



**SEI Response to:**

**DCMNR Consultation on Energy RD&D in Ireland**

May, 2005

## EXECUTIVE SUMMARY

1. **SEI supports the concept of a DCMNR led Coordinating Council** as a pragmatic option and a sensible way to proceed in formulating a coherent national approach to energy RD&D.
2. **Such a Council should align its priorities to be consistent with national enterprise policy, and to work towards a national energy RD&D strategy in support of energy policy objectives.** Designing such a strategy will require considerable further deliberation and should be informed by public consultation as well as robust analysis.
3. **A clear, transparent and stable RD&D support environment is required for the development of the sustainable energy sector in Ireland.**
4. **RD&D as a policy tool must complement, and be complemented by, other policy instruments.** It will not succeed in isolation.
5. **It is recommended that, wherever feasible, recourse be had to existing structures and organizational competences.**
6. Sustainable energy RD&D has three principal goals: (i) **accelerating** new market solutions through the deployment of those technologies that are most advanced along the innovation path; (ii) nurturing and **progressing** a suite, or limited selection, of SE technologies along the development pipeline; and (iii) in the process, foster the development of R&D capacity amounting to an enduring innovation **capability** within the Irish SE RD&D community.
7. The RTD Framework and Energy Framework Programmes of the EU have energy RD&D as a significant component. **More can be done to align EU and Irish national energy RD&D strategies and to enable Irish researchers to obtain maximum benefit from Calls under the programmes,** both for funding and for collaboration.
8. In moving beyond the consultation phase into policy formation in the area, **it will be critical to be explicit and define the areas of RD&D to be targeted and most essentially how they are defined.** This will require addressing the continuum of RD&D from fundamental and applied academic research, to commercial research, through pilot demonstration and full commercial applications (these distinctions are often blurred). This will call for a systematic analytical benchmarking and consultative exercise to: (i) map/audit/characterise technical and economic status/ maturity, capability, positioning, potential and other attributes of the different streams of SE technologies and practices, (ii) grade and prioritise proposed RD&D interventions, differentiated by instrument type, and (iii) propose pathways, resources and timescales for same.
9. The Framework for the All-island Energy Market states that it should, "...provide for competitive, sustainable and reliable markets in electricity and natural gas on the island of Ireland at the minimum cost necessary." **This all-island policy and market context should be an integral part of the design of a national energy RD&D strategy.** This relates to the effective use of both R&D resources and the opportunities that the larger market provides.
10. **Consideration should be given to leveraging private sector participation** or sponsorship of RD&D endeavour, by complementary economic instruments. This is a policy issue that extends well beyond the sustainable energy arena.

11. With regard to the manifest need to support and inform the SE aspects of current national policy commitments – notably the national spatial strategy and investments in transport infrastructure – **there is a need for a new field of research in Ireland on the energy dimension to transport policy** in the context of shaping public policy and investment guidelines and as a component of wider co-ordinated actions in the direction of building more sustainable energy communities.
12. **Capacity building in the sustainable energy sector is critical to all stakeholders.** The signalling of stable long-term funding for RD&D in the energy sector for both academia and industry is a pre-condition for commitment to, and investment in, capacity building.
13. **International links will be crucial, to inform, catalyse and calibrate progress, including support for mobility of researchers, given Ireland’s limited resource pool.** The exercise proposed should take cognisance of IEA and EU recommendations regarding international RD&D collaboration opportunities, identify such opportunities for strategic alignment, and selectively pursue such opportunities.
14. **RD&D is required not just in science and engineering related topics, but also in economics and even business related topics such as finance and business strategy.**
15. **SEI as independent statutory Authority has been entrusted with the delivery of a number of RD&D programmes.** The lessons learned and experience garnered from these, along with the institutional and administrative structures associated with them, has allowed for significant “learning-by-doing” since its inception. The portfolios of projects supported currently by SEI takes account of the need to balance shorter and longer term perspectives, ranging from near-market RD&D addressing urgent issues of market failure, to developing and applying technologies and building capabilities with the prospect of medium and longer term strategic benefit to Ireland.

## PREAMBLE

*This response, and the DCMNR consultation paper to which it refers, are animated by a specific national challenge. How much public funding should be allocated to sustainable energy<sup>1</sup> (SE) research, development and demonstration (RD&D<sup>2</sup>), on what mix of activities should it be focused, and how that allocation can be justified? Subsidiary challenges include how to manage such funds, and how to evaluate progress and performance. This is a challenge faced by all governments in allocating scarce resources. The historical precedents of increased RD&D support for SE after fossil-fuel price rises is again topical in light of the currently high gas and oil spot and futures prices internationally. This paper is SEI's response and it explores the process of making appropriate decisions for the support of RD&D within the wider framework of energy policy.*

By virtue of its status and mission SEI is committed to supporting DCMNR in the development of a sustainable energy R&D programme within the associated and wider energy policy priorities for Ireland. SEI being an independent statutory Authority has already been entrusted with the delivery of several sectoral RD&D programmes funded through the NDP 2000-2006. The lessons learned and experience garnered from these, along with the institutional and administrative structures associated with them, have allowed for significant “learning-by-doing” since their inception. The comments throughout this submission are informed by this and previous SEI experience with EU R&D programmes.

The DCMNR consultation paper is important in that it recognises the need for the DCMNR to take the lead role on the subject of RD&D in support of energy policy goals<sup>3</sup>. This is a timely intervention. The broad approach and general content of the consultation document appear to be robust. However, to arrive at useful outcomes, a very specific dialogue around the meaning and added value of “RD&D” and “research” will be needed. For example, fundamental research in chemistry or particle physics is far removed, both in how it is structured and resourced, from say development of a tidal device in the Shannon estuary. Such activities may each have valid reasons for support under the heading of “RD&D”, yet **the timeframes, amounts of funding required, types of support appropriate, and processes for obtaining support will need to be very different**. It is important to recognise that there are topic areas where such distinctions become blurred or foreshortened, making definitive policy making difficult. There are also considerable areas of feedback, interaction and reinforcement between different parts of the RD&D spectrum. Opportunities for synergy are critical to foster.

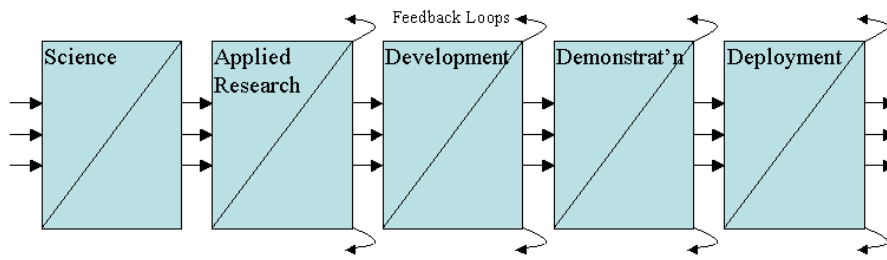
Figure 1 below is a schematic of an “innovation pipeline” as a general product progression through RD&D (Baldwin, 2002). It is useful in portraying the feedback loops that exist within and between elements of product development.

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1 In the interests of brevity, the term sustainable energy is not defined in detail. For the purposes of this document it includes reference to renewable energy, energy efficiency, and technologies like carbon capture and sequestration and fuel cells.

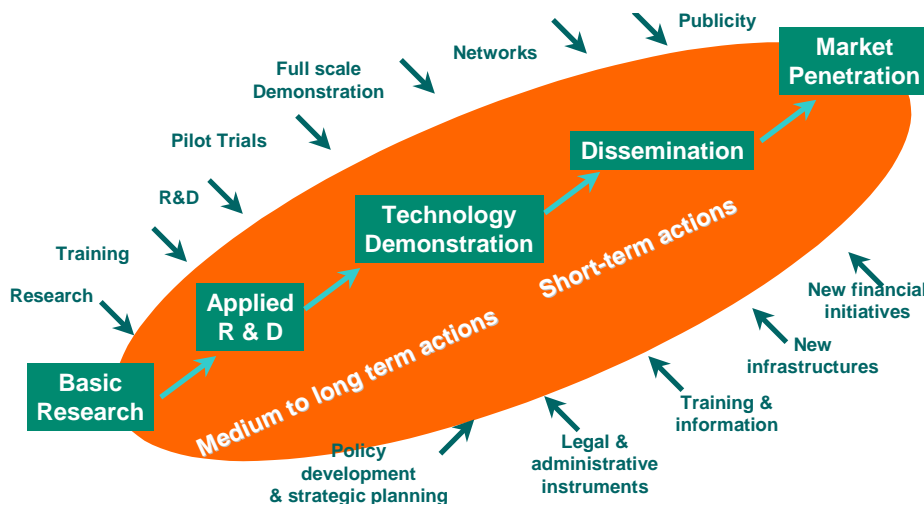
2 RD&D will be used rather than RD&D in this submission, to include the notion of demonstration.

3 This is comparable to the configuration of certain RD&D activities sponsored at the EU level being proximate to the point of policy advice and formation (e.g. DG TREN and DG Environment). However, it is noteworthy that other elements of the EU RD&D agenda fall solely within the remit of a central research directorate, DG Research. This does not mean that this is the appropriate model for Ireland, but the rationale behind this configuration is worthy of exploration.



**Figure 1:** Innovation pipeline (adapted from Baldwin, 2002)

Figure 2 shows an alternative construct, depicting an “innovation ladder” supported by accompanying measures.



