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Approaches to Developing National Environmental Research Agendas in Six Jurisdictions

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Approaches to Developing National Environmental Research Agendas in Six Jurisdictions

Final Report

**Prepared for
Environment Canada**

By

Roger Voyer

December 8th, 2003

Executive Summary

The purpose of this study is to present approaches to developing national environmental research agendas in other countries. Six jurisdictions were chosen; Australia, Netherlands, Sweden, United Kingdom, United States of America and the European Union.

A five level analytical framework is used to present the results.

All six jurisdictions have mechanisms linking environmental research agendas to policy frameworks. They are as follows;

- **Australia;** government agencies develop research implementation plans on how they will meet the environmental national research priority (i.e.- one of four research priorities). The research priorities were arrived at through a three-stage consultation process. Agencies report annually on progress. This is a new approach. A government wide evaluation will be undertaken after three years;
- **Netherlands;** highly organized, top-down designed programmes are focused mainly on system renewal through technological solutions, within the context of the National Environmental Policy Plan (NEPP4) which was developed through a broad-based consultative process. The Ministry of the Environment (VROM) and the Netherlands Agency for Energy and the Environment (Novem) play key roles;
- **Sweden;** agencies are expected to align their research activities with the 15 objectives of the environmental legislation. The Environmental Objectives Council plays a key role in coordinating and monitoring progress;
- **UK;** the Sustainable Development Research Network, sponsored by the Department of the Environment, Food and Rural Affairs (Defra), is central to coordinating and monitoring research activities related to the White Paper on sustainable development;
- **USA;** The Council on Environmental Quality is the main link between the White House and the federal agencies that have responsibilities for the implementation of the National Environmental Policy Act (NEPA) objectives. Much of the environmental research agenda appears to flow from this linkage;
- **European Union;** the Directorates-General act on the environmental objectives of the Sixth Framework Programme (FP6) directives through peer-reviewed projects. New Structures (IPs, NoEs) have been set in place aimed at creating an integrated European Research Area.

These environmental research agendas linked to environmental policy frameworks can be seen as 'top-down' approaches; but much co-ordination is needed to ensure effectiveness.

Since Australia has similar governance structures and institutions to those in Canada, the newly established Australian approach to setting and acting on an environmental research agenda is possibly the most attractive model for Canada.

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1 Introduction

The purpose of this study is to present approaches to developing national environmental research agendas in other countries. The aim is to obtain knowledge on how other countries have approached an integrated environmental research (or possibly S&T) agenda, including processes that have been used to make the agendas national, to achieve buy-in, lessons learned, and so on.

Six jurisdictions were chosen; Australia, Netherlands, Sweden, United Kingdom, United States of America and the European Union. This selection provides a mix of both large and small countries and includes federated states.

The methodology used was an Internet search followed by e-mail contacts with officials in the above jurisdictions. Also, the OECD, SPRU, PREST and MERIT web sites were accessed.

The study also includes a profile of the key environmental science structures and activities and attempts to provide a view of the dynamics of the implementation of national environmental research agendas. However, there were limitations to the information available regarding the latter.

Commentary and analysis are found in the following sections. The profiles of responsible agencies and activities related to the setting and implementation of national environmental research agendas in the six jurisdictions are found in the Appendix.

2 Australia

Australia has set in place a national environmental research agenda by establishing national research priorities and a process by which government agencies are to respond. The Department of Education, Science and Technology is charged with the governance of this process. This can be considered as a 'top-down' approach.

The research priorities were arrived at through a three-stage consultative process;

- The first stage, in mid-2002, was an inclusive consultative process that spanned cities and regional and rural Australia and focused on a framework for setting priorities. A major outcome was a broad consensus in the community on the value of setting research priorities.
- The second stage was the setting of national research priorities. An expert advisory committee chaired by Dr. Jim Peacock, President of the Australian Academy of Science, examined more than 180 public submissions about possible research priorities and developed a short-list for the Government's consideration.
- In late 2002, the Government considered these suggestions and, on December 5th, announced four 'whole-of-government' themes of long-term importance to Australia:

1. An Environmentally Sustainable Australia;
2. Promoting and Maintaining Good Health;
3. Frontier Technologies for Building and Transforming Australian Industries; and
4. Safeguarding Australia.

These priorities draw on many fields of research. In developing the priorities, the initial focus was on the contributions of science and technology. It was felt that the key to achieving effective outcomes for national research priorities required a deeper understanding of the human dimension, particularly how people are affected by and respond to technological change, and to other challenges and opportunities. Therefore, in the third stage, the Government worked with the social sciences and humanities research communities to encompass their knowledge and contributions in order to refine and elaborate the four priorities.

The priorities embrace a vision for research for all Australia. The Australian Government intends to work with State and Territory Governments to implement the priorities.

The environmental research priority is expressed as follows;

Transforming the way we use our land, water, mineral and energy resources through a better understanding of environmental systems and using new technologies.

Key federal agencies expected to respond to this research priority are;

- The Department of the Environment and Heritage (DEH);
- The Commonwealth Scientific and Industrial Research Organization (CSIRO);
- The Australian Research Council (ARC);
- The Co-operative Research Centers (CRCs).

Australia also has bodies, such as the Australian Academy of Science (AAS) and the Commission on Sustainable Development (CSD), which keep environmental issues and research needs in the public eye.

3 Netherlands

The general planning approach in use in the Netherlands necessitates a very high degree of co-ordination among national ministries; environmental plans have to be co-ordinated with a number of other national sectoral plans. Integration of environmental policies with other national policies remains in most cases voluntary. Integration among the actions of central, provincial and local government is also critical.

The Dutch Government considers it important to seek consensus on all aspects of its environment policy. Extensive consultation takes place with various social partners and NGOs. Much information is provided on all aspects of environmental problems and their possible solutions. The general approach of full disclosure is a characteristic element of Dutch environmental policy.

The Netherlands tries to achieve a broad consensus on environmental policy directions and research flows from this consensus. However, this consensus is developed within the framework of the Fourth National Environmental Policy Plan (NEPP4) and the lessons of the Sustainable Technology Development (STD) programme. So, the approach seems to be a 'loose top-down' one.

For the NEPP4 itself, input was based on the opinions and wishes of society as a whole, including the perspectives of the business and nonprofit sectors, is crucial to the process. Discussions were held with regional and local authorities and with the various stakeholders. This is the broad framework within which the NEPP4 took shape. Another key element of NEPP4 included building and maintaining a strategic shared vision for managing short-, mid-, and long-range environmental problems. Six requirements to support this vision were established:

1. Environmental policy must be easier for people to identify with;
2. Environmental policy must be based on down-to-earth considerations;
3. Environmental policy must be placed in an international context;
4. Environmental policy must be expressed in terms of sustainable
5. Environmental policy must be rooted in the assumption that the relevant parties must shoulder their own responsibilities; and
6. Environmental policy must be driven by clear collective values.

The NEPP4 Project Team, an interdepartmental working party, was charged with organizing these discussions. Almost all the Ministries were represented on the Project Team. These explorations were completed by the summer of 2000, after which firm decisions were taken about the content of the NEPP4. The NEPP4 was submitted to the Lower House early in 2001.

Key agencies responsible for environmental policy and related research include;

- Ministry of the Environment (VROM);
- Netherlands Agency for Energy and the Environment (Novem);
- Netherlands Organization for Scientific Research (NOW);
- Royal Netherlands Academy of Arts and Science (KNAW).

There are numerous bodies trying to influence environmental policy and research directions; in particular the Dutch Advisory Council for Research on Spatial Planning, Nature and the Environment (RMNO).

The Sustainable Technology Development Programme (STD) is considered to be an *excellent* model on how to link policy to research.

The Netherlands is de-coupling environmental policy from economic growth.

4 Sweden

The Government's overall environmental policy objective is to solve Sweden's major environmental problems within a generation, i.e. 25 years. This policy objective was set out in the Bill *Swedish Environmental Quality Goals – An Environmental Policy for a Sustainable Sweden* (Gov. Bill 1997/98:145). The 15 directions of Sweden's environmental policy, set out in this legislation, are to: protect human health, conserve biological diversity, manage natural resources so as to ensure their sustainable use, and protect natural and cultural landscapes. Environmental policies, today, focus on the following 15 themes: climate change, ozone layer depletion, acidification and ground-level ozone, urban environmental quality, eutrophication, metals and persistent organic compounds, management of land and water resources, protection of nature, ecocycle and waste management, chemical safety and nuclear safety. Research programs flow from these objectives.

These 15 objectives are a distillation of some 170 uncoordinated goals undertaken through public consultations in the 1990s.

The main task of the Ministry of the Environment is to carry out the Government's priority tasks in the field of the environment as set out in the above legislation. This includes providing directions for environmental research. Twenty-one agencies report to Ministry. These agencies have responsibilities towards reaching the 15 objectives.

An Environmental Objectives Council was set up in 2002 to coordinate efforts to achieve the goals set out in the Bill. It monitors the action being taken and publishes a progress report in June each year. Every four years it carries out an in-depth evaluation, assessing progress towards the objectives and proposing further measures.

This is a 'top-down' implementation approach.

5 United Kingdom

In the UK, the national environmental research agenda is multifaceted; input come from a variety of sources, both inside and outside government. The government's White Paper on sustainable development has created an umbrella under which some environmental research activities can be oriented and coordinated. This can be said to be a loose 'top-down' approach. This is to be expected in a large country with a high level of R&D expenditures spread across a wide variety of activities.

The Department of the Environment, Food and Rural Affairs' Sustainable Development Unit plays a key role in ensuring that research activities are in line with the White Paper. The UK Sustainable Development Research Network links research to policy-making.

The Department of Trade and Industry has set in place a strategy and program to respond to the government sustainable development White Paper. As part of this strategy, a Sustainable

Development Initiative (SDI) was established to support collaborative research and development aimed at improving the sustainability of UK business. It is jointly funded by the Department of Trade and Industry (DTI), the Engineering and Physical Sciences Research Council (EPSRC), the Economic and Social Research Council (ESRC), the Biotechnology and Biosciences Research Council (BBSRC) and the Department of Environment, Food and Rural Affairs (DEFRA).

Other agencies involved in supporting the White Paper are the Natural Environmental Research Council (NERC) and the Environment Agency.

Influences on the environmental research agenda come from a variety of sources, such as the Royal Society and the Sustainable Development Commission.

In recent years, the UK has focused on scientific issues that cut across government departments and agencies in an attempt to get better coordination and effectiveness¹. The Government's Chief Science Adviser has been charged investigate areas where the budgets of government departments could be merged to address cross-cutting areas of research², which include environmental research.

6 United States

The US environmental research agenda, like the UK agenda, comes from various sources, with the National Environmental Policy Act (NEPA) being a major constituent. It can be said to be a loose 'top-down' agenda.

The Council on Environmental Quality is responsible for the implementation of NEPA. All departments and agencies, including science-based ones, must comply with NEPA requirements.

The US goals come from various statements made by the Administration, one of the more powerful being budgetary allocations. The Office of Science and Technology Policy (OSTP), in the Executive Branch, and the Office of Management and Budget (OMB) issued a budget-planning memo for 2004, which stated the following national R&D priorities; R&D for combating terrorism, networking and information technology, nanotechnology, climate change, molecular life processes and education. These priorities are to guide horizontal or interagency initiatives.

Some coordination takes place under the National Science and Technology Council (NSTC), an interagency body comprised of cabinet officers and is chaired by the President. NSTC has organized a number of interagency initiatives in areas of R&D. The NSTC has a Committee on Environment and Natural Resources (CENR).

¹ Roger Voyer, International Comparative Study of Approaches Used to Address Issues that Cut Across Science-Based Departments, Prepared for Environment Canada, March 31, 2003

² HM Treasury, Investing in Innovation; A strategy for science, engineering and technology, July 2002

The purpose of the CENR is to advise and assist the NSTC to increase the overall effectiveness and productivity of Federal research and development (R&D) efforts in the area of the environment and natural resources. The CENR addresses science policy matters and R&D efforts that cut across agency boundaries and provide a formal mechanism for interagency coordination relevant to domestic and international environmental and natural resources issues.

