field, but given that most actors are small organisations, there is a recognised need for collaboration where this is possible.

The diversity of technological approaches in ocean energy at present means that it would be difficult to envisage a completely integrated R&D programme; indeed, such an approach would be risky. However, there is scope for an over-arching programme which could link parallel lines of research wherever possible, develop common standards, and operate (for example, real-world test environments) within a shared set of facilities. Discussions with those involved in the field indicate a readiness for such collaboration.

It may well be that if reasonable progress is to be made in this field, then there will be a need for much closer co-ordination of national programmes, development of further links with power producers, and ultimately development of arrangements with partners outside of Europe. While the present network does aim to increase co-operation with the power industry, it is not actively seeking any deeper involvement with national programmes.

The R&D effort in Europe is now well known by the key actors in the field. The current mapping of technologies and development of a strategy and action plan are fairly well advanced, and could establish a reasonable base for proposals for IPs and/or

NoEs, and for participation within the ERA. However, this may require considerable assistance from the Commission, in order to facilitate the kind of co-ordination and management structures needed.

6. Wind energy

Wind energy in Europe is now a mature industry, and the technology also is mature. Rapid progress is being made in increasing penetration, and wind energy is expected to increase its share rapidly over the coming five years. Whilst R&D continues in wind power - for example, cost reduction, increasing turbine capacity - much of the focus within the broader energy field now is on integration of renewables into distributed generation systems, and on issues such as energy storage.

The European wind energy industry is already well served by the European Wind Energy Association (EWEA), which was established in 1982 and now has a membership of over 15,000. A thematic network on wind energy under the co-ordination of the EWEA has, as its mandate, to evaluate and co-ordinate wind technology development as an input to inform RDD strategy, and more specifically to input to the ERA. Essentially, it aims to ensure that the needs of the wind industry are addressed by European programmes and within the ERA. The Wind Energy TN also undertakes structured reviews of RTD strategy for Europe. The network has a steering group, seven discussion groups, and a secretariat provided by the EWEA. The discussion groups cover all of the important aspects of wind energy, including socio-economic issues, standardisation and certification, and integration of wind energy into energy systems.

The European wind industry is well organised and well structured, with a keen knowledge of developments towards the ERA, and the emerging priorities of FP6. It appears to be well positioned to take advantage of any opportunity for participation in the ERA.

7. Hot Dry Rock/Hot Fractured Rock

The HDR/HFR project in effect operates as an Integrated Project already, albeit within the limitations of current instruments (the increased flexibility envisaged for IPs would undoubtedly present great advantages for a project such as this). The management of the project feels confident that they are presently ready to engage in planning and creation of any basic infrastructure needed in order to operate within the ERA. There appears to be a readiness to develop further phases in the context of FP6 and the ERA, and to assist in forming a Network of Excellence which could encourage other organisations to join the research programme with a view to exploit the technology further. Existing links with countries outside Europe seem to be excellent. There also appears to be considerable awareness of the ERA concept, and of what is required.

In short, this field could really be said to be fully prepared for the ERA, and the only issues are those of planning and timing, and of working out how the existing consortium could evolve through ERA instruments without compromising the positions and investments of existing partners.

8. Oil & Gas

The oil and gas industries and technologies are considered to be mature and are not included as priorities within FP6. However, research actors in the gas industry may participate in RTD associated with hydrogen production and the use of natural gas in fuel cells, CO₂ capture and sequestration, and possibly use of rigs in offshore wind parks.

The industry is well organised in Europe, following an initiative of the Commission some five years ago, via EUROGIF, an industry association representing more than 2,500 companies. EUROGIF provided an input to FP5, and a number of thematic networks were proposed by EUROGIF, addressing different aspects of the industry. Some of these are administered within NNE (DG RTD and DG TREN), and others within the GROWTH and IST programmes. One of them, focused on CO₂, is dealt

with in a later section.

Previous actions over many years means that now there is considerable collaboration between companies and research institutions, and strategic issues and RTD needs are well known. Centres of Excellence are well known, and the new networks aim create appropriate working links between CoEs. EUROGIF oversees a range of information sharing activities, including a website, reports, electronic workshops, conferences and seminars.

The principal issue facing this field is identification of the points of entry into R&D conducted within the ERA. These are likely to be within the fields of hydrogen/fuel cells and CO₂ capture and sequestration.

9. Clean coal and coal/biomass co-utilisation

Coal technology on its own is not a priority RTD area for FP6, and thus is not currently seen as a likely candidate for the ERA. Although this is the case, it must be stated that it is a field where Europe has a strong (present) lead, and in which there is enormous market potential.

Coal/biomass co-utilisation has potential within the ERA, and the POWERCLEAN network is likely to include actions which could lead to proposals for IPs or NoEs. However, the way to proceed is not yet clear, and there remains a lack of clarity in developing a strategic framework for this area. It is likely to be one to two years before this area would consider itself ready to formulate a coherent European RTD strategic framework and management structure that would facilitate progress towards the ERA.