**Figure 2:** Innovation ladder as a representation of the RD&D process

From an economic perspective, the principal rationale for supporting sustainable energy (SE) is to address various market failures (primarily of an environmental and security of supply nature). Many SE generation technologies are considered technically and financially immature in comparison, for example, with conventional thermal power plants. To achieve successful deployment they may require additional support at all stages of the product development chain. There are a number of policy instruments that could compensate for market failure, and help bring sustainable energy forward as a competitive energy supply option. In this submission, the focus is on research and development as a policy instrument to promote SE implementation. **It is worth highlighting that RD&D as a policy tool must complement and be complemented by other policy instruments. It will not succeed in isolation.**

This submission begins with a contextual discussion of SE RD&D, its implementation in Ireland to date (Section 3), and then addresses the issues raised in the DCMNR consultation paper individually (Section 4), before making some concluding remarks.

## 1. INTRODUCTION

The DCMNR consultation paper on RD&D is an important starting point to the process of defining a coherent approach to research in the energy sector in Ireland. By allowing for submissions from a wide stakeholder group, the future direction of RD&D coordination in Ireland should be well informed. SEI is pleased to submit comments related to the document as well to support the undertaking through the provision of an annual RD&D inventory<sup>4</sup>.

Sustainable energy (SE) addresses all three pillars of energy policy (security of supply, environmental protection and price competitiveness), as they are inherently interrelated. It is against this framework that this submission has been prepared. SEI's current role in RD&D is an important element of the total energy RD&D effort in Ireland. It represents Ireland on several EU and IEA committees and SEI directly disburses significant public funding for energy RD&D in Ireland. Given SEI's statutory mandate, it should maintain this position given the need to meet national commitments to abating risks of climate change and improving security of supply.

In moving beyond the consultation phase into policy formation in the area, it will be critical to define explicitly what areas of Research Development and Demonstration are to be targeted and how they are defined. As outlined in the Preamble, this will require addressing the continuum of RD&D from fundamental and applied academic research, to commercial research, through pilot demonstration and full commercial applications (again, these distinctions are easily blurred), and accompanying initiatives to inform or reinforce market development. Given the limitations of resources, the design of RD&D programmes at a national level might include the necessity of "picking winners" to a certain degree. However, by creating an appropriate structure and providing for market inputs and responses there will be an opportunity for a national RD&D strategy to be less prescriptive and more receptive. It will also allow for leveraging funds and better alignment with industry as well as other government departments, their agencies, and research councils.

This submission does not address SEI positioning or activities post-2006. It does include some discussion of the significant experience to date of SEI's principal RD&D programmes that formed part of the NDP 2000-2006 priorities. The majority of this information has been annexed, in the interests of brevity in the main text.

## 2. CONTEXT

RD&D needs in Ireland are broader than and include the energy sector. Energy research must therefore be informed by and support this wider research framework and its activities. Thus, the perspectives of other government departments, agencies, universities, industry and the like will need to be taken into consideration. The process of making detailed proposals for structuring energy research funding to DCMNR will therefore require considerable further thought and detail. This submission should be considered as an early contribution to a process aimed at formulating a coherent national energy RD&D strategy pertinent to Ireland's recognised and emerging needs. RD&D needs with respect to both energy supply and demand should be defined as an early part of this process.

In 2003 the IEA completed its Energy Policies of Ireland Review. Chapter 10 of that report was devoted to energy RD&D. It reviewed the energy RD&D policies in Ireland from the Sustainable Energy Green Paper (1999) and through the NDP (2000-2006). It notes that the stated intention of the Programme for Government was, with regard to R&D, to:

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<sup>4</sup> A new inventory is being compiled concurrently with the DCMNR consultation process.

- Ensure that Ireland develops a world class research capacity
- Recognise the importance of encouraging a dynamic research culture, and
- Build the capability of firms to carry out and manage RD&D in Ireland

To date these goals have been met to a limited extent in the energy sector. SEI is dedicated to helping to provide support for the realisation of these goals and this submission is written in that context.

**Priorities for research and development need to be made explicit and be supported by stable long-term financial commitments.** Such a position would convey an appropriate signal to RD&D stakeholders. Energy research priorities should be linked to: i) government energy policy objectives (or strategies), ii) available resources (human and natural), iii) likely industrial and regional development impacts, opportunities for innovation, etc. It is anticipated that with additional budgets (and clear priorities) DCMNR can formulate a co-ordinated and innovative programme in research on energy and its impacts. The outcomes of a well conceived and administered programme will inform energy policy, help Ireland to meet its targets on sustainable energy and emissions reduction, allow for a better interface between academia, government, business and industry (informed by UK NERC, 2004), as well as for increased international collaboration (all-island, etc.) and impact<sup>5</sup>.

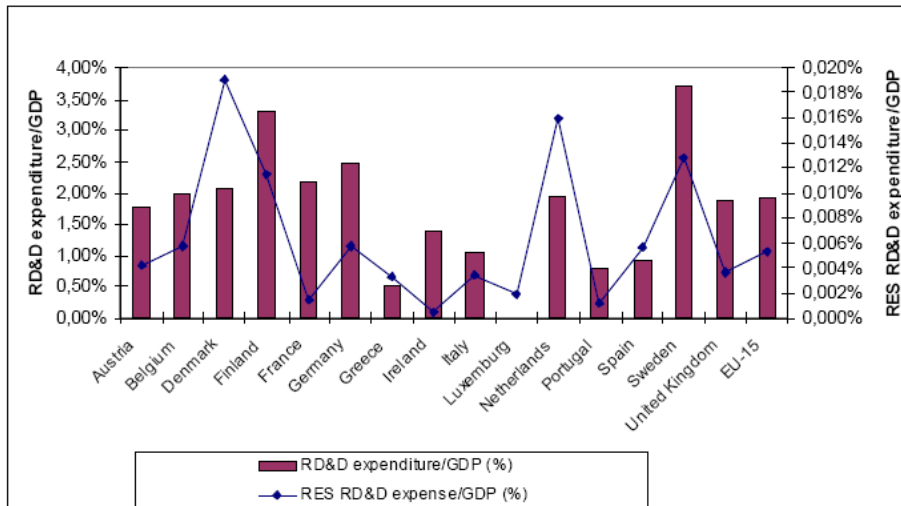
The development of a European Research Area was agreed by EU Heads of State in Lisbon in 2000 as a pillar of the strategy to develop Europe as the ‘...most competitive knowledge-based economy in the world by 2010’. In 2002 in Barcelona, the Heads of State set a target for gross expenditure on RD&D in Europe to equal 3% of GDP by 2010, a significant increase from the current level of 1.9%. It was also agreed that two thirds of the additional investment should come from the business sector. In April 2003, the European Commission published a 3% Action Plan, entitled ‘More Research for Europe’ which sets out the policy requirements for Europe to achieve the 3% target (ERA Report, 2004).

Illustrative of the strength of this resolve<sup>6</sup>, a recent EU commissioned report undertaken by the Fraunhofer Institute (2004) shows the level of general and renewable energy RD&D funding in the EU 15 (using year 2000 data, Fig.3) compared to GDP. The 3% target is a distant one for most of the countries (including Ireland).

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<sup>5</sup> Indeed, these goals have informed the SEI programmes to date.

<sup>6</sup> And to complement the IEA graph utilised in the DCMNR Consultation Paper Annex.



**Figure 3:** General and Renewable Energy RD&D expenditure in EU-15 2000 (EU, 2004).

### *Energy RD&D Trends*

Funding cycles in the last 30 years for energy RD&D have been similar in many OECD countries. They have responded closely to geopolitical energy trends (oil prices and supply shortages primarily), and appear as short-term spikes that follow prices in the commodity markets fairly closely<sup>7</sup>. In considering RD&D support for energy technologies there is always a choice of high risk (revolutionary) to lower risk (evolutionary) projects. By appropriately balancing and hedging these risks in a portfolio mix, a programme can increase its likelihood for success based on the risk profile of the investor (the public, the government, an agency, a private company, etc.).

Government leadership is required to set policy and to establish consensus about RD&D direction. Industry/government partnerships in RD&D are useful in order to add market relevance to the work and tap specialist expertise. However government must not lose sight of its special role in supporting long-term objectives. Internationally, governments often support high-risk, pre-competitive research in RD&D collaborations. Industry is often not in a position to do this.

Implementation of SE RD&D can include various projects, services, and programmes. Depending on their nature each will need to be undertaken at a pace appropriate to the exogenous and endogenous influences, various actors (academic through to investors), and with appropriate tools (direct RD&D, venture capital, incubator programmes, technology acceleration targeting, etc.). Sorensen (2003) emphasises the specific cultural considerations (in addition to technical and regulatory) when forming RE RD&D policy (price and income elasticities, comfort requirements, demand responsiveness, oil and gas revenues, mobility considerations, etc.). He also points out the difficulty in merging technology and policy thinking, citing specifically, "...the tendency to leave technology out of policy, the tendency to limit policy innovation, the tendency to limit policy experts, and inefficient policy instruments." The traditional dichotomy between those engaged in technology research and development and those in politics and policy is clearly apparent.

In terms of instrument type, it will be important to differentiate between at least two types of endeavour: (a) the application of research expertise to the classical innovation pipeline process in respect of SE technologies, from basic science through to market application and full commercialisation, and (b) research intelligence directed at informing policy and market action, in particular underpinning or flanking actions to address structural gaps in information and capability.

<sup>7</sup> Note the spike in RD&D funding after the oil price rises in the late 70's and early 80's in the IEA graph included in the DCMNR Consultation Paper Annex.

## *Evaluating Energy RD&D Performance*

Although there does not seem to be any widely accepted definition of energy RD&D, the following seems useful for present purposes. The Global Climate Change Group at the Pacific Northwest National Laboratory, (Dooley, 2000) define energy research and development as, “the linked process by which an energy supply, energy end use, or carbon management technology moves from its conception in theory (including necessary enabling basic research) to its feasibility testing and small scale deployment.” This group undertook a comprehensive cross-cutting analysis of energy RD&D in large industrial countries in the late 1990’s and early 2000’s. The principal results (Dooley, 1998) include:

- Unlike overall national RD&D, national energy RD&D efforts have not experienced significant growth over the past decade
- The performance of energy RD&D is highly concentrated. The top nine nations account for 95% of the industrialized world’s publicly supported energy RD&D.