Key agencies with a research mandate that have to comply with NEPA include;

- Department of the Interior (DOI);
- Department of Energy (DOE);
- Environmental Agency (EPA);
- National Oceanic and Atmospheric Administration (NOAA).

The US has numerous groups that attempt to influence the environmental research agenda, such as various national academies and the AAAS.

7 European Union (EU)

The research agenda, including the environmental research agenda, is established through a series of interactions between the Commission and The European research community with the final decision resting with the EU Council. Intense consultations are needed to accommodate the priorities of Member countries. While thematic priorities are set at high-levels, the scientific community determined the programme directions of FP6.

The priorities covered by FP6 include: life sciences, genomics and biotechnology for health; information society technologies; nanotechnologies and nanosciences, 'intelligent' materials, new production processes and devices; aeronautics and space; food quality and safety; sustainable development, global change and ecosystems; citizens and governance; and other promising research areas, including support for participation of small and medium-sized enterprises (SMEs). FP6 also addresses research and innovation, human resources and mobility, research infrastructures, and science/society relationships.

With the aim of testing the research priorities of the Sixth Framework Programme, the Commission invited European and international research players to submit their 'expressions of interest' in the form of suggestions for setting up integrated projects (IP) or networks of excellence (NoE) in these fields of research. The response was massive; some 15,000 consortia from across Europe responded. Some 28% of the responses were for environmental research priorities; 21% for Integrated Programs and 7% for Networks of Excellence.

The environmental research program objectives are as follows;

- The development, dissemination and adoption of innovative technologies and sustainable solutions in energy production and consumption, in particular through increased use of renewable energies.

- The development and introduction of environment friendly, safe and competitive mobility systems for passenger and goods transport, including all forms of surface transport, i.e. road, rail and sea.
- Improved understanding and forecasting capacities in regard to global changes, ecosystems and biodiversity as well as the creation of new management models.

The EU has formal monitoring and evaluation procedures for its Framework Programs.

8 Analysis

8.1 An Analytical Framework

In a recent study, the Technopolis Group presented a four level model of decision-making to assess its findings³. This analytical framework is has been adapted to present the results of this study.

In this framework there are four levels of decision-making;

Level 1 is the highest level. This involves setting overall environmental policy directions and research priorities across the whole National System of Innovation. It may be achieved through advice to government or by more binding means such as legislation or decisions of cabinet.

Level 2 is the level of ministries with environmental responsibilities. Mechanisms can also be found to coordinate the activities across ministries;

Level 3 is more operational, and involves the actions of funding agencies. This level, too, can involve administrative coordination.

Level 4 involves those who actually perform research and innovation. Here as well there can be mechanisms to provide coordination.

Using this framework, the various key bodies responsible for environmental policy and research in the six jurisdictions studied are shown in Exhibit 8.1. A **Level 5** has been added to include independent advisory bodies whose influence is largely indirect as opposed to those that are close to government (e.g.-NSTC which the US President chairs).

³ Technopolis Group: Research and Innovation Governance in Eight Countries; January 2003, p. 19.

Exhibit 8.1: Comparison of Six Jurisdictions

Jurisdiction	Level 1; Goals & Priorities	Level 2; Ministries & Agencies	Level 3; Operations	Level 4: Research Programmes	Level 5: Advisory Bodies
Australia	Env. research priority	DEH DEST	ARC	CSIRO CRCs	AAS CSD
Netherlands	NEPP4	VROM	NOW	Novem NIOO-KNAW	KNAW RMNO
Sweden	15 env. quality goals in legislation	Min. Env.	SEPA Formas MISTRA	SEI	Env. Objectives Council
UK	White Paper	Defra DTI	NERC Research Councils	Env. Agency LINK	Royal Society SDC
USA	NEPA	CEQ OSTP OMB NSTC DOI	NSF	DOE EPA NOAA	PCAST AAAS National Academies
European Union	Env. thematic priority	DGs Competiveness Council	DGs peer review process	IPs NoEs PEER	EEA

All jurisdictions have policies, processes and structures at all levels that shape their environmental research agendas.

8.2 Consultations on Environmental Policies and Priorities

Inputs on the formulation of environmental policies and priorities come from a variety of sources. They range from the pragmatic approaches of the UK and the US to the structured approaches of Australia, the Netherlands and the European Union. Australia, for example, had a three-stage process that lead to the formulation of four environmental research priorities. Sweden appeared to have had an evolutionary approach of continual refinement and distillation of some 170 uncoordinated goals during the 1990s, resulting in a cluster of 15 objectives today.

All jurisdictions, except the Netherlands, have formal processes when it comes to monitoring and reviewing performance against objectives. The Netherlands appears to depend to a large extent on consensual and voluntary approaches to implementation (see reference 7).

8.3 Linking Environmental Policy and Research

All jurisdictions have environmental policies, expressed as; priorities (Australia), White Paper (UK), Plan (Netherlands), Themes (EU) or legislation (Sweden, USA). These policies provide a framework for developing and implementing environmental research agendas.

All jurisdictions have mechanisms linking research to policy. They are as follows;

- **Australia;** government agencies develop research implementation plans on how they will meet the national environmental priority, one of four research priorities arrived at through a three-stage consultative process. Agencies report annually on progress. A government wide evaluation will be undertaken after three years;
- **Netherlands;** highly organized, top-down designed programmes focusing mainly on system renewal through technological solutions² within the context of NEPP4. VROM and Novem play key roles;
- **Sweden;** agencies are expected to align their research activities with the 15 objectives of the legislation. The Environmental Objectives Council plays a key role in coordinating and monitoring progress;
- **UK;** the Sustainable Development Research Network, sponsored by Defra, is central to coordinating and monitoring research activities related to the White Paper on sustainable development;
- **USA;** The Council on Environmental Quality is the main link between the White House and the federal agencies that have responsibilities for the implementation of NEPA objectives. Much of the environmental research agenda appears to flow from this linkage;
- **European Union;** the Directorates-General act on the FP6 environmental research objectives through peer-reviewed projects. New Structures (IPs, NoEs) have been set in place aimed at creating an integrated European Research Area.

All the jurisdictions studied have environmental research agendas that flow from environmental policy frameworks. It can be said that they all have some form of 'top-down' approach; but much co-ordination is needed to ensure effectiveness.

There is always room for tighter linkages between policy and research, especially regarding environmental concerns that transcend specific domains of activity. The Netherlands, the UK and the US, for example, have made deliberate attempts to establish closer ties between the policy and multi-sectoral research dimensions. The Dutch Sustainable Technology Development Programme (STD) can be summarized in two key elements: a long time horizon and system innovation. It is considered to be a model on how to link policy to research. The UK Sustainable Development Research Network coordinates environmental research activities. In the USA, CENR coordinates environmental research activities among federal government agencies.

A recent study⁴ has identified 'best practices' regarding the establishment of national research agendas within an environmental policy context;

- **Defining sustainability criteria for programme design:** Developing underlying

⁴ European Science and Technology Observatory; *ibid* p. 41

concepts for Sustainable Development (SD) framework programmes that encourage both change within the research system to address SD challenges and concepts that facilitate wider societal change through research processes.

- **Developing goal setting concepts:** Developing concepts that define which areas are to be addressed and what the targets look like.
- **Combining research with implementation:** Ensuring that research activities are organized with a clear implementation strategy in mind. This often involves a high level of field actor involvement in the research process.
- **Overcoming organizational and disciplinary boundaries to programme design and implementation:** Identifying and developing methods to facilitate and encourage different parts of the innovation system to work together in the design, organization and implementation of research programmes.
- **Mechanisms for including a wide range of actors:** Identifying and developing concepts that allow research activities to involve field actors.
- **Criteria for selecting and evaluating projects:** Identifying and developing criteria for selecting individual projects.
- **Creating synergies and continuity within programmes and between programmes:** Building research networks and activities that facilitate the collaboration of disciplines beyond the scope of the individual programme.

8.4 External influences on national environmental research agendas

The major external influences on national environmental research agendas appear to be the following:

- **Advisory bodies;** all jurisdictions have bodies that give advice. Some are close to the decision-making power (e.g.- NSTC in the US) while others are more independent (e.g.- Royal Society in the UK; AAS in Australia);
- **The scientific community;** all jurisdictions have inputs from their respective scientific communities. These inputs can be either structured (e.g.- EU) or not (e.g.- AAAS in the US);
- **International organizations;** international forums provide venues to develop a broad consensus. For example, the OECD released a report entitled *Environmental Strategy for the First Decade of the 21st Century: Adopted by OECD Environment Ministers, 16 May 2001*

8.5 The case of federated states

Federated states require interaction between the federal and other levels of government to have a truly national thrust.

The Australian Government has stated that it intends to work with State and Territory Governments to implement the priorities.

Under NEPA, US states and municipalities have to comply with NEPA directives when they receive federal government funding for environmental projects.

9 Conclusions

All six jurisdictions studied have environmental research agendas that are linked to their respective environmental policy frameworks.

Since Australia has similar governance structures and institutions to those in Canada, the newly established Australian approach to setting and acting on its environmental research agenda is possibly the most attractive model for Canada.

APPENDIX: Profiles

A-1) Australia

1.0 The Policy Context

After the adoption of the National Strategy for Ecologically Sustainable Development in the early 1990s, efforts are now directed at breathing life into Australia's sustainable development policy agenda and meeting the challenge of integrating the practice of sustainable development into economic and sectoral decisions. Sectoral strategies consistent with ecologically sustainable development have recently been completed for agriculture, forestry, waste, biodiversity and water. State and local governments have the main responsibility in addressing issues such as water, air and waste management, land use, transport planning and natural resource management.

As well, in 2001, the Australian Government published its innovation strategy, *Backing Australia's Ability*. This initiative committed \$3 billion to science and innovation and flagged the need to direct research investment in areas in which Australia has, or is likely to achieve, competitive advantage. This initiated a process to establish national research priorities.

The national research priorities were developed in three stages and will continue to evolve in future years to respond to changing circumstances. The first stage, in mid-2002, was an inclusive consultative process that spanned cities and regional and rural Australia and focused on a framework for setting priorities. A major outcome was a broad consensus in the community on the value of setting research priorities. The second stage was the setting of national research priorities. An expert advisory committee chaired by Dr. Jim Peacock, President of the Australian Academy of Science, examined more than 180 public submissions about possible research priorities and developed a short-list for the Government's consideration. In late 2002, the Government considered these suggestions and, on December 5th, announced four 'whole-of-government' themes of long-term importance to Australia:

5. An Environmentally Sustainable Australia;
6. Promoting and Maintaining Good Health;
7. Frontier Technologies for Building and Transforming Australian Industries; and
8. Safeguarding Australia.

These priorities draw on many fields of research. In developing the priorities, the initial focus was on the contributions of science and technology. It was felt that the key to achieving effective outcomes for national research priorities required a deeper understanding of the human dimension, particularly how people are affected by and respond to technological change, and to other challenges and opportunities. Therefore, in the third stage, the Government worked with the social sciences and humanities research communities to encompass their knowledge and contributions in order to refine and elaborate the four priorities.

The priorities embrace a vision for research for all Australia. The Australian Government intends to work with State and Territory Governments to implement the priorities.

All research and research funding bodies of the Australian Government are expected to participate in implementing the priorities to the extent that they are consistent with their mandates or missions. The research community, which advises the Government on the best way to proceed, drives implementation of the priorities.

Australian Government agencies develop plans outlining how they propose to implement national research priorities and submit them to Government. These plans include a description of strategies for building critical mass and for enhancing collaboration. They also indicate the current and projected levels of investment in the priority areas and identify any structural impediments or other issues likely to limit their capacity to respond. National priorities are to be funded from within the existing resources of the agencies and funding bodies. This will involve agencies and funding bodies boosting the relative emphasis given to national priorities within their operations.

The plans are expected to be released publicly, following a process to ensure they adequately deliver the Government's broad objectives in setting national research priorities. The first submissions were made by May 2003. Agencies will report annually on progress in meeting the research priorities. The government will review progress in meeting the research priorities in about three years. The Department of Education, Science and Technology is responsible for the implementation process. This is a new priority setting process, which is currently being assessed, and a progress report is expected to be published by the end of the year⁵.