10. CO₂ capture, transport and sequestration

A great deal has been achieved in a short period. Building on a number of successful projects in FP5 (and FP4), and developing both from EUROGIF and encouragement from the Commission, the initial accompanying measure has brought about a considerable awareness of what is required for CO₂ RTD to progress within the ERA. Most, though not all, of the key actors are already involved in the preparatory activities. The current work programme of the thematic network operating in this field includes strategy development and planning of prenormative research; cuts in the budget for this network apparently will lead to a delay in some of this work.

Although Member States are expected to be involved later on, there is little evidence of much involvement at this stage.

A co-ordination and management structure for integrated RTD activity has yet to emerge. However, it is likely that CO₂NET2 will lead to an emergent structure and resources. Those currently involved in this preparatory work are keenly aware of the issues involved in progressing towards the ERA, and there are many ideas for both IPs and NoEs. What is perhaps less clear at this stage is how various proposals on different aspects of the field will be co-ordinated and in some cases integrated. There may well be a need for several parallel actions with an over-arching management and co-ordination structure.

11. Gas turbines

The gas turbine industry is a mature one, but there remain many areas requiring research. The global market for gas turbines is huge, and the European industry faces stiff competition.

A great deal of work has been done to bring key European actors in gas turbine RTD together, and to work towards a well-integrated European programme of RTD with a medium to long term horizon. The work of existing actions includes mapping of national programmes, planning for prenormative work and creation of shared standards, mapping the technologies involved, and developing RTD strategies. 2002 sees a major leap in the direction of European-US co-operation and collaboration, and

this could well be of great importance to the future of the gas turbine industry. These activities are very well supported by virtually all of the major players in European RTD, including the major manufacturing companies. There appears to be widespread agreement in the industry that the Commission has played a pivotal role over a long time period in stimulating collaboration in Europe and between the EU and the US.

It is unclear how fields such as gas turbines will participate within the ERA, given that they are not included within FP6 priorities other than possibly in areas such as CO₂. It seems highly desirable that the Commission should retain a role in steering this RTD field in order to ensure a continuation of the work.

12. Energy in buildings; bldng components

This is a mature area, and one which is highly developed in terms of industry and professional associations, including the Council of European Producers of Materials for Construction, the European Council for Construction Research Development and Innovation, the Fédération de l'Industrie Européenne de la Construction, the European Network of Building Research Institutes, and the Architects' Council of Europe. All of these bodies are involved in a thematic network funded within NNE/FP5, ENERBUILD. This network has as one of its priorities to contribute to the identification of future research priorities. Its principal focus would appear to be on collaboration and exchange between EC-funded projects and researchers, but it also plays a valuable role both in stimulating co-operation and information exchange and in minimising overlaps between national and EC-funded activities.

A further thematic network specifically focused on prenormative areas such as quality and testing started in April 2002, and an accompanying measure on dynamic analysis and modelling was started at the same time.

None of these activities appear to be focused on development towards a mode of working that would fit into the ERA framework. However, given the very broad scope of buildings technologies, there are links between this field and others such as photovoltaics, which are included as FP6 priorities. There are suitable cross-linkages between the buildings area and photovoltaics.

13. Socio-economic research in NNE (environment)

[The comments following refer to major socio-economic projects undertaken in the field of NNE and environment; not included are actions undertaken to survey energy policies and programmes in Member States, which are addressed separately (below).]

The principal researchers in the field of energy economics in Europe are well known to one another, and are well used to collaborating on major socio-economic modelling and analysis projects. Such projects include POLES (within DG TREN), PRIMES, GEM-E3, SAFIRE, ExternE, and the current extension to ExternE, NEWEXT. The outputs from these projects have been vital to policy formation in the energy/environment field at European and national levels, and the models continue to be used by researchers on an ongoing basis. Thus, researchers in this field know one another extremely well, and collaborate on an ongoing basis.

The European Network for Energy Economics Research (ENER) has its origins in a co-operation agreement between three research bodies in this field in 1985, since when the network has been supported by DG RTD. The ENER thematic network currently in operation comprises 23 members, many of which are from CEE countries; its aims are to strengthen links between national centres in energy/environmental policy and economics research, especially in accession countries. It also aims to use the network as a springboard for collaborative research at a European level in such a way that the resulting activities exceed present joint activities. Thus, the ambition of the ENER network is to perform large scale and long term projects on a European scale. Thus far, the possible scope of the tasks of such an activity have not been defined, but there is the possibility that the network could evolve into a Network of Excellence, or alternatively that it could form a work package within a very large IP.

This field is not ready for such a development towards ERA, in the sense that the nature of the work within the ERA is not clear, and this may take some time to formulate. However, the necessary linkages, collaboration and trust exist to make it feasible to move towards such a development.

The Commission has been highly proactive and supportive over a long period of research in this area, and there may well be a need at this point to forge new links between the Commission and this field, since the outputs from the socio-economic field represent necessary inputs to energy-environment policy at national and European level.