Both the focus of RD&D programmes and the methods of measuring and evaluation are critical in assessing their costs and benefits. Renault (2004) defines evaluation as, “...the collection, analysis, interpretation, and communication about the effectiveness of programs undertaken for the public good.” She also notes that that evaluation process needs to have questions formed that are derived from the programme itself (and not some exogenous source).

The UK DTI undertook an independent review of its RD&D Programmes for RE (New and Renewable Energy Programme (N+RE) 1994-1998). Three conclusions are salient here (SPRU, 2002):

- That in future the objectives of any supporting programme of RD&D and technology transfer should be more clearly delineated from the objectives of other parts of the Government's overall N&RE programme such as the NFFO and administrative action;
- That the programme has added value to the NFFO in terms of success of deployment though whether at lower cost has been difficult to discover;
- The risks of not developing renewables in plausible climate change policy scenarios are quite uncertain and potentially quite large.

Dooley (2000) outlines the various international and national sources of data on energy RD&D and their associated strengths and weaknesses. He identifies that there are ancillary benefits in other sectors that are not normally captured in evaluation of RD&D spending, “...the exclusion of ancillary RD&D efforts is driven by practicality and a desire to keep some temporal integrity to the data set being examined.”

Two relevant and fundamental reasons for failure of RD&D programmes in the USA were outlined in a report by Resources for the Future (RFF, 2001)<sup>8</sup>.

- Incompetent programming, in the form of narrowly focused research initiatives, and
- Political rather than economic motives influencing the funding process.

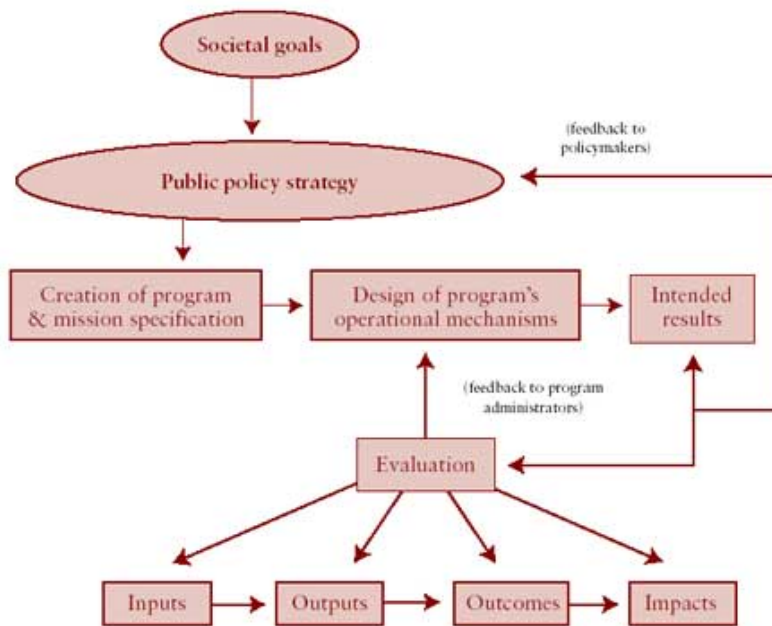
These will be important pitfalls to avoid. Critical reviews of other national strategic plans for energy RD&D will be required in formulating Ireland’s policies. These processes are underway in Canada, Germany, Norway, and Sweden to name just a few. Some key messages from a seminar on defining priorities for RD&D in the RE sector (held at the International Energy Agency (IEA), in March, 2005) include:

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<sup>8</sup> according to Gerry Taylor director of natural resource studies at the Cato Institute

- Technology learning takes place both through RD&D and market deployment.
- RD&D coupled with technology deployment is needed to achieve the desired goals.
- Technologies have different development profiles but may feature similar potentials (for example hydro/wind/PV).
- RD&D and policy strategies that differentiate among technologies are necessary to address diverse problems of non-uniform technical challenges.
- Technology collaboration has provided proof that it contributes substantially to accelerate progress.

The U.S. National Institute of Standards (NIST, 2003) produced a concise set of steps in the evaluation of programmes. The generic evaluation model is presented schematically in Figure 4.



**Figure 4:** Generic evaluation logic model (NIST, 2003).

The IEA seminar also noted that each country prioritises funding in a different manner according to particular resource endowment, technology expertise and industrial strengths. **This prioritisation will need to be undertaken for Ireland and it will inevitably be informed by a combination of political, social, economic, and technical considerations and perspectives.**

### *Public Funding of RD&D in Ireland*

In response to the European Commission's 3% Action Plan, each Member State is required to develop its own national action plan to set out the contribution it will make to the target for Europe. In January 2003, the Tánaiste and Minister for Enterprise, Trade and Employment, Mary Harney T.D., established an Interdepartmental Steering Group (ERA Report, 2004). More recently the establishment of the Office of the Chief Science Advisor is a significant step in advancing national RD&D efforts. Likewise the programmes of Forfas and the OST are critical in this discussion.

In recent years, the Irish Government has substantially increased its investment in technology, innovation and scientific research, proposing a five-fold increase in investment for RTDI in the National Development Plan 2000-2006 amounting to €2.48 billion. This compares with €0.5 billion over the period 1994-1999. This commitment, backed by enhanced financial markets and

institutional structures, is aimed at building the skills needed for a modern knowledge-based economy and strengthening Ireland's research base. This investment is already having an impact on Ireland's ability to attract leading researchers and more sophisticated industrial projects (ERA Report, 2004). This is especially the case in the areas SFI has focused on, namely, biotechnology and ICT.

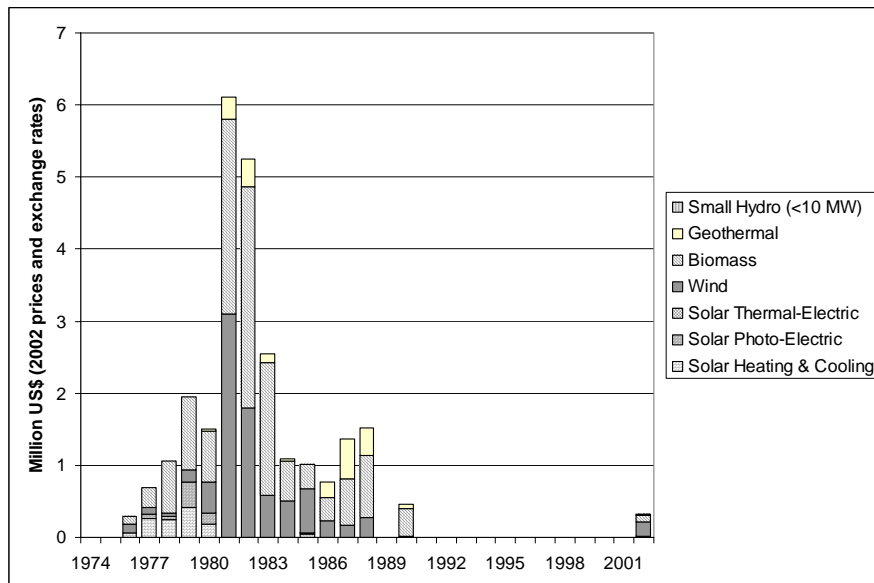
Key Recommendations of the Report to the Inter Departmental Committee on Science, Technology and Innovation, Ireland, 2004, include:

- Overall vision: Ireland by 2010 to be internationally renowned for the excellence of its research and be at the forefront in generating and using new knowledge for economic and social progress, within an innovation driven culture.
- Business and public sector (including higher education) RD&D expenditure to increase from 0.9% and 0.4% of GNP respectively in 2001 to 1.7% and 0.8% in 2010.
- Increase number of researchers from 5.1 per thousand in 2001 to 9.3 in 2010, and make Ireland a highly attractive environment for high quality researchers and research careers.
- Strongly support the development of strategic research competencies (technology platforms) based on enterprise needs.
- Develop a national plan to increase the performance, productivity and efficiency of research in the higher education and the public sectors.
- Re-orient enterprise support budget to RD&D and develop a new and less bureaucratic approach to RD&D support that encourages a systematic and continuous approach to RD&D within enterprise.

These will be very useful guidelines in forming an SE RD&D strategy.

Ireland spent a total of US\$ 94.5 million (in 2002 prices and exchange rates) on government energy RD&D between 1974 and 2002. About 31.6% of the total energy RD&D budget in this period was allocated to renewable energy RD&D. As shown in Figure 5, the overall trend of government RD&D expenditures for renewables peaked in the early 1980s and declined notably after 1983. There was no significant funding between 1990 and 2001 (IEA, 2004).

Among the various renewable technologies, biomass received the highest level of funding at US\$ 13.6 million, or 45.6%, in the 1974 to 2002 period. Wind was funded at US\$ 8.4 million, representing 28% of renewable energy RD&D (IEA, 2004). **Figure 5 illustrates the stop-start nature of RD&D funding over the last 25 years.** (In the figure it is easy to see what appears to be a response to fund the RE area due to spikes in oil prices.) A vision for the future with an associated national strategy would help to enable such stability and continuity of implementation. The DCMNR consultation paper should encourage Government in that direction.



**Figure 5:** RE RD&D expenditure in Ireland 1974-2001.

### *SEI's role*

It is well understood (in the literature) that the private return of conducting RD&D generally falls short of societal returns (and thus benefits). This provides both a need for support from a public good perspective and a challenge in correctly focussing that support. Blanes (2004) reinforces this sentiment, "...the public agency must be able to identify those RD&D projects where the gap between private and social returns is high, and would not be carried out without some type of subsidy." The interaction between public and private investment into different categories of SE RD&D can be viewed based on the differential leveraging of funding in SEI's programmes. Funding varies between 10% and 50% for demonstration, up to 50% for RD&D, up to 75% for certain categories of feasibility studies, and up to 100% for certain public good research projects. The matching funding comes from a variety of other sources including the private sector.