Agencies with an environmental mandate develop their research agendas in line with the first priority, which is expressed as follows;

Transforming the way we use our land, water, mineral and energy resources through a better understanding of environmental systems and using new technologies.

The priority goals are;

- Water, a critical resource
- Transforming existing industries
- Overcoming soil loss, salinity and acidity
- Reducing and capturing emissions in transport and energy generation
- Sustainable use of Australia's biodiversity
- Developing deep earth resources

⁵ Michelle Leggo; Department of Education, Science and Technology, private communication

1.2 Department of the Environment and Heritage (DEH)

The Department of the Environment and Heritage advises the Australian Government on policies and programs for the protection and conservation of the environment, including both natural and cultural heritage places.

It manages a number of major programs. The most significant of those dealing with natural resource management come under the umbrella of the Natural Heritage Trust and the National Action Plan for Salinity and Water Quality. Both the Trust and National Action Plan are administered jointly with the Department of Agriculture, Fisheries and Forestry.

The Department of the Environment and Heritage works with Australian business organizations and industrial sectors, the community and other levels of government to protect Australia's atmosphere and to improve the environmental performance of Australian industry.

It is concerned with the conservation and appreciation of Australia's natural and cultural heritage places.

The Department of the Environment and Heritage administers environmental laws, including the *Environment Protection and Biodiversity Conservation Act 1999* and a range of other Acts.

It is responsible for Australia's participation in a number of international environmental agreements

Research is undertaken under the authority of the Supervising Scientist whose mandate is to working to protect the environment through:

- environmental research and monitoring
- environmental supervision, audit and inspection

The research activities are in areas such as uranium mining, wetland ecology, environmental monitoring and protection.

1.3 Commonwealth Scientific & Industrial Research Organization (CSIRO)

CSIRO, Australia's equivalent to Canada's NRC, has a Sustainable Ecosystems Program which focuses research into five key disciplinary areas:

- Tropical Landscapes
- Agricultural Landscapes
- Rangelands and Savannas
- Wildlife, Pests and Diseases

- Resource Futures

CSIRO also has activities in atmospheric research, marine research, exploration and mining, flora resources and management, forestry and forest products, land and water and energy technology.

1.4 Australian Research Council (ARC)

ARC's mandate is to advance Australia's capacity for quality research to the economic, environmental, social and cultural benefit of the community. It is a funding agency.

In the environmental area, ARC has expressed the following research priorities for 2004-2005 under the government's first research priority, 'An Environmentally Sustainable Australia';

1 Water – a critical resource

Ways of using less water in agriculture and other industries, providing increased protection of rivers and groundwater and the reuse of urban and industrial waste waters.

Australia is one of the driest continents and is dependent upon access to freshwater supplies for economic and social development. It has a complex geological structure and unique ecosystems, flora and fauna. Enhancing our understanding of the links between water availability and these factors will result in a better understanding of sustainable water management practices.

2 Transforming existing industries

New technologies for resource-based industries to deliver substantial increases in national wealth by reducing environmental impacts on land and sea.

Resource-based industries underpin much of Australia's prosperity and have the potential to do so in the future. For example, Australia remains highly prospective for minerals discoveries and highly attractive for the development of new era foods from agricultural and marine sources. Our competitive advantage will depend on research and new technologies.

3 Overcoming soil loss, salinity and acidity

Identifying causes and solutions to land degradation using a multidisciplinary approach (examples include incorporating hydrology, geology, biology and climatology) to restore land surfaces.

The Australian landscape is fragile: soil salinity, acidity, and nutrient levels pose significant, long term challenges for agriculture and the environment. Research is helping to find solutions to these problems. For example, the *National Land and Water Resources Audit* shows the extent of salinity in the Australian environment and illustrates Australia's leading edge in national mapping of critical resource data.

4 Reducing and capturing emissions in transport and energy generation

Alternative transport technologies and clean combustion and efficient new power generation systems and capture and sequestration of carbon dioxide.

Australia is well positioned to produce world class solutions to reduce and capture greenhouse gas emissions and the Government is committed to meeting the emissions target set for Australia at Kyoto. We are also well placed to develop alternative energy technologies and ecologically sustainable transport and power generation systems.

5 Sustainable use of Australia's biodiversity

Managing and protecting Australia's terrestrial and marine biodiversity to develop long term use of ecosystem goods and services ranging from fisheries to ecotourism.

Australia has a unique and rich flora and fauna. Our complex ecosystems are resilient and have adapted to events such as drought and fire, and underpin the health of our agricultural, fisheries and tourism industries. There is a need for a more comprehensive understanding of these natural systems and the interplay with human activities.

6 Developing deep earth resources

Smart high-technology exploration methodologies, including imaging and mapping the deep earth and ocean floors, and novel efficient ways of commodity extraction and processing (examples include minerals, oil and gas).

Many of Australia's known mineral assets may be nearly exhausted within the next decade. New land-based deposits are believed to be buried deeper in the crust and the deep marine areas surrounding Australia are also largely unexplored. New technologies, such as remote sensing, indicate scientists are on the brink of being able to 'see' inside the earth and identify deeply buried deposits.

1.5 Cooperative Research Centres (CRCs)

The CRCs establish collaborative links between researchers in universities, government and industry in order to create a multi-disciplinary, multi-institutional research environment focussed on addressing industry and user needs. These collaborative links are aimed at increasing efficiency and cost effectiveness of research and research training and make better use of research resources through sharing of major facilities and equipment. As of July 2002, there were 62 CRCs spread over 40 locations across Australia. On average, a CRC would have some 30 full time researchers and an annual budget of \$7 million (Aus) with about \$ 3 million (Aus) coming from government.

In the environmental area, there are the following CRCs;

- Reef Research Centre
- Catchment Hydrology
- Tropical Savannas
- Water Quality and Treatment
- Waste Management and Pollution Control
- Conservation and Management of Marsupials
- Sustainable Tourism
- Sustainable Production Forestry

1.6 Commission on Sustainable Development (CSD)

The Commission on Sustainable Development was formed in 1992 after the Earth Summit (United Nations' Conference on Environment and Development) in Rio de Janeiro, to monitor and report on the implementation of the Earth Summit agreements, such as Agenda 21

Agenda 21 is an international framework agreement for pursuing global sustainable development that was endorsed by national governments, including the Australian Government, at the 1992 Rio Earth Summit. Australia's commitment to Agenda 21 is reflected in a strong national response to meet the country's obligations under this international agreement. For example, all levels of government endorsed the *National Strategy for Ecologically Sustainable Development* in 1992.

- Annual CSD reports by Australia identify national measures that contribute to the country's commitments under Agenda 21.

1.7 Australian Academy of Science (AAS)

As an independent body of Australia's leading research scientists, the Academy can bring together experts from universities, industry and government to consider and report on scientific issues.

The Academy supports 22 National Committees. Each Committee, widely representative of its discipline, fosters a designated field of science, and serves as a link between Australian and overseas scientists in that field. The Committees are frequently called on to comment on proposals and advise on science policy.

Through the National Committees and ad hoc committees, the Academy prepares reports, submissions and public statements.

The Committees that have an environmental element are the following;

- Antarctic Research
- Biomedical sciences
- Earth sciences
- Geography
- Plant and animal sciences
- Sustainability

A-2)Netherlands

2.1 The Policy Context

The Dutch Cabinet published its fourth National Environmental Policy Plan (NEPP4) in June 2001. It will remain in effect from 2002 to 2006. It specifically addresses persistent environmental problems and sets the agenda and the strategy for dealing with these problems.

NEPP4 takes a long-term perspective (2030), focusing on transitions to sustainability in three areas: energy efficiency, agriculture and biodiversity, and natural resources.

Input was based on the opinions and wishes of society as a whole, including the perspectives of the business and nonprofit sectors, is crucial to the process. Discussions were held with regional and local authorities and with the various stakeholders. This is the broad framework within which the NEPP4 took shape. Another key element of NEPP4 included building and maintaining a strategic shared vision for managing short-, mid-, and long-range environmental problems. Six requirements to support this vision were established:

1. Environmental policy must be easier for people to identify with;
2. Environmental policy must be based on down-to-earth considerations;
3. Environmental policy must be placed in an international context;
4. Environmental policy must be expressed in terms of sustainable development;
5. Environmental policy must be rooted in the assumption that the relevant parties must shoulder their own responsibilities; and
6. Environmental policy must be driven by clear collective values.

The NEPP4 Project Team, an interdepartmental working party was charged with organizing these discussions. Almost all the Ministries were represented on the Project Team. These explorations were completed by the summer of 2000, after which firm decisions were taken about the content of the NEPP4. The NEPP4 was submitted to the Lower House early in 2001.

This Plan builds on previous Plans including the 1989 Dutch National Environmental Policy Plan "To choose or to lose" which adopted Sustainable Development (SD) as a micro-economic policy objective. The plan initiated supporting new research lines on SD that went above and beyond more traditional research on environmental themes. The Dutch policy towards SD is based on a co-operation model that requires a balance to be made between environmental, social and economic objectives. This requires a paradigm shift to a system where all three policy objectives can be met. This change in policy is not market led. Most SD research in the Netherlands is focused on de-linking economic growth from environmental stress and achieving "trend breaks" in production and consumption patterns. The focus is on the development of tools in support of the transition process. The Sustainable Technology Development Programme (STD) was a deliberate attempt to link sustainability policy and technology policy⁶.

The starting point of the Dutch STD programme, which was conducted in the period 1993-1998, was a *time horizon of 50 years*. It was argued that given the expected growth of prosperity in that period by a factor 5, of world population by a factor 2 and, in the meantime the inordinately large impact on the environment (factor 2), the use of the environment and natural resources should in the same period be reduced by a factor 20. This 'factor 20' is not a strict dogma but can be regarded as a motive to think about what can be done now to realize sustainable development in

⁶ European Science and Technology Observatory; National Research Activities and Sustainable Development, A survey and assessment of national research initiatives in support of sustainable development; Synthesis Report, Prepared by: Katy Whitelegg and Matthias Weber (ARC Seibersdorf research GmbH, Austria) June 2002, p. 33

2050. Another element of STD was *system innovation*. Trying to achieve sustainable technology development, one has to deal with culture, structure and technology. *Culture* stands for needs like shelter, safety, health and comfort. It also concerns traditions, behaviour, habits at home and at work, etc. People often only accept changes when these connect with their needs and are attractive. *Structure* stands for the existing rules, laws, the economic system, the labour market, spatial planning, physical infrastructures, networks between people and companies, knowledge etc. *Technology* concerns all current and future possible technological options and solutions. Technology in itself is often not the problem. However, in implementing technology on a larger scale, culture and structure often appear to raise barriers. STD showed that only a *integral* analysis of culture, structure and technology can achieve the realization of system innovation and steps towards sustainable development in the year 2050. STD has developed a methodology that can support long-term policy planning as well as the formulation and implementation of STD-projects.

The STD programme did not regard itself as a research and technology programme as such but could be seen as a type of meta-research programme seeking to study methods for achieving the quantum jumps in technology development which were both intended and required for sustainable development. The programme also regarded itself as a stimulation and demonstration programme for showing the goals and possibility of sustainable technology development, in order to initiate self-organised processes of sustainable innovation. The aim was to demonstrate the practicability and benefits of the sustainability model as a new paradigm for technology development. The programme was intended to function as a catalyst. As the development of sustainable technology is regarded as a long-term process, the programme served primarily:

- to give industry, major national research facilities and universities initial experience of integrating the model into their research and development work and to stimulate new networking between the relevant actors, and
- to explore lines of research which could lead to sustainable technology development with the help of "illustrative processes".

The criterion for the success of the programme, which was supported by five ministries with a limited five-year term (1993-1998) and budget (NFL 25 million) was not the development of a mature sustainable technology ripe for application but rather the adaptation and further development of the research results from the programme by companies, social groups and research facilities.

Although the STD programme was not based on a new methodology, but on a methodology already proven in other contexts, it did represent an innovative approach to research and technology policy in its combination of different procedures with respect to the goal of initiating new innovation processes which cannot be derived directly from the further development of existing lines of technology.