14. Horizontal actions: (a). NNE policy studies (other than socio-economic) and Member State data collection across the whole NNE field

A number of horizontal actions have been taken over the past five years which have focused on gathering policy and other information on Member States concerning their NNE RTD activities:

- SENSER, an examination of synergies between European and Member States' energy RTD, was completed in 1998, after a 2-year study. Among other findings concerning trends in RTD within national programmes, it concluded that there was reasonable complementarity between national and European RTD priorities. It also found that there are wide discrepancies between the approaches used by Member States to develop NNE programmes and priorities in RTD. The SENSER report was widely circulated, and it formed a useful framework for opening discussions on alignment between Member States' RTD programmes and those at the European level. Although the findings are now five years old, some of the findings are no doubt still valid.
- A follow-on study to SENSER, the Priority Setting Initiative (PSI) was completed in 2000. This study analysed Member States' priorities and expenditures on different fields of NNE research; not surprisingly, PSI's findings supported earlier findings from SENSER. PSI also established a prototype database to compile and analyse Member State information; however, since there were no resources following the end of PSI to manage or develop the database, this project did not lead to an ongoing information collection process.
- An ambitious action aiming to collect data on public and private expenditure on research expenditure in the RES field is expected to start in September 2002. This action (REDS) also aims to develop indicators with which to evaluate the efficiency of RTD expenditure in RES. If this action meets its objectives, it could provide valuable information for policy making and form a discussion point for potential co-ordination of programmes at national and EU levels.
- Some attempts have been made to gather information via the Programme Committee, though these efforts are always hampered by lack of complete information, and lack of resources. A new study aiming to develop a common database, and to assess users' needs (including at political level) may be launched in the second half of 2002. This could provide extremely valuable information needed in considering closer co-ordination of national and European programmes.

Despite the above actions, the actual level of knowledge of RTD priorities and expenditures in NNE across Europe remains dismal. There is no systematic or regular information gathering or assessment, and there appear to be no resources within the Commission to perform this work. Furthermore, there appears to be no real knowledge of how each Member State develops its long term priorities, or what tools and approaches are used to do so (PSI identified diverse approaches in use by individual administrations. This is a very complex field, and it requires detailed preparatory work to identify reliable sources and channels of information, definitions of RTD fields, assessment of methodologies followed, development of frameworks for containing and assessing information gathered, follow-up mechanisms and resources, and finally effective dissemination and discussion mechanisms in order to make use of the information both within the Commission itself and across Europe. There is a very long way to go.

15. Horizontal actions: (b). Development of energy technology indicators

An exercise to gather information as indicators of the state of the art in energy technology development, along with a set of suggested RTD targets with time-frames, is currently in progress¹¹. This is ultimately intended to cover all fields of NNE technology. At the time of this study, comprehensive data have been compiled for PV, small hydropower, solar thermal energy for electricity, wind energy, CHP micro-turbines, geothermal energy, and solar heating and cooling.

This exercise represents a potentially extremely valuable database of needed information. Although the data presented so far are intended only as a first attempt, nonetheless they form a basis for discussion and further adjustment where needed. Assuming some level of consensus on the figures presented, they form a valuable tool both for researchers in the fields covered and an essential set of data for planning of RTD priorities.

It seems surprising that the Commission has not previously engaged in this kind of systematic and critical data gathering exercise. It is the kind of activity which could easily be envisaged as a requirement in the strategic administration of major RTD programmes and activities within the ERA - indeed, it is difficult to see how the Commission can operate at a satisfactory planning level without such data. Even supposing Networks of Excellence gather such data themselves in the future, there would be a need for the Commission to have its own access to a compiled and verified data-set in order to maintain an informed and independent strategic view of energy RTD priorities and needs. In short, this work seems to represent a useful and needed input to future management of research within the ERA, and given a consequential altered role for the Commission within the ERA.

16. Horizontal actions: (c). Training and Mobility of researchers: Marie Curie Research Fellowships

Training and in particular mobility of researchers is identified by many in the Commission and in the external activities examined as a vital element in the successful operation of ERA. Mobility is presented as a major barrier to progress (see section 4).

The main instrument for exchange and training of younger research staff - and this represents the *only* current mechanism for assisted staff exchange - is the Marie Curie Fellowship scheme. There are currently some 58 fellowships within the NNE field. Since 1997 some nine regular workshops have been organised for research fellows - six in a previous contract, and since the beginning of 2001 three further workshops have been held. A further three are planned to take place within the current contract (SWERF: Workshop Series for Energie Research Fellowship Holders). The workshops appear to be organised to a high standard, and attract a reasonable attendance from research fellows. They represent an extremely valuable link between fellows and the NNE programme, and a means of networking among fellows themselves.

It could not be said that these activities represent in themselves a preparation for the ERA, other than that they highlight the need for a continuation and expansion of such actions within FP6 and the ERA. Indeed, training of researchers and real mobility of research staff are central to the concept of the ERA. It remains unclear how this activity will continue within FP6: the involvement of NNE in the administration of the Marie Curie fellowships is likely to be less than currently, and training of researchers is intended to form an essential element within IPs and NoEs, although many actors express grave reservations about this aspect of the ERA.

The current workshops, along with the maintenance of a database of past and present fellows in NNE, are essential elements in the programme. However, there is no indication so far as to how this will continue after the present activity is completed. There is a need for cross-programme discussion of this aspect of ERA.

¹¹ See <http://www.cordis.lu/eesd/src/indicators.htm>