SEI's role in national SE RD&D stems from the NDP sustainable energy priorities as presented in the ESIOP complements. These goals were translated into a series of RD&D programmes. The aim of this activity as a whole is to stimulate and accelerate the generation, delivery and implementation of demand side and supply side solutions contributing to a sustainable energy economy in Ireland. These solutions, leading to improved products, systems, practices and policies, are to be created through funding portfolios of sectoral research, development, and demonstration and associated projects supported through a set of focussed sectoral programmes.

To ensure effective RD&D programmes with which market recipients and service providers can engage, the activity was organised into four action lines corresponding to the needs of the main supply and demand sectors:

- Housing (responsible for 26% of national primary energy use), through the "House of Tomorrow" programme
- Renewable Energy for Power & Heat Supply
- Industrial & Commercial (responsible for 40% of national primary energy use), where the available support will be channelled into RD&D that complements other Irish national initiatives while pursuing sustainable energy objectives, and
- Transport<sup>9</sup> (responsible for 31% of national primary energy use).

<sup>9</sup> Transport budgets have been essentially removed from SEI's programmes since the inception of the NDP.

The portfolios of projects supported across the four action lines take account of the need to balance shorter and longer term perspectives, ranging from near-market RD&D addressing urgent issues of market failure, to developing and applying technologies and building capabilities with the prospect of medium and longer term strategic benefit to Ireland. Priorities were finally determined by the human and financial resources allocated to SEI.

The scheduling of these portfolios was also to take specific account of:

- Assessments of market and policy needs to identify key knowledge gaps addressable with the help of RD&D - including gaps identified by the SEI's market facing teams.
- The need to access and successfully undertake the transfer of appropriate technology developed within the EU and the wider international arena.
- The need to inform and contribute to implementation of the National Climate Change Strategy (i.e. the relatively short term Kyoto imperatives), through to
- The need to align RD&D activities with longer term strategic development opportunities informed by exercises such as Technology Foresight.

The level of funding support to RD&D projects within each action line is related to project costs, and varies according to the timeframe, nature and specificity of the accompanying benefits and risks, grouped by delivery mechanism as set out in the Green Paper for Sustainable Energy: shared cost RD&D, public good research and international collaboration (which can be of either a shared cost or public good nature). (These are elaborated further in the "Funding" part of Section 5 below.)

The rationale was given as, "*to move to the path of a Kyoto compliant and more sustainable market based energy economy in Ireland, it is necessary to achieve early efficiency improvements in the main end use sectors – housing, tertiary buildings, industry and transport – and a more competitive contribution from renewable supply sources.*"

Historically, the under-provision of RD&D in Ireland has contributed to a failure to effectively exploit the full range of sustainable energy demand and supply side opportunities. SEI RD&D support activities aim to address this market failure by assisting in the exposition and development of a least-cost path to achieving CO<sub>2</sub> emissions reduction in a more sustainable energy economy. Specifically they are designed to deliver solutions to Irish needs that will:

- accelerate the development and deployment of improved energy related products, systems, practices and services in the Irish market, and
- provide a technical and analytical basis for informing, shaping and implementing policies for sustainable energy – including policies relating to security of supply, enterprise and services competitiveness, spatial strategies and environmental protection.

The process of supporting projects which deliver these solutions will also help to stimulate and establish a capacity among providers of energy RD&D and energy services, necessary towards continuing innovation and competitiveness as part of the wider sustainable development agenda.

### 3. DCMNR SPECIFIC CONSULTATION ITEMS

#### *Institutional and Governance Options*

**SEI supports the concept of a DCMNR led Coordinating Council as a pragmatic and sensible way to proceed. It should align its priorities to be consistent with national enterprise policy with view to a designing a national energy RD&D strategy to support energy policy objectives. It is recommended to utilise, where feasible, existing structures and organizational competences. This council should provide DCMNR with an overarching policy direction role, not a detailed funds management one.**

As noted in the consultation document, several government departments and associated agencies undertake or support research activities in Ireland in the energy sector. Ideally these activities could benefit from coordination through a central body. However this is not a simple task and it will need to be more fully and explicitly outlined to reap the potential benefits. This becomes rather more complex in the all-island context, where two countries are involved with differing policies, industries, and educational systems.

Some of this wider government and agency funding/support is disbursed as academic scholarships or research funding, some is commissioning specific research (normally by consultants or industry), some supports demonstration, some is undertaken as education of students, industry, etc. The focus of the funding may stem from government priorities that can vary somewhat between departments.

A competitive approach to disbursing funds might well be ideal from a governance and transparency perspective. However, as previously discussed the nature of the competitions will need to be categorised into discrete areas of research. (i.e. tendering for a commissioned piece of “research” is very different from undertaking a full peer review of detailed proposals from academic researchers.)

The RD&D community is considerably wider than academic institutions. It is also wider within those institutions than engineering faculties. (There will need to be provision for economics and basic science as well as engineering for example). Again, there will need to be explicit consideration for the different types of “research” that are wide and varied as previously mentioned.

Additional to the priorities of topic content and funding mechanisms, key issues needing consideration in establishing future institutional options for SE RD&D are the best ways of:

- Positioning SE RD&D within the national RD&D framework;
- Identifying and aligning SE RD&D priorities and budget requirements within energy policy objectives and the international SE RD&D framework;
- Managing existing and any new programmes;
- Building capacity.

Regarding the three institutional options in the Consultation Document, viz.:

- Co-ordination function within the Department;
- Co-ordination Council;
- Energy RD&D Agency;

Each has advantages and disadvantages with respect to the key issues above.

SEI supports the concept of a DCMNR led Coordinating Council as the appropriate way to proceed because:

- It can meet all of the primary needs at lowest cost and shortest timescale;
- It provides a mechanism for formulating proposals, recommending priorities and advising DCMNR and Government at the strategic and national levels within the energy policy objectives set by DCMNR;
- It can utilize the established organizations and procedures as a basis for managing programmes without the additional investment required to establish new organizations;
- It most easily facilitates involvement by all stakeholders which is essential to forming a consensus on priorities and achieving buy-in by those players required to participate;
- It facilitates the early involvement by Northern Ireland stakeholders to move towards an all-island policy;
- It is the structure most likely to be supported by the stakeholders and is therefore likely to be the quickest to establish;
- It retains the Departmental responsibility for dispersing budgets to appropriate agencies and managing those agencies;
- It would facilitate the Department in accessing the resources and skills available in the existing agencies and stakeholders that are necessary to undertake the tasks
- It would facilitate alignment with other government department and agencies that have a linked interest between energy and other requirements (agricultural policy, transport, environment, etc.).

Key early tasks for the Council would be to:

- Initiate preparation of a national energy RD&D strategy to include a focus on SE, including budget priorities, consistent with national objectives and international frameworks. This strategy would be updated on a rolling basis, say every three years, and would underpin budget allocations and priorities to the funding agencies and programme managers in the relevant areas.
- Prepare advice on proposals for the next NDP programme;
- Make recommendations where particular action is required in areas such as capacity building.

The Council could be structured with:

- DCMNR (and/ or NI authorities) in the Chair to ensure alignment with energy policy objectives;
- Key stakeholders from Government, academia, relevant agencies, utilities and industry represented;
- Support/secretariat provided from an existing agency such as SEI.

Particular consideration might be necessary for building on and co-ordination of existing key agencies such as SFI and SEI. Programme management capacity required for disbursing funds is substantial and requires considerable effort to establish. SEI and SFI both have such governance structures, delegated powers, processes, procurement rules, advisory committees, etc. in place. It should be noted that the RD&D undertakings of SEI and SFI are dramatically different in nature, scope and aim. The SFI function might very well be appropriate for particular elements of academic funding. SFI could utilise its well-established peer-review and applications processes for academic funding and apply them in the energy sector. This might also serve to leverage considerable funds available to SFI in support of energy objectives. SEI has the requisite structures in place to handle other parts of the RD&D spectrum. Decisions on which paths

funding might most effectively be routed could be taken in light of the first strategy output from the Coordinating Council, which would need to consider the balance between fundamental and applied research. The two mentioned agencies report to different government departments. This is not a minor matter within the construct of a DCMNR led process. However a memorandum of understanding could provide the necessary structure without recourse to legislation.

**A DCMNR led Coordinating Council will likely allow for the formation of a coherent national approach to energy RD&D. Its structure will be able to optimally utilise existing structures and resources, and be able to take a strategic view in line with energy policy and wider government policy.**

### *All-island perspective*

The Framework for the All-island Energy Market states that it should, “...provide for competitive, sustainable and reliable markets in electricity and natural gas on the island of Ireland at the minimum cost necessary.” The context for the framework is given as the, “...European Union’s (EU) single market for electricity and natural gas and the growth of regional energy markets.” Thus, it is inevitable as part of this process that future consideration should be given to the wider and developing European regional context of the island of Ireland and Great Britain, not limited to just the NI (at least in the longer term). **The all-island context should be an integral part of the design of a national (RoI) energy RD&D strategy.** It does however introduce a number of complexities in aligning and coordinating policies, industry structures, educational structures, and varying financial incentives in the area. Some areas of RD&D policy will be easier to align and accommodate in an all-island energy RD&D programme than others. This requires further analysis.

The metric used to assess success of the All Island market project is described as: “...energy users in both parts of the island are better off than they would be in two smaller markets which are mutually supportive good neighbours, but which trade together opportunistically rather than systematically.” In formulating programmes and projects it will be important to adhere to and reflect this measure of success.