The methodology of the programme essentially involves the following steps. Based on analysis of areas of demand intended to show which needs will exist in 2040 in various areas, a so-called "back-casting" procedure was used to select suitable examples of technologies which could ensure sustainable satisfaction of these needs. Illustration processes were used to study the

technological and economic conditions for their feasibility. Concrete research and development programmes were then elaborated for some of these illustrated lines of technology, and preparation made for their implementation.

The definition of the tasks for research and technology development were not based on existing lines of technology: instead, the environmental objectives set in the Dutch national environmental plan were used as a basis for determining the problems in various areas of needs to be solved with respect to sustainable development. With this as orientation, suitable lines of technology and research tasks were defined. The programme also seemed to have succeeded in combining fundamental and applied research by establishing or stimulating new research and development networks. The back-casting process also ensured long-term orientation in the research and development projects pursued, which in individual cases have also been linked with medium-term interests of industry. Overall, the STD programme seems to have succeeded in individual projects in establishing networks of actors from politics, science and industry to pursue long-term research and development processes oriented towards sustainable development. In addition to the individual projects promoted, the programme seems to offer a promising way of stimulating innovation processes for sustainable development which, despite the necessary long-term and uncertain development prospects, are capable of being attached to strategies and interests of the actors in the system of innovation – for example, several of the ideas thrown up by the programme are currently being taken up and pursued by other Dutch research programmes

The Dutch Government considers it important to seek consensus on all aspects of its environment policy⁷. Extensive consultations take place with various social partners and NGOs. Much information is provided on all aspects of environmental problems and their possible solutions. The general approach of full disclosure is a characteristic element of Dutch environmental policy. The quality and quantity of printed material released to the public are among the highest in OECD countries.

2.2 Ministry of the Environment (VROM)

VROM operates under the leadership of the Minister and the State Secretary. The Minister and the State Secretary are responsible to the Lower House of the Parliament.

VROM works together with several organizations, groups and individuals, including:

- local, regional national and international governments;
- companies and businesses;
- intermediary organizations and institutions;
- interest groups;
- inhabitants of the Netherlands.

The main overall objective of VROM is: "Working for a permanent quality of the living environment."

⁷ OECD Working Party on Environmental Performance; Environmental Performance Reviews (1st Cycle), Conclusions and Recommendations, 32 Countries, 2000, p.179

The above objectives are translated into concrete aims annually in the budget of the Ministry. The most important guidelines for VROM are the following:

- Freedom in responsibility; Citizens are free to make decisions in a socially responsible way.
- Sustainable development; Managing the living environment, energy, raw material and nature in a way that will allow future generations to benefit from them optimally.
- Diversity; The quality of the living environment.
- Social justice; Satisfying expectations and wishes of the general public as well as being considerate towards the weak in our society.

VROM tries to put the above plans into practice by:

- preparing memoranda formulating the views of VROM;
- establishing legislation in co-operation with social partners;
- inspections aimed at making sure that rules are observed;
- supplying organizations and individuals with subsidies;
- influencing the social agenda in order to feature subjects and opinions important for VROM.

The roles of VROM regarding the above are: guidance, consulting, reacting, facilitating, delegating, controlling, stimulating and inspiring partners. VROM is not an executive organ. It is primarily a policy making body that creates favourable circumstances for others. The most adequate way to describe VROM is to call it a network-ministry.

2.3 Netherlands Agency for Energy and the Environment (Novem)

As an agency of the Dutch Ministry of Economic Affairs, Novem supports both government and market parties in implementing sustainable development, and ensures that government goals become a practical reality. As intermediary, Novem matches government and market objectives, disseminates knowledge and encourages technological development.

Many programmes are carried out on behalf of various Dutch ministries, such as the Ministry of Economic Affairs; Housing, Spatial Planning and the Environment; Transport, Public Works and Water Management; and Agriculture, Nature Management and Fisheries.

Novem currently has approximately 500 employees.

To summarize, Novem:

- manages and coordinates energy and environment-related programmes and studies
- advises the government on sustainable development
- promotes knowledge transfer

- supports the market introduction of new technologies
- evaluates and monitors the effects of government policies

2.4 Netherlands Organisation for Scientific Research (NWO)

NWO promotes scientific research at Dutch universities and research institute and seeks to raise the quality of that research.

NWO also promotes the dissemination and use of research results achieved wholly or partly with NWO support. NWO pursues an active information policy aimed both at researchers and at the media, politicians and the public at large.

To help it achieve these aims NWO receives funding of around EUR 450 million (roughly NLG 1 billion) from the government. Most of this funding comes from the Ministry of Education, Culture and Science, though other ministries also contribute. NWO targets all fields of research activity pursued in the Netherlands, from physics to theology and from information technology to research on ethnic minorities.

NWO also responds to promising trends and to new, often multidisciplinary developments in research through the introduction of Themes. There are currently nine themes. An environmental theme is 'System Earth' which focuses on Climate change research geared to the Dutch concern of rising sea levels and flooding.

2.5 Royal Netherlands Academy of Arts and Science (KNAW)

The Academy's mission is to promote scientific research. Its main functions are;

- Advising the government on matters related to scientific research
- Assessing the quality of scientific research (peer review)

- Providing a forum for the scientific world and promoting international scientific cooperation
- Acting as an umbrella organization for the institutes primarily engaged in basic and strategic scientific research and disseminating information

One of its institutes is The Netherlands Institute of Ecology (NIOO-KNAW) which carries out fundamental and strategic research on individual organisms, populations, ecological communities and ecosystems. The research takes place at three centres. The Centre for Limnology (CL) in Nieuwersluis studies the ecology of fresh water. The Centre for Estuarine and Marine Ecology (CEME) in Yerseke concentrates on the ecosystems of brackish and salt water, and the Centre for Terrestrial Ecology (CTE) in Heteren focuses on land-based ecology.

2.6 Dutch Advisory Council for Research on Spatial Planning, Nature and the Environment (RMNO)

The RMNO advises the government, either of its own accord or in response to requests from ministries, on the content and organization of research concerning spatial planning, the environment, nature and landscape. This includes not only research in the natural sciences and technological research, but also research in the social and political sciences. Multidisciplinary or interdisciplinary research is often needed to analyze environmental problems and their possible solutions.

Its main tasks are;

- *drawing attention*

drawing attention to trends in society and science which are relevant to both current and future problems involving nature and the environment, and on research into these problems;

- *identifying*

determining knowledge gaps and formulating research needs with a view in order to find ways of solving future nature conservation and environmental problems;

- *acting as a go-between*

acting as an intermediary between the parties involved in research on the environment, nature and landscape, for instance assisting social groups in formulating research needs and improving communication between people who need knowledge and researchers;

- *stimulating*

stimulating public debate on research into nature conservation and environmental problems on the mid-long term.

Its target groups are;

- Ministries: Economic Affairs (EZ), Agriculture, Nature Management and Fisheries (LNV), Education, Culture and Science (OCW), Public Works and Water Management (V&W) and Housing, Spatial Planning and the Environment (VROM);
- local authorities: provinces, municipal councils (metropolitan and urban) and district

water boards;

- knowledge institutes;
- large firms and branch organizations;
- social organizations;
- the European Commission, the General Directorates of the European Union, the Organization for Economic Cooperation and Development (OECD) and other international organizations.

A-3) Sweden

3.1 The Policy Context

After almost a decade of deep economic crisis, the Swedish growth policy agenda went through important changes towards the end of the 1990s. Having focused heavily on fighting the large public budget deficits during the first half of the 1990s, the policy agenda shifted to include more growth policy measures, such as instruments found in industrial and research policy. The policy reformulation took place against the background of almost three decades of comparatively slow growth in Sweden and increasing regional economic imbalances.

The economic recession and entry into the European Union have provided the context for economic and environmental decision making in Sweden. The Government's overall environmental policy objective is to solve Sweden's major environmental problems within a generation, i.e. 25 years. This policy objective was set out in the Bill *Swedish Environmental Quality Goals – An Environmental Policy for a Sustainable Sweden* (Gov. Bill 1997/98:145). The 15 directions of Sweden's environmental policy, set out in this legislation, are to: protect human health, conserve biological diversity, manage natural resources so as to ensure their sustainable use, and protect natural and cultural landscapes. Environmental policies, today, focus on the following 15 themes: climate change, ozone layer depletion, acidification and ground-level ozone, urban environmental quality, eutrophication, metals and persistent organic compounds, management of land and water resources, protection of nature, ecocycle and waste management, chemical safety and nuclear safety. Research programs flow from these objectives.

These 15 objectives are a distillation of over 170 uncoordinated goals undertaken through various public consultations in the 1990s.

3.2 Ministry of the Environment

The main task of the Ministry of the Environment is to carry out the Government's priority tasks in the field of the environment as set out in the above legislation. This includes providing directions for environmental research.

Agencies for which the Ministry is responsible are the following;

Environmental Management Market

National Board of Housing, Building and Planning

Finnish-Swedish Frontier Rivers Commission

National Organization for Aid to Owners of Private Small Houses

Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning

National Chemicals Inspectorate

Board of the Swedish Nuclear Waste Fund

National Land Survey

Environmental Advisory Council

National Environmental Protection Agency

Stadsmiljörådet

Swedish Geotechnical Institute

Swedish Institute for Ecological Sustainability

Swedish Nuclear Power Inspectorate

Swedish Radiation Protection Institute

National Water Supply and Water Sewage Tribunal

Swedish Water and Air Pollution Research Institute

Foundation for Strategic Environmental Research

Stockholm Environment Institute, SEI

Swedish Meteorological and Hydrological Institute

Swedesurvey

3.3 Environmental Objectives Council

An Environmental Objectives Council was set up in 2002 to coordinate efforts to achieve the goals set out in the Bill. It monitors the action being taken and publishes a progress report in June each year. Every four years it carries out an in-depth evaluation, assessing progress towards the objectives and proposing further measures. The Council is served by a Secretariat based at the Swedish Environmental Protection Agency.

The Council includes representatives of the authorities responsible for the objectives, other sectoral agencies, county administrative boards, local authorities, the Confederation of Swedish Enterprise and NGOs. This collaborative approach is designed to promote progress towards the objectives on a broad front.

Authorities responsible for the Objectives

Authorities	Responsibility
Swedish Environmental Protection Agency	Environmental objectives: Reduced climate impact Clean air Natural acidification only A protective ozone layer Zero eutrophication Flourishing lakes and streams A balanced marine environment, flourishing coastal areas and archipelagos Thriving wetlands A magnificent mountain landscape Broader issue related to the objectives: The natural environment
Swedish Radiation Protection Authority	Environmental objective: A safe radiation environment
National Chemicals Inspectorate	Environmental objective: A non-toxic environment
Geological Survey of Sweden	Environmental objective: Good-quality groundwater
National Board of Forestry	Environmental objective: Sustainable forests
Swedish Board of Agriculture	Environmental objective: A varied agricultural landscape
National Board of Housing, Building and Planning	Environmental objective: A good built environment Broader issue related to the objectives: Land use planning and wise management of land, water and buildings

National Heritage Board	Broader issue related to the objectives: The cultural environment
National Board of Health and Welfare	Broader issue related to the objectives: Human health
County administrative boards	Broader issue related to the objectives: Regional implementation and evaluation

3.3 Swedish Environmental Protection Agency (SEPA)

This is a key agency responsible for achieving several of the 15 environmental objectives mentioned in the Bill. To this end the agency supports environmental research.

The Swedish Environmental Protection Agency (Naturvårdsverket) is making available funds totalling SEK 100 million per year for environmental research (approx \$17 million CDN). Researchers at universities and colleges are invited to submit applications. Some of the funding, SEK 83 million, will be used primarily to finance research in support of the work of Naturvårdsverket, and to support the combined research and development efforts of Naturvårdsverket and the business sector. The latter research is being performed by the Swedish Environmental Research Institute (IVL) at a maximum funding level of SEK 18 million. SEK 16 million of the funds is to be used to obtain and disseminate the necessary knowledge to ensure sustainable utilization and otherwise good management of the country's game stocks (Game Research).

The Environmental Research Council (ERC), a special body appointed by the Swedish government, is responsible for making all decisions on the awarding of grants. The ERC has drawn up a set of policies and guidelines on research. The Research Secretariat at Naturvårdsverket provides administrative support to the ERC.

3.4 Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas)

Formas, the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning, is a governmental research-funding agency related to several ministries, the Ministry of Environment, the Ministry of Agriculture, the Ministry of Industry, Employment and Communications and the Ministry of Education and Science.

Formas encourages and supports scientifically significant research related to sustainable development. Especially this means support in the areas of the environment, agricultural sciences including forestry, horticulture, veterinary medicine, food, fish and reindeer husbandry, and spatial planning including building sciences and community systems. The projects supported cover a wide range of approaches from basic research to more applied efforts and within the built environment also demonstration and experimental projects.

Formas stimulates activities aiming at cross-sectoral and interdisciplinary approaches within its area of responsibility.

Formas provides mechanisms for the communication of research results and stimulates the public debate on issues of concern emerging from or related to research for sustainable development

Formas was partly responsible for the Swedish contacts with the EU programmes under the 5th Framework Programme on *Environment* and *Quality of Life*. It also had several assignments related to the urban oriented actions within the 5th Framework Program.

Formas represents Sweden in several IEA programmes and annexes and promotes Nordic research co-operation within its areas of responsibility.

Formas is the Swedish member organisation of IIASA, the International Institute for Applied System Analysis

3.5 The Foundation for Strategic Environmental Research (MISTRA)

The Foundation for Strategic Environmental Research, MISTRA, supports strategic environmental research with a long-term perspective, aiming to solve major environmental problems. The main part of MISTRA's funding is focused on broad-based interdisciplinary programmes.

An endowment of more than SEK 4.7 billion, as of Jan. 1, 2001, makes it possible to allocate an annual sum of some SEK 250 million to funding of research. This makes MISTRA the largest source of funding for environmental research in Sweden.

Boundaries - primarily those between research and practical implementation - are to be bridged by a MISTRA programme. A MISTRA programme must be able to provide users in enterprises, authorities and organisations, as well as international negotiators, decision-makers on different levels and interest groups, with the latest scientific findings, irrespective of sectoral boundaries. A MISTRA programme must also provide the research community with problems as they have been formulated by the problem owners/users, irrespective of its disciplinary boundaries.

3.6 The Stockholm Environment Institute (SEI)

SEI is an independent, international research institute specializing in sustainable development and environment issues. It works at local, national, regional and global policy levels. The SEI research programmes aim to clarify the requirements, strategies and policies for a transition to sustainability. These goals are linked to the principles advocated in Agenda 21 and the Conventions such as Climate Change, Ozone Layer Protection and Biological Diversity. SEI along with its predecessor, the Beijer Institute, has been engaged in major environment and development issues for a quarter of a

century. It seeks to be a leader in the creation of a new field of sustainability science aimed at understanding the fundamental character of interaction between nature and society, and to contribute to the capacities of different societies to build transitions to more sustainable futures.

The Swedish Government established the Institute with a strong mandate to provide intellectual and research leadership to develop sustainable development strategies and initiatives throughout the world. SEI has established an enviable reputation as a non-profit and non-partisan research institute, as an honest broker in its handling of complex environmental and social issues, as a research institution committed to rigorous and objective scientific analyses in support of improved public policies, and as an agent of creative change in seeking global transitions to a more sustainable world.

SEI brings substantial resources to this role. It has research centres in Sweden, Estonia, the United Kingdom, and the United States, and an office in Bangkok. Each of these centres brings a commitment to integrated analyses of complex problems, drawing upon the full range of scientific and policy expertise across the SEI centres. Each centre has its own personality and foci of interests, and each operates with significant autonomy while participating in the five cross-cutting SEI research programmes. And each centre shares a common commitment to policy-relevant research, and to the goal that SEI should make a difference in the global quest for a more equitable and sustainable planet.

The processes of institute research and think-tank activities also have distinguishing features. SEI purposely selects major issues that act as impediments to creating more sustainable societies so that scientific progress has potential for shaping important human interventions and processes of change. The SEI approach is typically highly collaborative and participatory, involving partners in the regions and places of research so that local knowledge and values are mobilized and explicitly considered. Projects are designed to incorporate the building of regional capacities and the strengthening of institutions so that the long-term capabilities of SEI's collaborators are enhanced as part of the process. Running through SEI programmes and efforts is an uncompromising commitment to high ethical standards for the conduct of research and the provision of policy advice.

A-4) United Kingdom

4.1 The Policy Context

In May 1999, the UK government published its White Paper on a strategy regarding a sustainable development⁸.

The strategy for sustainable development has four main aims. These are:

- social progress which recognizes the needs of everyone;
- effective protection of the environment;
- prudent use of natural resources; and
- maintenance of high and stable levels of economic growth and employment.

⁸ UK Government: A Better Quality of Life: a strategy for sustainable development in the UK, 1999

For the UK, priorities for the future are:

- more investment in people and equipment for a competitive economy;
- reducing the level of social exclusion;
- promoting a transport system which provides choice, and also minimizes environmental harm and reduces congestion;
- improving the larger towns and cities to make them better places to live and work;
- directing development and promoting agricultural practices to protect and enhance the countryside and wildlife;
- improving energy efficiency and tackling waste;
- working with others to achieve sustainable development internationally.

Government policy will take account of ten guiding principles;

- putting people at the centre;
- taking a long term perspective;
- taking account of costs and benefits;
- creating an open and supportive economic system;
- combating poverty and social exclusion;
- respecting environmental limits;
- the precautionary principle;
- using scientific knowledge;
- transparency, information, participation and access to justice;
- making the polluter pay.

Departments and agencies having an environmental mandate take their lead from this strategy statement.

As proposed in the White Paper *A better quality of life* the Government has established the Sustainable Development Commission whose role is to advocate sustainable development across all sectors in the UK, review progress towards it, and build consensus on the actions needed if further progress is to be achieved. Its specific objectives are to:

- review how far sustainable development is being achieved in the UK in all relevant fields, and identify any relevant processes or policies which may be undermining this;
- identify important unsustainable trends which will not be reversed on the basis of current or planned action, and recommend action to reverse the trends;
- deepen understanding of the concept of sustainable development, increase awareness of the issues it raises, and build agreement on them;
- encourage and stimulate good practice.

4.2 Department of the Environment, Food and Rural Affairs (Defra)

Defra is a major funder of science; spending of over £300m annually on research and other scientific activities such as surveillance and monitoring.

Defra has recently issued a science and technology (S&T) strategic plan⁹ which centers on six areas;

- Conservation and Use of Natural Resources
- Marine and Coastal Environments
- Thriving Rural Economies and Communities
- Climate Change and Other Environmental Risks
- Sustainable Farming and Food
- Public and Animal Health

The strategic plan includes a set of performance indicators;

Science quality

- the proportion of research projects subject to external peer review;
- the proportion of the budget for research and development placed through open competition and the number of individual contractors and distribution of spend;
- the proportion of Defra's science expenditure with contractors that have undergone quality auditing;
- the results from our in-house quality assessment programme;

Recognizing and managing science risks

- the extent to which horizon-scanning activities support our science programmes;

Uptake of science and technology transfer

- expenditure through LINK programmes;
- commercialization of research outputs (in the light of the Public Accounts Committee recommendations following a report by the National Audit Office);

Partnership working

- the proportion of budgets for research and development committed to co-ordinated or joint programmes with other funders and the number of joint facilities supported;

Engagement in common EU programmes

- the extent of our involvement in collaborative EU research programmes and

Communication with the public and stakeholders

- surveys of the degree to which the public accept that Defra policies are soundly based on scientific evidence.

⁹ Delivering the Evidence – Defra's Science and Innovation Strategy (2003-06)

Defra's Sustainable Development Unit was consulted to ensure that The S&T strategic plan was in keeping with the White Paper. Defra is currently undertaking a project to identify the scientific challenges and opportunities that may emerge over the next ten years and to which Defra may need to respond. This work also links with the Delivering the Evidence report (see reference 5). The main aim of the project is to scope the likely nature of our scientific requirements up to 2013 so that we can plan for appropriate investment in science (including social and economic) over that time span¹⁰.

On 18 June 2002, the Secretary of State launched Defra's sustainable development strategy, *Foundations for our Future*.

The strategy clarifies what the UK government's sustainable development strategy means in practice for the Department's policy development and decision-making, as well as its own operations. In particular the strategy:

- sets out the principles and processes which Defra needs to adopt to ensure all its policies address economic, social and environmental objectives at the same time;
- identifies Defra policy areas which pose the greatest challenges or can make the greatest contribution to the achievement of sustainable development;
- looks at the scope to contribute to sustainable development through Defra's own operations (e.g. energy, waste, travel, procurement).
- The strategy also establishes a way of monitoring and reporting on progress.

The UK Sustainable Development Research Network is a UK wide initiative, sponsored by the Defra Sustainable Development Unit and co-ordinated by the Policy Studies Institute (PSI) in collaboration with the Centre for Sustainable Development (CfSD) at the University of Westminster and the Centre for the Study of Environmental Change and Sustainability (CECS) at the University of Edinburgh. The aim of the Network is to contribute to sustainable development in the UK by facilitating the better use of evidence and research in policy-making. Its specific aims include:

- Monitoring and mapping research relevant to the UK Sustainable Development Strategy
- Fostering a network of organizations with an interest in sustainable development research
- Facilitating the flow of information about current and planned activities; and
- Promoting sustainable development research activity by influencing funders and research organizations.

In December 2001 the Network published a document entitled "Towards a New Agenda for UK Sustainable Development Research". The document identified:

- Priorities for research to underpin the implementation of UK sustainable development
- Barriers to high quality cross-cutting SD research in the UK

¹⁰ Amanda Plimmer; Defra Science Strategy Team, private communication

- Recommendations for funding bodies to overcome these barriers
- Measures to improve the use for research in SD policy formation and implementation.

This document was used as the basis for public discussion, which led to the publication in 2002 of the document 'A New Agenda for UK Sustainable Development Research'.

4.3 Department of Trade and Industry (DTI)

DTI has set in place a strategy and program to respond to the government sustainable development White Paper. As part of this strategy, a Sustainable Development Initiative (SDI) was established to support collaborative research and development aimed at improving the sustainability of UK business. It is jointly funded by the Department of Trade and Industry (DTI), the Engineering and Physical Sciences Research Council (EPSRC), the Economic and Social Research Council (ESRC), the Biotechnology and Biosciences Research Council (BBSRC) and the Department of Environment, Food and Rural Affairs (DEFRA). It will operate in the following ways:

- A LINK programme¹¹, funded by DTI, EPSRC, BBSRC and DEFRA which provides up to 50% funding of collaborative R&D projects between businesses and universities
- DTI grants to businesses for specific projects, up to 50% of eligible costs
- EPSRC funding for networks
- ESRC fellowship grants to academia

The total funding available is c£21m (£10m from DTI, £5m from the EPSRC, £3m from ESRC, c£2m from DEFRA and £1m from BBSRC) for ten calls for proposals (one in November and another in April every year until April 2005).

The Office of Science and Technology (OST) is responsible for funding basic research via the seven Research Councils. It also supports the Chief Scientific Adviser to the UK Government in his role of coordinating science and technology across Government. He also seeks to promote inter-departmental collaboration and policy co-ordination in areas where there is no clear departmental lead¹². Therefore, the Chief Scientific Adviser can get involved in environmental matters on an 'as needed' basis. An example is the recent *Report of the Chief Scientific Adviser's Energy Research Review Group*. OST also supports a number of bodies involved in providing science policy advice to Government including the Agriculture and Environment Biology Commission.

¹¹ The LINK scheme is the Government's principal mechanism for promoting partnership in pre-competitive research between industry and the research base. LINK focuses on areas of strategic importance for the future of the national economy. All new programs address priorities under the Government's Foresight program. The Foresight program has addressed environmental issues.