Academic research is already being conducted in an *ad hoc* manner in some areas on an all-island basis. Likewise commissioned reports in the energy sector have increasingly utilised an all-island approach. The challenges of protocol or procedure in appropriately coordinating research undertaken on an all-island basis in a formal manner are not insignificant. As an example the UK DTI funds demonstration projects, utilises significant amounts of commissioned studies to inform policy, and has established its own research council. In theory, however, there is no obstacle to beginning to coordinate and align with these organizations or processes. Indeed, it is being undertaken both on an *ad hoc* manner and through the Joint Steering Group (JSG).

Certainly when disbursing public funds, the all-island approach could become either a mandatory aspect prior to funding or one that is required to be considered in all programmes. This would likely require that most currently operating RD&D programmes be refined at the next appropriate review opportunity. The differences in academic institutional structures and private industry will add to the complexity of this undertaking.

**The Coordinating Council would likely provide the most elegant approach to initiating alignment of RD&D activities between the Republic and Northern Ireland in tandem with the All-Island Energy Market Joint Steering Group.**

### *EU Perspective*

The EU programmes most pertinent to Ireland's SE RD&D agenda are the Framework Programme for research, technological development and demonstration RTD and the Framework Programme for Energy, which includes the "Intelligent Energy for Europe" programme.

**The Sixth Framework Programme (FP6)** (2002-2006) for RTD includes a "Sustainable Energy Systems" (SES) thematic sub-priority. This sub-priority field of research comes under the 'Sustainable development, global change and eco-systems' thematic area together with two other research fields: 'Sustainable surface transport' and 'global change and eco-systems'. The SES field of activity evolves from the ENERGIE part of the Fifth Framework Programme and the JOULE and THERMIE parts of the Fourth Framework Programme. For the duration of the FP6 programme, €10M has been allocated to SES. This budget has been divided (approx. 50:50) into two complementary parts, based on timeframe of expected market impact:

- **Research activities having an impact in the short and medium term.** The focus here is on integrated demonstration-type actions with a typical research component of up to about 20% and including, where appropriate, pre-normative research, energy technology integration, dissemination and technology transfer activities. The risks to be addressed are mainly technological and might include market related and financial issues. Projects funded under this part of the programme are managed by DG Transport and Energy.
- **Research activities having an impact in the medium and longer term.** The focus here is on research and development activities (including pre-normative and socio-economic research and the validation of technical and economic feasibility in pilot plants and prototypes), research-related networking activities, training and dissemination activities. The main risks to be addressed are scientific and technological rather than market and financial. Projects funded under this part of the programme are managed by DG Research.

To date participation from Ireland in the energy part of FP6, compared with earlier Framework Programmes, has been less effective than might have been the case. Recent Calls under FP6 prompted a good level of Irish participation in proposals but a poor rate of funding approvals, in the very competitive environment that the Calls create.

Action is therefore required to improve the quality of proposals in which Irish researchers are involved, to increase their success rate. In considering this matter, the term "quality" needs some explanation. From the FP6 perspective, the priority is on stimulating collaborative trans-national research effort, frequently entailing multi-annual commitment of resources on a (by Ireland's standards) large scale. A "quality" proposal by this measure will tend to be one in which a consortium of academic, industrial, institutional and possibly regulatory interests commits to a body of scientific, technological or related (can be socio-economic) work which offers the prospect of delivering a tangible advancement in that field of endeavour which is, or approaches, world class and offers the ultimate prospect of a beneficial impact on a European scale.

In this context, an important criterion in evaluating proposals is termed "European added value", as distinct from national or regional added value. "Quality" is thus a wider concept than mere scientific or technological excellence. Such a rationale has been a strong force in concentrating greater resources within FP6 among new categories of large-scale proposals, termed "Integrated Projects" and "Networks of Excellence". For many Irish RD&D interests, gaining access to, and recognition of their potential contribution to such a consortium, as part of a process which is increasing in bureaucratic complexity, has to date posed a considerable and insurmountable

deterrent. A further competitive factor is the expansion of the EU to 25 member states, with no increase in budget.

More specific action is needed to improve the success rate of Irish proposers from the energy sector, both the in the remaining FP6 Calls and also in future framework programmes. The focus of such action should be on mobilising and guiding Irish groupings to work together and to create an enhanced, concentrated effort in specific segments of the energy sector. Target areas include topics of national priority, which build upon existing national centres of expertise or capability. Suggested actions include:

- Increase collaboration within specific energy sectors in the Irish economy, such as grid infrastructure, biomass<sup>10</sup>, etc. This could be achieved through expansion of SEI's promotional programme to target specific these groups and encourage more cohesion among the market actors in these sectors.
- SEI currently runs a feasibility study programme, which is designed to assist prospective proposers in assembling their applications to the 'CONCERTO' (Sustainable Community) initiative under FP6. This support programme could be expanded to provide assistance in preparing proposals under each of the sustainable energy Calls for Proposals. The programme would provide a means of selecting promising proposals early in the process and the assistance provided would help bolster the strength of the proposals from these successful candidates.

More resource is needed than is currently available in SEI to help proposers improve quality, and encourage more Irish researchers to lead proposals and hence have more influence over their quality.

Action is also required in order to maximise the benefit of Framework Programme funding for energy RD&D and to enhance our ability to influence EU policy developments and decisions which bear on energy RD&D. Many Member States have successfully increased their ability to influence EU policy direction by taking a strategic decision to provide resources to participate in many of the committees and sub-committees which are organised by the EU Commission, with a view to inform future policy development. Finland has been particularly successful in this regard, which has also been reflected in their success rate under the FP6 programme. It is recommended that Ireland should take such a strategic decision.

The seventh framework programme (FP7) is currently being defined by the EU. It is expected that Sustainable Energy will be one of nine themes for collaborative action and currently has an indicative budget of €2951M over the life of the programme (2007-2013), over the full spectrum of RD&D type activities.

In order to overcome the inherent difficulties with the FP6 programme, such as:

- The complexity of FP6 and its orientation towards large scale projects and consortiums, as described above, making it is very difficult for small countries such as Ireland to participate as often they do not have the critical mass of activity required to participate / add sufficient value to such projects;
- Excessively slow release of EU funds to contractors on previous framework programmes, resulting in a negative experience for some market players, and consequently created a number of sceptics that do not wish to participate in any further EU programmes;

In recent years Irish applicants to the EU FP programme in particular have been less numerous and less successful than they have been historically, and action is required through Irish programme managers to improve the quality of Irish applications. Ireland needs to establish

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<sup>10</sup> Two topical areas in sustainable energy.

improved mechanisms to encourage the participation of SMEs. The following recommendations are suggested for FP7:

- Enhancement of mechanisms to encourage participation of emerging research groups including SMEs, and/or research groups new to the FP. For example, the inclusion of evaluation criteria, which explicitly rewards proposal consortia for including participation from SMEs.
- Introduction of specific calls to encourage participation from SMEs within the sustainable energy systems thematic Calls, in addition to the specific SME programme.
- Introduction of specific calls for STRP (small) projects that are more suited to smaller countries such as Ireland.

In addition to the Sustainable Energy Systems" (SES) thematic sub-priority a number of cross cutting FP programmes are in place, which are designed to build the structure of the European Research Area (ERA). For Irish researchers the Marie Curie research programme is the most important of these programmes. The Marie Curie programme aims to build human resources in all areas of research and increase the mobility of researchers across Europe. To date the energy RD&D community in Ireland has made limited use of this programme and may benefit from specific efforts to encourage participation in the programme.

*The "Intelligent Energy for Europe" programme (IEE)*, administered by DG Transport and Energy, incorporates two previous sustainable energy initiatives, the SAVE programme (energy efficiency) and Altener (renewable energy). It has an indicative budget of €10-120M for these activities over the period 2003-2006. While this programme is not strictly characterised as RD&D *per se*, it is an important complement to the FP in terms of supporting many of the accompanying and reinforcing measures set out in the RD&D ladder of Figure 2.

The entry barriers to this programme are considerably lower than those for FP and, while the levels of funding have been lower than with FP, the performance of Irish proposers in transnational networking and partnership building, and in securing support from IEE, has remained consistently strong since the inception of the originating programmes in 1990. These have included some university research groups from Ireland.

In October of last year the Commission established 'The Intelligent Energy Executive Agency', to assist it in the implementation of the Intelligent Energy for Europe programme. The Agency is responsible for implementing all tasks, except for programme evaluation, monitoring of legislation and strategic studies, or any other actions that comes under the exclusive competence of the Commission.

Finally, **the Irish energy RD&D programme requires integrating within the European framework if maximum benefit is to be gained.** Two key mechanisms exist through which the Irish energy RD&D programme can become more integrated with other similar European programmes:

- ERANET: This mechanism is designed to support the cooperation and the coordination of research activities carried out at national or regional level.
- Technology Platforms: The Commission has decided to use mechanism to help inform them as to the priority areas for FP7. Ireland has recently been nominated to the advisory council of the EU technology Platform on Electricity Networks of the future, an area of strategic national importance.

**There should be participation in EU RD&D policy formation forums in order to help maximise the benefit to Ireland.** International representation from macro to specialist level is necessary to maximise focus, alignment and value from EU and other policies and programmes. Moreover, international collaboration enables the leveraging of existing knowledge within other

organisations and the benchmarking of our programmes and activities against best practice abroad. The energy RD&D strategy should address these issues.

### *IEA Perspective*

SEI (on behalf of the DoCMNR) has the responsibility of providing national delegates to the Executive Committees of the three RE Implementing Agreements (IA) to which Ireland is a party (Bioenergy, Ocean and Wind). SEI is responsible for the nomination and support of country experts to a small number of Tasks<sup>11</sup> (This typically takes the form of subsidising travel expenses and representation fees for research scientists, as well as funding for full-time researchers and specified pieces of collaborative international research). SEI provides representation and oversight through the CERT and the REWP delegates.