¹² John Holmes, Office of Science and Technology; private communication

4.4 Natural Environment Research Council (NERC)

The mission of the Natural Environment Research Council is:

- to promote and support, by any means, high quality basic, strategic and applied research, survey, long-term environmental monitoring and related postgraduate training in terrestrial, marine and freshwater biology and Earth, atmospheric, hydrological, oceanographic and polar sciences and Earth observation;
- to advance knowledge and technology, and to provide services and trained scientists and engineers, which meet the needs of users and beneficiaries (including the agricultural, construction, fishing, forestry, hydrocarbons, minerals, process, remote sensing, water and other industries), thereby contributing to the economic competitiveness of the United Kingdom, the effectiveness of public services and policy and the quality of life;
- to provide advice on, disseminate knowledge and promote public understanding of the fields aforesaid.

The Council is supported by the Science & Innovation Strategy Board (SISB) and the NERC Executive Board (NEB). SISB is responsible for developing NERC's integrated science strategy and prioritizing and funding new programmes and initiatives. The NERC Peer Review College assesses applications for funding. There are also a number of specialist advisory groups.

NERC's Strategic Priorities

Five strategic priorities have been identified for the period 2002-2007:

SCIENCE - to prioritize and deliver world-class environmental sciences to understand the Earth system

USING KNOWLEDGE - to use NERC funded science to identify and provide sustainable solutions to environmental problems

SKILLED PEOPLE - to train and develop skilled individuals to meet national needs

LEADERSHIP - to provide effective national and international leadership for the environmental sciences

and, to deliver these four priorities:

ORGANIZATION - to ensure that NERC is a flexible, fit for purpose organization, and to achieve excellence in service delivery and customer focus.

Within the context of its strategic priorities, NERC aims to encourage and grow three environmental priority areas over the period 2002-2007:

? Earth's life-support systems - water, biogeochemical cycles and biodiversity

? Climate change - predicting and mitigating the impacts

? Sustainable economies - identifying and providing sustainable solutions to the challenges associated with energy, land use and hazard mitigation

NERC's Science Budget increased from £219.3m in 2002-03 rising to £350.2m in 2005-06.

4.5 Environment Agency

This environmental protection agency has its own science and research program structured as follows;

- **Science Projects:** The Agency publishes its approved science programme at the start of each financial year. The overall program is co-ordinated by the research and development section although most of the work is contracted out externally through competitive tender. Each project is managed by an Agency project manager with experience in the subject area and procurement of the research and development contracts are spread throughout the year.
- **The Science Group:** Efforts will be focused on the themes of; Air, Land and Water, Ecosystems and Human Health, and Innovative Technologies.
- **Research Funding:** Projects are funded through competition. EA works closely with the Natural Environment Research Council (NERC) and have contributed funding to some of the thematic programmes that are relevant to its work. EA funds a number of fellowships and studentships and joint fellowships with NERC.

4.6 Research Councils

In recent years the UK Research Councils have invested significant collaborative funding in multidisciplinary centres and programmes (such as the Tyndall Centre for Climate Change and Sustainable Technologies Initiative) relevant to sustainable development.

Together the Biotechnology and Biological Science Research Council (BBSRC), the Engineering and Physical Sciences Research Council (EPSRC), the Economic and Social Research Council (ESRC) and the Natural Environment Research Council (NERC) have an annual spend of some £61.8 million on research relevant to sustainable development (BBSRC – approx. £22 million; EPSRC – approx. £20 million; NERC – approx. £16.8 million; ESRC – approx. £3 million).

4.7 The Royal Society

The Royal Society, through its science policy section, provides independent advice on scientific issues. It has issued reports on numerous environmental issues, ranging from climate change to biodiversity.

Environmental issues are also aired through its Science and Society programme whose aims are;

- To help earn public confidence in science

- To develop innovative, widespread and effective ways of communicating with the public
- To ensure that the voice of the public is heard when discussing and shaping science policy
- To take a leading role in promoting national science policy debate

4.8 Sustainable Development Commission (SDC)

The SDC was established as proposed in the White Paper to co-ordinate activities. Its mandate is to;

- review how far sustainable development is being achieved in the UK in all relevant fields, and identify any relevant processes or policies which may be undermining this;
- identify important unsustainable trends which will not be reversed on the basis of current or planned action, and recommend action to reverse the trends;
- deepen understanding of the concept of sustainable development, increase awareness of the issues it raises, and build agreement on them;
- encourage and stimulate good practice.

A-5) United States

5.1 The Policy Context

The National Environmental Policy Act of 1969 (NEPA) is the framework that structures much of the US national environmental research agenda. In enacting NEPA, Congress recognized that nearly all federal activities affect the environment in some way and mandated that before federal agencies make decisions, they must consider the effects of their actions on the quality of the human environment. Under the Act all federal agencies shall

(A) utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on man's environment;

(B) identify and develop methods and procedures, in consultation with the Council on Environmental Quality established by title II of this Act, which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision making along with economic and technical considerations;

(C) include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on --

- (i) the environmental impact of the proposed action,
- (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,
- (iii) alternatives to the proposed action,
- (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
- (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Prior to making any detailed statement, the responsible Federal official shall consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved. Copies of such statement and the comments and views of the appropriate Federal, State, and local agencies, which are authorized to develop and enforce environmental standards, shall be made available to the President, the Council on Environmental Quality and to the public.

Regarding research activities per se, the Act states that Federal agencies shall;

‘initiate and utilize ecological information in the planning and development of resource-oriented projects’.

It is within this framework that important decisions are made on environmental policies, programs and expenditures. However, Unlike the Parliamentary System, where the government in power dictates, as in those countries mentioned above, the United States has a government system where the Executive proposes and the Congress disposes. Because of this interaction there will usually be differences in the final outcome from what the Executive proposes.

The US goals come from various statements made by the Administration, one of the more powerful being budgetary allocations. The **Office of Science and Technology Policy (OSTP)**, in the Executive Branch, and the **Office of Management and Budget (OMB)** issued a budget-planning memo for 2004, which stated the following national R&D priorities; R&D for combating terrorism, networking and information technology, nanotechnology, climate change, molecular life processes and education. These priorities are to guide horizontal or interagency initiatives.

Some coordination takes place under the **National Science and Technology Council (NSTC)**, an interagency body comprised of cabinet officers and is chaired by the President. NSTC has organized a number of interagency initiatives in areas of R&D. The NSTC has a Committee on Environment and Natural Resources (CENR).

The purpose of the CENR is to advise and assist the NSTC to increase the overall effectiveness and productivity of Federal research and development (R&D) efforts in the area of the environment and natural resources. The CENR addresses science policy matters and R&D efforts that cut across agency boundaries and provide a formal mechanism for interagency coordination relevant to domestic and international environmental and natural resources issues.

The CENR acts to improve the coordination of all Federal environmental and natural resource research and development and to improve the link between science and policy. This includes maintaining and improving the science and technology base for environmental and natural resource issues, developing a balanced and comprehensive R&D program, establishing a structure to improve the way the Federal Government plans and coordinates environmental and natural resource R&D in both a national and international context, and to develop environment and natural resources R&D budget crosscuts and priorities.

Specifically the mandate of the CENR is to;

- develop a National Environmental and Natural Resource R&D Strategy;
- facilitate planning, coordination, and communication among Federal agencies engaged in environmental and natural resources R&D;
- identify and recommend environmental and natural resources R&D budget priorities;
- propose and update long-range plans for the overall Federal R&D effort relating to the environment and natural resources;
- review Federal R&D programs pertaining to the environment and natural resources, including both domestic and international programs;
- ensure that there is a strong link between science and policy in the area of the environment and natural resources; and
- provide reviews, analyses, advice and recommendations to the NSTC on Federal policies and programs concerned with environmental and natural resources R&D.

The membership of the CENR is as follows;

Department of Agriculture
Department of Commerce
Department of Defense
Department of Energy
Department of Health and Human Services
Department of Housing and Urban Development
Department of the Interior

Department of Justice
Department of State
Department of Transportation
Environmental Protection Agency
National Science Foundation
National Aeronautics and Space Administration
Smithsonian Institution
Tennessee Valley Authority
Federal Emergency Management Agency
Office of Science and Technology Policy
Office of Environmental Policy
Office of Management and Budget
The National Economic Council
Council of Economic Advisors
Domestic Policy Council

On September 30, 2001, President Bush signed Executive Order 13226 to form the **President's Council of Advisors on Science and Technology (PCAST)**. President George Bush originally established PCAST in 1990 to enable the President to receive advice from the private sector and academic community on technology, scientific research priorities, and math and science education. PCAST addresses environmental issues.

Congress also has its Committees that address environmental issues, such as the Senate Environment and Public Works Committee and the House Committee on Science.

5.2 The Council on Environmental Quality (CEQ)

The Council on Environmental Quality coordinates federal environmental efforts and works closely with agencies and other White House offices in the development of environmental policies and initiatives. The Council's Chair is appointed by the President with the advice and consent of the Senate and serves as the principal environmental policy adviser to the President. In addition, CEQ reports annually to the President on the state of the environment; oversees federal agency implementation of the environmental impact assessment process; and acts as a referee when agencies disagree over the adequacy of such assessments.

Congress established CEQ within the Executive Office of the President as part of the National Environmental Policy Act of 1969 (NEPA). Additional responsibilities were provided by the Environmental Quality Improvement Act of 1970. NEPA assigns CEQ the task of ensuring that federal agencies meet their obligations under the Act. The challenge of harmonizing economic, environmental and social aspirations has put NEPA at the forefront of the nation's efforts to protect the environment.

5.3 Department of the Interior (DOI)

The mission of DOI is to protect and manage the Nation's natural resources and cultural heritage; to provide scientific and other information about those resources; and to honour its trust responsibilities or special commitments to American Indians, Alaska Natives and affiliated Island Communities.

The National Environmental Policy Act (NEPA) and the regulations of the Council on Environmental Quality require that DOI have an effective compliance program and implementing procedures and its bureaus have similar programs and internal guidance. This includes issuing policy, technical, and procedural guidance; providing technical assistance; determining technical and procedural adequacy of certain environmental documents; resolving intra-Departmental differences that involve more than one program Assistant Secretary and interagency differences; conducting ongoing evaluation of compliance; and identifying problems, recommending solutions and implementing changes for improving Departmental and bureau compliance programs.

DOI fulfills its mandate through the following initiatives;

Improving Our National Parks

- Maintenance Backlog "Partnering and Managing for Excellence"
- Natural Resource Challenge
- Natural Resources Year in Review

Promoting Healthy Forests

- Healthy Forests Initiative
- National Interagency Fire Center (NIFC)

Improve Management of Public Lands

- Everglades Restoration
- National Invasive Species Council
- Invasive Species
- National Wetlands Inventory
- White House Council on Environmental Quality
- Wilderness in America
- Wildland Fire Leadership Council

Managing Water in the West

- Colorado River Water Agreement
- Water 2025
- Preventing Crises and Conflict
- Regional Conferences

Protecting Endangered Species and Wildlife Habitat

- Critical Habitat
- Endangered Species Information
- Species Recovery
- Policy for Evaluation of Conservation Efforts (PECE)

- Conservation Banking
- CITES

Improving Management of Departmental Resources

- Management Excellence

Promoting Public and Private Partnerships

- Grants and Financial Assistance
- Landowner Incentive Program
- Office of Educational Partnerships
- Private Stewardship Grants
- Cooperative Conservation
- Partners for Fish and Wildlife

Improving Quality of Life for Indian Tribes and Island Communities

- Native Americans
- Indian Trust
- Insular Affairs and Territories

Protecting Our Nation's Treasures

- Preserve America
- Discovering America's Natural Heritage
- Welcoming Researchers to National Parks
- Lighthouse Preservation

Promoting Responsible Energy Policy

- Renewable and Geothermal Energy
- Natural Gas
- DOI Role in President's Energy Policy
- Developing Energy Resources on Public Lands
- TAPS Renewal
- National Petroleum Reserve – Alaska
- Offshore Energy Development
- Economic Incentives to Promote Offshore Energy Development
- Mountaintop Mining

Answering the President's Call to Service

- Take Pride in America
- USA Freedom Corps
- Volunteer.gov

Encouraging Recreation on Public Lands

- Recreation.gov
- HealthierUS.gov
- BLM Recreation Guide

Major Scientific Activities: dolphins and whales; hurricanes; earthquakes; energy.