Ireland's participation has provided for excellent networking, information sources, access to lessons learned and experiences of technology deployment and RD&D. It has also provided a valuable networking tool to various researchers, and a means of supporting directed collaborative research. Indeed Ireland's participation in the last two years has been directed, created value for money, and the contribution of Irish delegates and nominees has been well received by other member countries and the IEA secretariat.

There are nearly 500 participating institutions, collectively, they mobilise annually an estimated US\$120 million to US\$150 million. The Renewables IAs are considered very active and successful programmes within this larger framework and some have been in operation for over 25 years. The IA's in the RE<sup>12</sup> area include (Irish participation is highlighted in bold):

- 1. BioEnergy**
2. Geothermal Energy
3. Hydropower
4. Photovoltaic Power Systems
5. Solar Heating and Cooling
6. Solar Power and Chemical Energy Systems
- 7. Wind Energy**
- 8. Ocean Energy Systems**

### *Links with Environment*

The energy-environment interface is critical. It is one of the pillars of energy policy and thus must be considered in a holistic manner along with security of supply and competitiveness. It can no longer be considered in isolation or a separate "issue". This should be apparent through the host of EC Directives in this area (LCPD, NEC, ETS, RES-E, etc.). Likewise Ireland's closest neighbour (The UK) has made a firm commitment to the environment sector in its energy policy (White Paper, 2003).

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<sup>11</sup> (within the IAs on specific areas of technology)

<sup>12</sup> Some recent significant outputs and publications include:

- RD&D Seminar at REWP 47 (March 2005)
- Renewable Energy Statistics
- Renewables Scenarios Analysis
- Distributed Energy Resources
- Analysis of RE Policies and Measures
- Energy Security Implications of Renewables
- Renewable Constraints: Seasonal Fluctuations and Intermittency
- Global Bio-resources

SEI supports the notion that there should be inclusion of energy related environmental research within the scope of the coordination actions that result from this consultation process. Again, this needs further definition. The RD&D in this genre is no different in its variations than other areas. It spans the continuum from fundamental research in say biology or chemistry to implementation of agricultural based bio fuels projects. The EPA and DEHLG have established research programmes in many areas and these like other energy related programmes (DETE) would ideally be aligned with DCMNR activities. The term “coordination” may be somewhat of an overstatement of what is required in this regard. However, communication, leveraging funds, and synergistic work programmes will be important.

(Sectoral funders of environment RD&D currently include: the Marine Institute (industry RTDI projects, EU FP-6 global change ecosystems, mobility grants and technology transfer) EPA (Water Framework Directive, Doctoral scholarships); Department of Agriculture, Food and Rural Development (Food Institutional Research Measure (FIRM)) and the associated programmes of Teagasc; Council for Forest Research and Development (COFORD); and SEI.)

**Energy -related environmental research needs to be included within the structure and programmes arising from this consultation.** A Coordinating Council of the key stakeholders including environmental interests would be best placed to achieve this.

#### *Long-term vs. Short-term*

As was previously noted, different sectors of the RD&D community have different requirements for funding. This includes timescales. As an example academic research cycles usually are in the 3-5 year range due to the nature of the resource (doctoral students) and the regular academic funding mechanisms. Even within academia, fundamental research sometimes requires longer time horizons than applied research because of the somewhat higher risks and long time horizons that are inevitable. Industry development and demonstration normally requires much quicker response times to coincide with financial commitments linked to business cycles.

The DCMNR consultation paper again points to the use of commissioned research. This type of research is usually undertaken to fill a gap in public knowledge and will inevitably be on a shorter time horizon than other types of research. **Long-term research requires a stable policy, regulatory and market as well as the aforementioned academic needs.** This stability can allow for the development of industry and its associated RD&D activities. Long-term funding also requires policy foresight, including careful policy needs and research capability analysis, international benchmarking and linkages, long-term budget commitments by government, and risk/reward analysis. Finally the notion of long-term vs. short-term RD&D is just one type of categorization that can be placed on RD&D.

**An RD&D strategy produced by Coordinating Council taking account of such considerations would provide a basis for balancing long and short -term RD&D needs.**

#### *Funding*

SEI’s RD&D funding spans the whole of sustainable energy with areas of emphasis reflecting DCMNR priorities. SEI programmes are open to a wide range of research, development and demonstration projects under the support mechanism categories proposed in the Green Paper on Sustainable Energy. This categorisation, and the level of support in each case, is related to the character of benefits and risks involved. Each category has varying support levels that range from 10%-100% of eligible costs<sup>13</sup>. The categories are:

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<sup>13</sup> All funding is subject to European Community limits on levels of State Aid.

1. **Shared cost Demonstration:** Projects demonstrating particular SE technologies or applications which, although at or near commercial viability and having potential for replication, currently face market barriers due to lack of expertise, knowledge or market confidence. The objective here is to gain information that will be made available to potential replicators to encourage action without further financial support under the programme. To facilitate this, independent monitoring at the programme's cost may be required.
2. **Shared cost RD&D:** Research and development into innovative technologies, systems or marketing approaches which support the commercial exploitation of sustainable energies, including applied research and development, technology transfer and adaptation and market research/feasibility studies.
3. **Commissioned public good activities:** Activities directed at increasing the value and impact of the programme results, which will ultimately be used to inform policy (generally commissioned by separate Invitations for Tender only – not normally open to *ad hoc* proposals).

Commissioned work to support public good research is one part of the RD&D programme (as described above, and addressed through procurement policies that include tendering). Such work is typically directed at informing policy and market action, in particular underpinning or flanking actions to address structural gaps in information and capability. Other segments of RD&D are awarded based on expert review and a series of advisory committees, normally. Like SEI, other agencies and departments will prioritise areas for commissioned studies or more general RD&D funding according to their remits and policy requirements. A coordination (or alignment, synergies, etc) function would be useful as a communication vehicle to allow for optimal disbursement of funding.

Identifying areas for national focus post-2006 will require considerable further effort and should be supported by the proposed council. In moving beyond the consultation phase into policy formation in the area, **it will be critical to define explicitly what areas of Research Development and Demonstration are to be targeted and how they are defined.** This will require addressing the continuum of RD&D from fundamental and applied academic research, to commercial research, through pilot demonstration and full commercial applications (these distinctions are often blurred). A recent IEA seminar (2005) included these relevant recommendations:

- RD&D and policy strategies that differentiate among technologies are necessary to address diverse problems of non-uniform technical challenges.
- Technology collaboration has provided proof that it contributes substantially to accelerate progress.

This will call for a systematic analytical benchmarking and consultative exercise to (i) map/ audit/ characterise technical and economic status/ maturity, capability, positioning, potential and other attributes of the different streams of SE technologies and practices, (ii) grade and prioritise proposed RD&D interventions, differentiated by instrument type, and (iii) propose pathways, resources and timescales for same.

In terms of instrument type, it will be important to differentiate between at least two types of endeavour: (a) the application of research expertise to the classical innovation pipeline process in respect of SE technologies, from basic science through to market application and full commercialisation, and (b) research intelligence directed at informing policy and market action, in particular underpinning or flanking actions to address structural gaps in information and capability. This should include a focus not only on science and engineering research, but financial, economic, and business related RD&D.

Finally, **an energy RD&D strategy is probably necessary to achieve the public and private sector communication necessary for better co-ordination of funding.** Each programme management agency could be charged with improving coordination within its field.

## *Capacity Building*

There is a need for capacity building on energy RD&D in all relevant areas including the universities, agencies, Government, utilities, consultancy and financial sector. Capacity building as described in the DCMNR consultation paper pertains mostly to the provision and incentivisation of university students. While this matter is of fundamental importance to all energy sector stakeholders it does, however fall within a different category than the previous discussion items. This capacity building would need to be addressed by a large stakeholder group including a wider grouping of agencies and research advisory bodies and departments. It would need to be underpinned by a strong energy policy that calls for prioritisation of this sector in the economy in general. Capacity building is always a function of a number of other economic and policy factors in a society.

A balance will need to be struck in regard to funding of student based versus other RD&D, as the former may not always be compatible with achieving early deliverables such as other resources might produce. This may be a price worth paying in the short term, in the interests of longer-term building of indigenous capability and potential centres of excellence. **SEI has funded a doctoral and post-doctoral scholarship programme in the areas of SE through the Irish Research Council for Science and Technology (IRCSET) for the past two years.** (It has allowed for research in areas varying from the integration of wind energy into power systems to mathematical modelling of ocean energy systems to economic analysis of the RE sector.)

**The signalling of long-term funding for RD&D in the energy sector for both academia and industry as well as focused technology, economic, and science RD&D funding would serve to stimulate and encourage capacity building.** A long-term signal for scholarships at all levels of third-level education and links with operating educational programmes in science and technology would be beneficial. Incentivising indigenous enterprise growth in the energy sector will also be crucial. This could lead to a growth in both industry jobs as well as related consulting and applied RD&D in industry. Again, this has ties with much wider economic and political considerations in the country, and should be given its own focus council. **International links will be crucial here as well, to inform, catalyse and calibrate progress, including support for mobility of researchers, given Ireland's small resource pool.**

In some cases (*i.e.* for supporting long-term programmes) it has been difficult for academic centres to avail of current SEI funding mechanisms given their structure and operational time scales. In order to do so increased budgets will be required and alternative procurement process and priorities will need to be established. The SEI RD&D programmes were originally envisaged and designed to accommodate project-based grant support and not longer term (>3 years) research funding. The nature of the approval processes, administrative compliance, and the like are not well suited to academic institutions currently for undertaking long term research. A set of appropriately challenging performance targets will need to be established to ensure an appropriate competitive edge to such a refined programme.

A “centres of academic excellence” support scheme may well be seen as a requisite for a viable and vibrant industry. A number of other Member States have recourse to national centres of excellence in the energy sector (ECN in Holland, Riso in Denmark, Fraunhofer in Germany, SINTEF in Norway, etc<sup>14</sup>). These centres are normally associated with Universities to varying degrees. Of course there are a wide range of options for defining what a Centre of Excellence is, and how it is structured and operated. A council, as proposed by DCMNR, could undertake this definition process.

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<sup>14</sup> It is acknowledged that a number of these grew out of nuclear research centers. They also do research in areas wider than energy in a number of cases.

The programme could be envisaged as a call for research centres currently operating in the various related fields of energy (RE, EE, technology, science, economics, policy, etc.). There is a need to focus the funding in the right places to get critical mass where there is already a demonstrated centre of excellence. It will also be critical to choose the topic areas that best support energy policy. Thus, some sort of wide stakeholder consultation and dialogue would need to be initiated to prioritise topics and areas for research. The areas for research and the units would ideally be aligned with EU FP7 priorities, so that the Centres could become self-sustaining (or supplemented) with EU research funds. (Although this may be a longer-term goal, rather than a short term expectation to allow for the benefits of stable funding patterns). There would also likely be a need to attract a number of well recognised international researchers in each area to supplement the current research centres. This may require an alternative mechanism. Consideration for regional issues, and North-South dimensions would need to be highlighted in the funding process.

The US NIST (2003) notes the importance of creating networks and relationships between research bodies. They characterise these networks as developing in the following manner:

- Universities and government labs function as technology sources.
- The network is sparse and evolving at the beginning of the project.
- Technology is new as indicated by relatively current cited patents.
- System spill-overs increase significantly; technology gets diffused rapidly.
- Influential companies perform significant basic research.
- Geographical concentrations (as incubators) develop.

**There is a need for capacity building on energy RD&D in all relevant areas including the universities, Agencies, Government, utilities, consultancy and the financial sector.** A long term RD&D strategy produced by the Coordinating Council would be essential to providing the confidence and budget allocations to facilitate capacity building. Centres of excellence are likely to be a requirement for significant capacity building. Making formal linkages with the HEA and similar organisations and departments with education remits would also be a sound way to instigate energy sector capacity building.

#### **4. POSSIBILITIES FOR FUTURE WORK AND OPPORTUNITIES<sup>15</sup>**

There are inevitably a large number of questions that arise from beginning an exercise of this type and scale. It will be required to come to terms with:

- The complexity of the issue,
- The interacting agents (departments, agencies, research councils, etc.),
- The requirement to deliver on current programmes,
- Positively and constructively influencing the post-2006 national budget process
- The interaction with EU FP7 programmes
- Learning and creating synergies with international partners, beginning with NI.
- Defining programmes that address the spectrum of RD&D.
- Define programmes with different temporal and process needs.

The energy sector is going through tremendous changes currently (new market, liberalisation, electricity sector review, etc.)

There are a number of opportunities for Ireland in establishing a larger and coordinated presence in energy RD&D. The topic headings provided below could be used in a variety of sectors. The

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<sup>15</sup> (some comments based on work by the UK NERC, 2004)

total budgets for the programmes and their impacts would need to be assessed further and in detail in working towards a future NDP (or other budget mechanism). The proposed Energy RD&D Coordinating Council (and/or its associated agencies) might:

- Initiate preparation of a national energy RD&D strategy, including budget priorities, consistent with national objectives and international frameworks.
- Assess research priorities and propose budget allocations.
- Prepare for NDP (or counterpart) submission in 2006 and going forward.
- Bring together key stakeholders and act as a focus for knowledge transfer and public engagement activities in the field.
- Act as the hub of a National Energy Research Network, linking other centres of excellence, research institutes etc.
- Co-ordinate a network of environmental, engineering, economic and social scientists.
- Create an industry council to oversee priorities on demand and supply side activities.
- Propose innovative financing for SE projects, including low-interest loans and the possibility of equity shares.
- Propose leads in energy research (in one or more areas) and which would also provide focal points for international collaboration.
- Create value in a regional model by attaining goals through linking robust RD&D support and programme activities for routes to market for both products and services.
- Propose a national grant support scheme for some specifically identified and prioritised technologies.
- Propose funding for specific technology Centres of Excellence in Universities.

The time frame for implementation of these various projects, services, and programmes is unclear. However, it will need to be undertaken at a pace appropriate to the exogenous and endogenous influences (FP7, NDP, etc.), various actors (academic through to investors), and with appropriate tools (RD&D, venture capital, Incubator programmes, technology acceleration targeting, etc.).

## APPENDIX 1: SEI R&D OVERVIEW AND PROGRAMMES

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This Appendix consists of three sections.

- Section 1 describes the context within which SEI's R&D programmes operate.
- Section 2 sets out a short summary of each programme.
- Section 3 describes some of the R&D support activities that underpin the programmes.

### Section 1 –SEI's R&D Programmes: Some Context

#### **R&D: A Sub-measure of the Sustainable Energy Priority**

The Sustainable Energy Authority of Ireland (SEI) operates and strategically manages a number of national R&D programmes in line with government policy outlined in the National Development Plan (2000-2006) and the Green Paper on Sustainable Energy (1999). SEI's R&D programmes form the basis of the R&D Sub-measure within the Energy Conservation measure of the Sustainable Energy Priority. This is one of the five priorities of the ESIOP programme of the NDP.

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#### **R&D Sub-Measure Objectives and Elements**

The R&D Sub-Measure is designed to assist the development of a least-cost path to CO<sub>2</sub> reduction and sustainable energy in Ireland. It has three elements:

- Public good activity designed to support the development and application of policies, measures and regulations to achieve, at least cost, sustainable energy services in Ireland.
- Shared cost activity to engage private and public sector interests in the development of least cost solutions in the area of energy efficient products and services.
- International collaboration on public good activities where either the risks are high or the additional public good benefits from international collaboration are high.

The research and development results are to provide guidance to policy makers and private entities on the practical, regulatory, technological and market opportunities to achieve sustainable energy goals.

Capacity building within the wider sustainable energy sector is also a key objective of SEI's R&D programmes. This includes building technical and commercial competence across a wide range of energy efficiency and renewable energy technologies.

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#### **Programme Responsiveness**

The programmes were developed to address the requirements identified in the NDP programme complements and the Green Paper referenced above. The focus of the programmes has continued to evolve, taking into account changing policy and market needs, as well as practical considerations such as budget allocations. All three of the primary R&D programmes have undergone significant formal revision in the past two years, and the programmes have continued to grow, both in terms of funds disbursed and the contribution to sustainable energy policy and market development.

It should be noted that SEI's R&D programmes could still be considered to be in their infancy. They are growing and adapting to both policy and market needs in line with budget constraints and administrative processes.

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**Programme Management**

In terms of programme management, there are formal and effective procedures in place for dealing with important programme management aspects such as project evaluation, programme administration, legal issues, results dissemination and marketing.

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**Current Programmes**

SEI currently operates three primary R&D programmes in: renewable energy, the built environment (house of tomorrow) and industry. There is also a small amount of work being undertaken in the transport sector. The R&D budget for 2004 and 2005 was €3.65M and €5.6M and can be broken down as follows:

	<u>2004</u>	<u>2005</u>
Renewable Energy R&D	2.1	2.4
Industry R&D	0.68	0.6
House of Tomorrow R&D	0.77	2.6
Transport R&D	<u>0.1</u>	<u>0.0</u>
	<b>€3.65M</b>	<b>€5.6M</b>

The total projected expenditure for the period 2001 – 2006 (as revised following the Mid-term review of the NDP) is €23.77M.

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R&D	2001	2002	2003	2004	2005	2006	
Actual Spend/Projected Requirements:							
HOT	0.00	0.62	0.48	0.99	2.60	3.50	8.19
Renewables	0.02	0.22	1.34	3.00	2.40	5.00	11.98
Industry	0.27	0.25	0.58	0.49	0.60	1.00	3.19
Transport	0.00	0.00	0.00	0.10	0.00	0.30	0.40
	<b>0.29</b>	<b>1.09</b>	<b>2.41</b>	<b>4.58</b>	<b>5.60</b>	<b>9.80</b>	<b>23.77</b>

*Table A1: SEI R&D Budget Allocations 2001 - 2006*

**Some Lessons from SEI's R&D Programmes under the NDP 2000 - 2006**

R&D is, by its nature, long term, and therefore requires a long-term approach to budget allocation. The Sustainable Energy Priority's R&D programmes set out an ambitious set of deliverables and related budget profiles reflecting significant growth patterns year on year. The annual budget estimates process introduced a degree of uncertainty to the planning process, and necessitated the regular adjustment of programme budgets. Working to agreed, and allocated, multi-annual budgeting, which is planned for the future, will significantly address this weakness.

The Renewable Energy R&D programme in particular played an important role in supporting the various strategy groups established to look at aspects of energy policy. Flexibility needs to be built into annual budgets to allow for such significant ad-hoc budget requirements.

Project lead times on such market led programmes can often be long and uncertain. This places significant pressure on the system where there is a need to meet strict profiled expenditures annually. The adoption of a multi annual capital envelope approach would also assist in addressing this challenge.