Scientific research is undertaken by the U.S. Geological Survey scientists who:

- Monitor, analyze, interpret, and disseminate information on earthquakes, volcanoes, and the geology and topography of the United States.
- Monitor and assess water quality, stream flows and ground water at thousands of sites across the nation
- Produce more than 100,000 different maps
- Estimate world and United States energy and mineral supplies
- Conduct a wide range of research on biology, geology, and water to provide land and resource managers with the information they need to make sound decisions, and to help mitigate the effects of natural hazards

5.4 Department of Energy (DOE)

DOE has four strategic goals;

Defense Strategic Goal: To protect national security by applying advanced science and nuclear technology to the Nation's defense.

Energy Strategic Goal: To protect national and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy.

Science Strategic Goal: To protect national and economic security by providing world-class scientific research capacity and advancing scientific knowledge.

Environment Strategic Goal: To protect the environment by providing a responsible resolution to the environmental legacy of the Cold War and by providing for the permanent disposal of the Nation's high-level radioactive waste.

Regarding its environment strategic goal, DOE has established the DOE-NEPA Web Site that provides information regarding DOE NEPA-related activities.

The Office of Biological and Environmental Research manages the Department's Biological and Environmental Research (BER) program. BER's extraordinary legacy spans 50 years and includes four areas:

- Climate Change Research
- Environmental Remediation Sciences
- Life Sciences
- Medical Sciences

The mission of the BER program is to develop the knowledge needed to identify, understand, and anticipate the long-term health and environmental consequences of energy production, development, and use. This mission is carried out through the program's support of peer-reviewed research at DOE National Laboratories, universities, and private institutions. The research is also designed to provide science in support of the Energy Policy Act of 1992.

The BER budget request for FY 2003 was \$504,215,000, including support for basic research (Labs, 41%; Universities/research institutes, 24%), scientific user facility operations (10%), and enabling research and infrastructure support (22%). In addition, the program includes funding for the Small Business Innovation Research (SBIR) and Small Business Technology Transfer program (STTR) (approx 3%).

5.5 Environmental Protection Agency (EPA)

The mission of the U.S. Environmental Protection Agency is to protect human health and to safeguard the natural environment--air, water, and land--upon which life depends.

EPA's purpose is to ensure that:

- All Americans are protected from significant risks to human health and the environment where they live, learn and work.
- National efforts to reduce environmental risk are based on the best available scientific information.
- Federal laws protecting human health and the environment are enforced fairly and effectively.
- Environmental protection is an integral consideration in U.S. policies concerning natural resources, human health, economic growth, energy, transportation, agriculture, industry, and international trade, and these factors are similarly considered in establishing environmental policy.
- All parts of society--communities, individuals, business, state and local governments, tribal governments--have access to accurate information sufficient to effectively participate in managing human health and environmental risks.
- Environmental protection contributes to making our communities and ecosystems diverse, sustainable and economically productive.
- The United States plays a leadership role in working with other nations to protect the global environment.

Research activities get 4.7% of the \$7.6 Billion budget distributed as shown below.



Resource Summary
(\$ in 000)

	FY 2003 President's Budget	FY2004 President's Request	Difference
Conduct Research for Ecosystem Assessment and Restoration.	\$119,115	\$122,886	\$3,771
Improve Scientific Basis to Manage Environmental Hazards and Exposures.	\$56,355	\$67,468	\$11,113
Enhance Capabilities to Respond to Future Environmental Developments.	\$50,966	\$68,911	\$17,946
Improve Environmental Systems Management.	\$52,274	\$45,447	-\$6,827
Quantify Environmental Results of Partnership Approaches.	\$9,058	\$9,037	-\$22
Incorporate Innovative Approaches.	\$29,788	\$31,939	\$2,151
Demonstrate Regional Capability to Assist Environmental Decision Making.	\$6,592	\$6,608	\$16
Conduct Peer Review to Improve Agency Decisions.	\$3,690	\$4,811	\$1,121
	\$327,838	\$357,106	\$29,268

Research is conducted through The Office of Research and Development (ORD). The work at ORD laboratories, research centers, and offices across the country helps improve the quality of air, water, soil, and the way we use resources. ORD has identified eight research areas considered as highest priority. They are:

- Air
- Drinking Water
- Ecosystem Assessment and Restoration
- Global Change
- Human Health Protection
- Water Quality
- Pollution Prevention and New Technologies
- Endocrine Disrupting Chemicals (EDCs)

EPA is legally required to comply with the procedural requirements of NEPA for its research and development activities, facilities construction, wastewater treatment construction grants under Title II of the Clean Water Act (CWA), EPA-issued National Pollutant Discharge Elimination System (NPDES) permits for new sources, and for certain projects funded through EPA annual Appropriations Acts.

5.6 National Oceanic and Atmospheric Administration (NOAA)

NOAA's mission is to understand and predict changes in the Earth's environment and conserve and manage coastal and marine resources to meet our Nation's economic, social, and environmental needs.

The Office of Strategic Planning (OSP) reports directly to the Office of Program Planning and Integration (PPI). OSP is responsible for developing and revising the Strategic Plan and ensuring that it is aligned with NOAA's mission and mandates. The Office shall:

- lead NOAA strategic planning efforts including planning research, program review and evaluation, consultation with stakeholders, and revision of the NOAA Strategic Plan in coordination with the Assistant Administrators and Program/Staff Office Directors;
- maintain an inventory of all existing plans on NOAA components and planning efforts occurring in the Agency;
- participate in all line and staff office (LO/SO) planning efforts and review all line and staff office plans and annual budget documents for alignment with the NOAA Strategic Plan before approval by the Under Secretary;
- maintain a planning handbook documenting the NOAA strategic planning process;
- evaluate the barriers to improve Agency performance in preparation for the annual strategic planning process; and
- coordinates all NOAA activities implementing the National Environmental Policy Act (NEPA) and ecology and environmental conservation matters, and serves as the focal point for Department NEPA compliance and implementation.

NOAA Research, conducted primarily through the NOAA Office of Oceanic and Atmospheric Research, drives the NOAA environmental products and services that protect life and property and promote sustainable economic growth. Research, conducted by in-house laboratories and by extramural programs, focuses on enhancing our understanding of environmental phenomena such as tornadoes, hurricanes, climate variability, solar flares, changes in the ozone, El Niño/La Niña events, fisheries productivity, ocean currents, deep sea thermal vents, and coastal ecosystem health. NOAA research also develops innovative technologies and observing systems. All divisions of NOAA conduct research in their respective disciplines.

The NOAA Research network consists of 12 internal research laboratories, NOAA Office of Ocean Exploration, extramural research, a network of more than 200 institutions participating in the Sea Grant university and research programs, six undersea research centers, a research grants program through the Office of Global Programs, and 11 cooperative institutes with academia. Through NOAA and its academic partners, thousands of scientists, engineers, technicians, and graduate students participate in furthering knowledge of natural phenomena.

5.7 National Science Foundation (NSF)

NSF has an Environmental Research and Education (ERE) program. It has supported activities associated with environmental research and education for decades, primarily through disciplinary programs. In recent years, program officers have recognized that many exciting research opportunities in this area cut across extant disciplines and have formed interdisciplinary and inter-organizational programs in response. NSF staff work with their counterparts at these agencies to develop joint or complementary programs. The Office of Science and Technology Policy (OSTP) in the office of the President is responsible for development and coordination of major environmental programs that involve many agencies. Research on climate change, plant genomics, and toxics are examples of areas of interest that are subject to interagency coordination¹³.

In supporting activities at the interdisciplinary frontiers, NSF has sought to integrate holistic multidisciplinary investments with disciplinary-intensive opportunities. Because of the tremendous opportunity for advances in environmental science and engineering revealed by this integrative approach, NSF considers environmental research and education a strategic priority for the Foundation.

In FY 2001, funding in ERE areas totaled approximately \$825 million, roughly one-fifth of NSF's research budget.

5.8 American Association for the Advancement of Science (AAAS)

The AAAS is the US's foremost organization for engaging public discussion of scientific activities and their impacts. It publishes a variety of reports. Among the important ones is an analysis of the US federal R&D budget and the AAAS Science and Technology Policy Yearbook.

Related to environmental research, a search of the AAAS web site brought up 1145 documents.

The AAAS does not have an environmental focus among its 24 divisions (committees). However, it has an international program on ecology and human which is described as follows;

The Program on Ecology and Human Needs (EHN) seeks to disseminate knowledge from the sustainable and environmental sciences to audiences around the world. The goal of EHN is to help provide the information infrastructure necessary for societies to achieve sustainable development and equitable resource use. Since its inception in 1994, EHN (formerly the Population and Sustainable Development Program) has sponsored numerous international experts' workshops, educational meetings, and publications on human impacts on the environment.

¹³ Melissa Lane, NSF, private communication

The EHN Program exists to address the lack of information and scientific capacity that can allow societies to better understand their resource needs and consequences of resource use. The majority of scientific knowledge in use by resource managers has evolved out of traditional economic and development policies that externalize environmental and social costs. As not all parties are able to contribute their knowledge to the decision making process policymakers often lack sufficient information. Further, connections between stakeholders are often weak, both between individuals and organizations and between disciplines and fields.

To help address this knowledge gap, the EHN Program supports the development of multidisciplinary information sources that span the socioeconomic and environmental sciences, including The AAAS Atlas of Population and Environment. EHN also promotes watershed level multidisciplinary analysis and capacity building through the Science for Sustainable Development (SSD) program.

5.9 National Academies

National Academies with an environmental mandate that provide independent advice include the following;

- **Board on Agriculture and Natural Resources** ~ addresses science and policy issues confronting the agricultural, food and environmental systems.
- **Board on Atmospheric Sciences and Climate** ~ seeks to advance understanding of the atmosphere and climate, improve the ability to apply this knowledge for benefit and assist the federal government on problems and programs within the board's areas of interest and expertise.
- **Board on Chemical Sciences & Technology** ~ serves the nation as its gateway to timely, unbiased scientific advice and guidance on matters involving the chemical sciences.
- **Board on Earth Sciences and Resources** ~ serves as a focal point for National Research Council activities related to the earth sciences and involving research, the environment, natural hazards, resources and education.
- **Board on Energy and Environmental Systems** ~ conducts studies and other activities to provide independent advice to the federal government and private sector on energy and environmental technology and related public policy.
- **Board on Environmental Studies and Toxicology** ~ addresses questions about air and water pollution; solid and hazardous waste; toxicology; epidemiology; risk assessment; applied ecology; natural resources; and environmental engineering, economics, law and policy.
- **Board on Radioactive Waste Management** ~ provides scientific and technical analyses to inform national and international decisions on management and disposal of nuclear wastes.
- **Disasters Roundtable** ~ facilitates communication and the exchange of ideas among scientists, practitioners and policymakers to identify important issues related to the understanding and mitigation of natural, technological and other disasters.

- **Coordinating Committee on Global Change** ~ fosters stronger coordination and integration of National Academies activities related to global change science, technology and policy.
- **Committee on Human Dimensions of Global Change** ~ serves as a source of broad scientific expertise and judgment for setting agendas for research on human-environment interactions.
- **Ocean Studies Board** ~ explores the science, policies and infrastructure needed to understand and protect coastal and marine environments and resources.
- **Polar Research Board** ~ provides independent analysis to the federal government and the nation on matters of science and technology affecting public policy on research needs, environmental quality, natural resources and other issues in the Arctic, the Antarctic and cold regions in general.
- **Water Science and Technology Board** ~ improves the scientific and technological basis for resolving important questions associated with the efficient management and use of water.

A-6) European Union

6.1 The Policy Context

The **Council** of the EU, the principal decision-making body in the EU is composed of the elected Ministers of the Member States (MS) governments. Hence, the fifteen Transport Ministers come together to form the Transport Council, the fifteen Agriculture Ministers to form the Agriculture Council and so on.