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## Section 2 – Programme Summaries

<b>Programme</b>	Renewable Energy RD&D
<b>Budget Allocation (2000 – 2006)</b>	€1.98 million (Based on expenditure to 2004, budget allocation 2005 and estimated for 2006)
<b>Budget 2005</b>	€2.4 million
<b>Programme Rationale</b>	<p>Renewable energy is aligned with the three main energy policy drivers of cost competitiveness, environmental protection and security of supply. The goal of the programme is to make a positive impact on the implementation of renewable energy in Ireland. The programme focuses on areas that can have a significant impact in Ireland with utility-scale, grid connected RE featuring strongly. The programme seeks those applications that present excellent possibilities for replication and acceleration of the take up of appropriate RE.</p> <p>In order to address the historic under-provision of R&amp;D, the programme aims to establish a balanced portfolio of renewable energy research projects to facilitate least cost path to renewable energy deployment. The programme provides support for renewable energy product R&amp;D, market demonstration of new technologies, resource studies and public good research activities.</p>
<b>Programme Elements</b>	<ul style="list-style-type: none"><li>• Research aimed at developing policy options, defining the market structure, reducing costs, improving reliability and / or opening new markets</li><li>• Feasibility studies for renewable energy projects</li><li>• Demonstration aimed at high risk, high reward projects or non-technical innovation</li><li>• Investigation into core areas common to many renewable technologies</li></ul>
<b>Progress in 2004</b>	<p>In the period to December 2004, a total of €7 million was committed to 72 projects and €4.5m has been disbursed. In May 2004, the RE RD&amp;D strategy was further refined, with the emphasis for support placed on wind energy, biomass heating, liquid biofuels, wave energy and energy storage technologies. A review of the RE RD&amp;D programme was presented at SEI's Renewable Energy Summit in September '04 where a number of the programme's key projects were showcased.</p> <p>The first biomass CHP project in the country, developed by Independent Biomass Systems, began operations in May 2004 with support from SEI's Renewable Energy RD&amp;D programme. Coillte installed, and is now operating, a 100 kW wood chip/wood pellet biomass boiler, with grant support also provided by SEI. The boiler will be used to provide training for Irish technicians in the installation and operation of wood heating systems.</p> <p>Ocean energy continues to attract significant RD&amp;D interest. Three device developers are currently being supported by SEI in addition to the commissioning of a study aimed at estimating the potential tidal energy resource available to an All-Island electricity market.</p>

<b>Programme</b>	House of Tomorrow RD&D
<b>Budget Allocation (2000 – 2006)</b>	€8.19 million (Based on expenditure to 2004, budget allocation 2005 and estimated for 2006)
<b>Budget 2005</b>	€2.6 million
<b>Programme Rationale</b>	<p>The residential sector accounts for one quarter of Ireland’s energy-related CO<sub>2</sub> emissions. From a Kyoto compliance perspective, the rate of new house building and the deficient energy performance of much of the existing housing stock present a major challenge.</p> <p>This programme aims to stimulate widespread uptake of superior sustainable energy planning, design, specification and construction practices in both the new home building and home improvement markets, including improved technologies, products, practices and policies.</p>
<b>Programme Elements</b>	<ul style="list-style-type: none"> <li>• Research that will guide policy and identify deficiencies and barriers to energy performance improvements</li> <li>• Model demonstration projects, for new build, refurbishment or retrofit, with the potential for market influence and replication;</li> <li>• R&amp;D of products, systems and services</li> </ul>
<b>Progress in 2004</b>	<p>28 projects in the areas of research and development, international collaboration, and public good research were approved for funding support. This represents a total of €5 million in new funding commitments. Highlights for 2004 included the approval of 22 new demonstration projects comprising 1,183 homes demonstrating innovative or best practice technologies and design strategies.</p> <p>SEI’s SEBNet programme was created and launched, which has since attracted membership from 37 leading Irish product suppliers. The programme specifically promotes the uptake of energy efficient products and systems by specifiers and consumers.</p> <p>A pilot survey of Irish housing stock was commissioned. Its aim was to assess the actual energy performance of the housing stock and to assist in the development of a survey methodology designed to support the implementation of the Energy Performance of Buildings Directive.</p> <p>The sustainable energy technologies employed in the 1670 housing demonstration projects approved to the end of 2004 include:</p> <ul style="list-style-type: none"> <li>• Condensing boilers (1,153 homes)</li> <li>• Solar water heating (300 homes)</li> <li>• Heat recovery ventilation (176 homes)</li> <li>• Ground source heat pumps (128 homes)</li> <li>• Wood pellet boilers (50 homes)</li> </ul>

<b>Programme</b>	Industry RD&D
<b>Budget Allocation (2000 – 2006)</b>	€3.19 million (Based on expenditure to 2004, budget allocation 2005 and estimated for 2006)
<b>Budget 2005</b>	€0.6 million
<b>Programme Rationale</b>	<p>Industry accounts for almost one-fifth of energy related CO<sub>2</sub>. To meet the sectoral challenges presented by the national commitment under the National Climate Change Strategy, there exists a need for a range of instruments to ensure that targets are met. The programme is concerned with developing these instruments.</p> <p>In addition there are increasing demands from industry for the formalisation of a robust approach to energy management, the development of appropriate frameworks and examination of opportunities to utilise appropriate renewable energies.</p> <p>The adoption of proactive and integrated tools and techniques, if appropriately applied, have the capacity to mitigate some of the cost competitive issues associated with increasing energy market volatility and environmental legislation, the impact of EU emissions trading and other associated market and economic risks.</p>
<b>Programme Elements</b>	<ul style="list-style-type: none"> <li>• Development and testing of a formalised, practical energy management action plan for Irish enterprises</li> <li>• Stimulating a focus on advanced energy management practices</li> <li>• Formal agreement where firms obtain (and retain) a new national energy management standard (IS 393)</li> </ul>
<b>Progress in 2004</b>	<p>Electrical and thermal technical modules that will help companies to identify energy-saving opportunities within the Energy Agreements structure were developed during 2004.</p> <p>In addition the development of two energy management products commenced - firstly the 'Energy Management Action Programme' (EMAP), which provides a practical roadmap for any business that wishes to manage energy sustainably. Also SEI and the National Standards Authority of Ireland (NSAI) developed an Irish Energy Management Standard (IS 393)</p>

### Section 3 – R&D Support Activities

<b>Research &amp; Development Co-ordination</b>	SEI's support programmes for research, development and demonstration are diverse, multilayered and interface with other national and international programmes. The RD&D co-ordination function enables the efficient and effective development and management of a portfolio of programme activities so as to achieve synergies, and to access external expertise and best practice. That includes liaison with other national R&D funding bodies, representation, national delegate and contact point service and promotion of EU and other international RD&D support initiatives.
<b>RD&amp;D Inventory</b>	<p>SEI is required to submit annual returns to both the EU and the International Energy Agency (IEA), detailing the amount and type of energy RD&amp;D (Research, Development and Demonstration) currently being undertaken in Ireland.</p> <p>In order to comply with this requirement SEI is preparing an inventory of all publicly funded energy RD&amp;D activities in Ireland over the past 3 years. This will include projects funded by national and/or EU programmes. National programmes include those administered by SEI as well as energy related projects funded by other State agencies, such as EPA (Environmental Protection Agency) and EI (Enterprise Ireland). Relevant EU programmes may include the Fourth, Fifth and Sixth Framework Programmes, and the Operational Programmes, for example SAVE and Altener.</p>
<b>International Energy Agency Implementing Agreements</b>	DCMNR has designated SEI to be the contracting party for three IEA agreements relating to Wind, Biomass and Ocean energy. These have provided SEI with excellent networking opportunities as well as opportunities for national experts to work with other OECD experts in RE in applied research.
<b>EU Programmes</b>	<p>Four Irish projects were successful under the first Calls for Proposals on the EU 6th Framework Programme (<a href="http://europa.eu.int/comm/research/fp6/index_en.html">http://europa.eu.int/comm/research/fp6/index_en.html</a>) for Research. Three of these are medium to long-term research projects, one in the area of biofuels and two in ocean research development. The other is a short to medium term project examining the integration of micro-CHP and renewable energy technologies.</p> <p>A further important programme, which DCMNR leads the promotion of, is the Intelligent Energy - Europe <a href="http://europa.eu.int/comm/energy/intelligent/index_en.html">http://europa.eu.int/comm/energy/intelligent/index_en.html</a>. This is the Community's support programme for non-technological actions in the field of energy, precisely in the field of energy efficiency and renewable energy sources. The duration of the programme is from 2003-2006. Its aim is to support sustainable development in the energy context, making a balanced contribution to achieving the general objectives of security of energy supply, competitiveness, and environmental protection.</p>
<b>External Relations</b>	SEI is responsible for co-ordinating and liaising with relevant bodies on a regional, national and international basis in order to achieve most effective advancement of sustainable energy objectives. In particular, international

collaboration enables the leveraging of existing knowledge within other organisations and the benchmarking of national programmes and activities against best practice abroad.

At an international level, SEI continues to participate in the EnR network (<http://www.enr-network.org>), the association of European national energy agencies, which is a useful medium for information on the effectiveness of national programmes and exploring new initiatives.

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**Academic  
Student  
Funding**

Funding for two Doctoral scholars and one Post-doctoral fellow has been introduced as a new annual initiative in coordination with IRCSET. This allows for the only support programme of its kind in Ireland for specific focused support for young researchers in the sustainable energy field. It is a crucial part of building future capacity to carry out the plans included in this paper as well as other visions for SEI.

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**RTDI**

SEI is part of the RTDI (Research Technology Development Innovation) Group which also includes the EPA, Coford, Marine Institute and the Dept of Agriculture. The Group meet on a bi-monthly basis to discuss issues of common interest, e.g. NDP Mid Term Review, budget allocation etc and to share information regarding recent calls for proposals, up-coming events, recent developments in each organisation which may be of interest to the other organisations.

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**RD&D  
Database**

SEI has developed a national database that includes all the active market actors that we know to be interested in energy. Ranging from university researchers, consultants, utilities / energy suppliers, government departments, government agencies, local authorities, local energy agencies, community enthusiasts, architects, industrial developers, product / service providers and relevant financial experts.

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