The **Competitiveness Council** is formed by the Ministers for Science, Research or Industry from each of the MS. The Council is supported by a General Secretariat, which includes a Research Directorate-General, charged with reviewing research policies and budgets, and overseeing intergovernmental coordination. The MS take turns holding the Presidency of the Council of the EU, which rotates every six months. In 2003, Greece held the January-June Presidency and Italy currently holds the July-December Presidency.

The **European Commission** (EC) is the bureaucracy and executive body of the EU. There, legislative text is drafted, legislation is implemented, and the daily management of the EU's programs and policies is undertaken. The EC is the guardian of the Treaties and has the sole right to initiate legislation. The EC is divided into various Directorate Generals (DGs), of which several have mandates relating to elements of S&T and R&D:

DG Research, with some 1,300 staff, oversees the European Research Area initiative and manages the Framework Programs. Its Joint Research Centre (JRC) supports EU policy making by providing specific research and services, and by contributing to the development and operation of a EU scientific reference system for policy decisions. The JRC has a mandate to support the ERA and FP6.

DG Information Society is responsible for the Information Society Technologies (IST) Program. Under FP6, IST shifts its focus from applications toward basic and essential technologies, and

thus to longer term, more essential research. DG-InfoSoc hosts an annual conference to advance and showcase IST research. IST 2003 will be in Milan in October.

DG Transport and Energy has some 650 staff and manages programs worth 850 Million Euros that center on trans-European networks, technological development and innovation. Of this, close to 300 Million Euros per year is granted to co-fund selected research and innovation projects close to the market.

DG Enterprise addresses the business environment, to enhance corporate competitiveness and further the EU goal of sustainable development. It is responsible for the Innovation part of the Framework Programs, including the coordinating and benchmarking of national innovation policies.

Regarding scientific research the EU is currently in its sixth programme since 1984. The Sixth Framework Programme (FP6) objective continues to be the development of a true European scientific community equipped with the best skills and know-how, and to support scientific and technical work of the highest quality, conducted through transnational projects.

FP6 will distribute €17.5 billion to the parties involved in European research and technological development (RTD), but its aims go far beyond mere co-financing of research projects. This programme provides a coherent and ambitious pan-European framework for supporting RTD as part of EU research policy and constitutes a five-year strategic plan for the period 2002-2006. During this period, it will stimulate transnational collaboration in research, particularly between industry and universities, and in the establishment of networks of excellence.

FP6 will also help to establish a conducive environment in Europe for innovation to flourish. This means encouraging technology transfer, ensuring the availability of venture capital, providing greater protection for intellectual property rights, and developing human resources. Increased resources will also be devoted to encourage SME participation in all the Framework Programme activities.

FP6 will be instrumental in achieving the March 2000 Lisbon European Council goal of turning Europe into the world's most competitive knowledge-based economy by 2010; i.e.-moving to a GERD/GDP ratio of 3% by 2010. It will also greatly contribute to the creation of the European Research Area (ERA), a true European internal market for research and knowledge, where EU and national R&D efforts are better integrated.

The process for establishing FP6 was the following. The Commission made the first proposal for a new Framework Programme. Its proposal was based on expertise and results gained from previous programmes. It relied on in-house advice, and on feedback from experts, scientists and specialists from Member States, candidate countries, academia, industry and technology users. In 2000, the Commission got a massive response from the scientific community and industry on the realization of a European Research Area. The European Parliament and the Council of Ministers took the final decision on the Framework Programme, its budget, priorities and modalities. Extensive debate at every level of decision-making ensured that all angles were taken into consideration, all voices were heard and the final result was the best possible.

In March of this year, the Commission published a call for ideas for projects and networks that would fit the main orientations and priorities of FP6. A massive reply was received; more than 15,000 consortia from across Europe responded¹⁴. Based on this input, the Commission developed the detailed work programme.

In order to contribute to both the creation of the European Research Area and to innovation, the Sixth Framework Programme is structured around three headings:

- focusing and integrating EU research
- structuring the European Research Area
- strengthening the foundations of the European Research Area

The priorities covered by FP6 include: life sciences, genomics and biotechnology for health; information society technologies; nanotechnologies and nanosciences, 'intelligent' materials, new production processes and devices; aeronautics and space; food quality and safety; sustainable development, global change and ecosystems; citizens and governance; and other promising research areas, including support for participation of small and medium-sized enterprises (SMEs). FP6 also addresses research and innovation, human resources and mobility, research infrastructures, and science/society relationships.

International participation in these activities will be assured and will be open to all countries having concluded association agreements with the EU to this effect, including associated states and candidate countries. Other 'third' countries may participate in FP6 via bilateral co-operation agreements. Researchers and organizations from third countries may also participate in projects on a case-by-case basis. Canadians can participate on a self-funded basis.

The environmental research program is as follows;

OBJECTIVES

- The development, dissemination and adoption of innovative technologies and sustainable solutions in energy production and consumption, in particular through increased use of renewable energies.
- The development and introduction of environment friendly, safe and competitive mobility systems for passenger and goods transport, including all forms of surface transport, i.e. road, rail and sea.
- Improved understanding and forecasting capacities in regard to global changes, ecosystems and biodiversity as well as the creation of new management models.

SUPPORTING RESEARCH

Community action will concentrate on three major fields:

Sustainable energy systems

- Technological development and integration of renewable energy sources in the energy system, including storage, distribution and use.
- Energy savings and energy efficiency.

¹⁴ Euroabstracts, Vol. 40-5/2002, p. 11

- Development of alternative motor fuels.
- Development of fuel cells and their application, in particular for transport and hydrogen storage.
- Reduced use and clean burning of fossil fuels, especially coal.

Sustainable surface transport

- New technologies and concepts for surface transport, including novel propulsion systems, in particular fuel cells.
- Advanced design and production techniques leading to improved quality, safety, recyclability, comfort and costeffectiveness.
- Rebalancing, integration and interoperability of different modes of transport, in particular at urban and regional level.
- Increased safety and reduced traffic congestion, in particular in urban areas, by means of electronic and telematic solutions and advanced satellite navigation systems.

Global change and ecosystems

- Research into reducing greenhouse gas emissions – generated by energy, transport, industry and agriculture – and evaluation of solutions offered by carbon sinks.
- Research on ozone layer depletion.
- The water cycle, including soil-related aspects.
- Understanding and protection of marine and terrestrial biodiversity and genetic resources, sustainable management of the impact of human activities on ecosystems.
- Land management, in particular for the integrated management of coastal zones and integrated concepts for the multipurpose utilization of agricultural and forestry resources.
- Operational forecasting and modelling, in particular of climate change.
- Risk assessment and methods for appraising environmental quality, including research on measurements.

The budget for environmental priorities is €2.120 billion (18.8% of the €11.3 billion allocated to thematic priorities).

6.2 The Concept of a European Research Area (ERA)

The ERA forms the heart of a strategy that seeks to resolve the funding, innovation and fragmentation dilemmas that constrain European R&D. The ERA should enable the EU to identify excellence, to strengthen pan-European collaboration and to establish clearer and more consistent priorities for public research. Steps include:

- networking national and joint research programs on a voluntary basis;
- improving the environment for private R&D investment, R&D partnerships and high technology start-ups;
- developing an open method of coordination for benchmarking national R&D policies;
- creating a very high-speed trans-European telecommunications network for research;
- attracting foreign researchers and creating free mobility for researchers within Europe;
- developing a simple, effective and inexpensive European Community patent system.

6.3 New Initiatives

To overcome past problems with the Collaborative Research Program of disbanding consortia when short-term research ends and the lack of 'critical' mass in projects, two new approaches are being used in FP6; Integrated Projects and Networks of Excellence.

Integrated Projects (IPs) are usually multidisciplinary projects of 'critical mass' of activities, expertise and resources with at least 3 participants from 3 different countries. The parties enter into a consortium agreement and one coordinator is named to interface with the FP6 authority. Projects last from 3 to 5 years and are chosen through peer review. FP6 will provide 50% of costs for R&D and innovation components, 35% for demonstration projects and 100% for consortium management and training.

Networks of Excellence (NoE) projects involving large numbers of researchers from across Europe; the larger the number of researchers the larger the grant. There is a legal minimum of 3 parties from 3 different countries. The parties enter into a consortium agreement and one coordinator is named to interface with the FP6 authority. It is recommended that a governing board be appointed along with a scientific council of external experts. Projects last from 5 to 7 years and are chosen through peer review. There is a university training dimension to the projects. The Networks are expected to continue beyond the period of European Commission funding. The financial contribution is a fixed grant calculated on the basis of the value of the capacities and resources (amount of people involved) to be integrated, but not more than 25% of the cost. Proposals are evaluated by peer review using the following criteria;

- Objectives and strategic impact; how the project fits within FP6;
- Excellence of the participants and resources of the network;
- Degree of integration and the joint program of activities;
- Organization and management.

With the aim of testing the research priorities of the Sixth Framework Programme, the Commission invited European and international research players to submit their 'expressions of interest' in the form of suggestions for setting up integrated projects (IP) or networks of excellence (NoE) in these fields of research. The response was massive. Some 28% of the responses were for environmental research priorities; 21% for Integrated Programs and 7% for Networks of Excellence.

The EU has formal detailed monitoring and evaluation procedures for its Framework Programs.

6.4 Partnership for European Environmental Research Initiative (PEER)

PEER is an example of a research consortium that obtains funding from the EU Framework programs.

PEER brings together seven European research institutes whose aim is;

- to develop and promote joint strategies in environmental research in support of both EU and national policies;

☐ to create synergies and critical mass to avoid redundant work, save resources and improve the competitiveness of European environmental research;

☐ to promote collaboration within PEER, ensuring gender equality, knowledge and technology transfer, a dissemination of the scientific results and a close co-operation with policy-makers and other relevant stake-holders;

☐ to build the capacity to integrate European environmental research databases with a focus on their interpretation and exploitation;

☐ to create opportunities for the exchange of scientific personnel and the training of young scientists;

☐ to support environmental research capacity building in third countries, especially the candidate countries of the European Union;

☐ to facilitate large-scale research infrastructure such as research vessels and specialised laboratories that can be used by partner institutions throughout Europe;

☐ to prepare and facilitate proposals for the instruments foreseen in the Framework Research Programmes of the European Union;

☐ to develop management capacities for large-scale and long-term European research projects and programmes dedicated to complex problems.

☐ to co-operate in other fields of activity that may arise from this co-operation, for example in joint task forces.

Presently, PEER organizations employ together 4500 persons and have a combined annual budget of 340 Million Euro.

6.5 European Environment Agency (EEA)

The mandate of the EEA is to support sustainable development and to help achieve significant and measurable improvement in Europe's environment, through the provision of timely, targeted, relevant and reliable information to policy-making agents and the public.

The EEA's clients are;

- Institution level:
European Commission, Parliament, Council, EEA member countries
- General public:
NGOs, business, media, advisory, groups/persons, debaters and the policy engaged public

The EEA's main products are;

- Broad integrated assessments
(Five-year state & trends reports)
- Indicator-based reports
(yearly Signals report, TERM report)

- Specific issue reports
(eg. Greenhouse gases, GMOs, Hazardous Waste)
- Best practices
(eg. Wastewater treatment report, env. Taxes reports, EnviroWindows)
- Frameworks, guidelines or databases

The EEA's budget is about 24 million Euros and has some 100 staff.

The EEA has intensified its work both to use results and competencies from DG Research supported programmes/projects, and to influence the research agenda. In its role as analyst and assessor of the state of the environment, the EEA must be competent to also assess research gaps. Influencing the research agenda, and particularly FP6, has been carried out in two ways: "top down" and "bottom up".

"Top down"

DG Research has been invited to the EEA Scientific Committee meetings. Letters have been exchanged wherein the EEA has expressed opinions about FP6 content, programme structure and the process, as well as expression of interest to be involved in consultations. Work on an agreement between the EEA and DG Research is in progress. Such an agreement may influence FP7.

"Bottom up"

Contacts have been established between the EEA and several potential DG Research supported consortia, mainly to improve the research dissemination. In some cases, the EEA has been successful in influencing the research and communication agenda of the consortia. EEA staff are members of the advisory boards of some of the consortia. In one case, the EEA involvement has been more intensive, through written expression of interests to FP6 and cooperation in writing FP6 call text.

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