BELGIAN FEDERAL PUBLIC PLANNING SERVICE
SCIENCE POLICY

rue de la Science 8 ▪ Wetenschapsstraat
B-1000 BRUSSELS
Tel. +32 2 238 34 11 ▪ Fax +32 2 230 59 12
www.belspo.be

Research programme
"Science for a Sustainable Development"
(SSD)

RESEARCH AREAS ENERGY, TRANSPORT AND MOBILITY, AGRO-FOOD, HEALTH AND ENVIRONMENT, BIODIVERSITY, TERRESTRIAL AND MARINE ECOSYSTEMS, AND TRANSVERSAL RESEARCH

Call for proposals 2

January 2006

Closing dates

Expression of interest (obligatory): Friday 17 March 2006

Research proposals: Thursday 20 April 2006 at 3:30 p.m.

INFORMATION FILE FOR USE BY PROPOSAL SUBMITTERS

TABLE OF CONTENTS

FOREWORD

- This document contains all information useful to the teams wishing to participate in the call for research proposals for the research areas **Energy, Transport and Mobility, Agro-Food, Health and Environment, Biodiversity, Terrestrial and Marine Ecosystems, and Transversal Research** of the **"Science for a Sustainable Development" research programme**.

- The Public Planning Service Science Policy ("PPS Science Policy") supervises and coordinates the Programme at both the scientific and administrative levels.

- The call is for proposals for **2- or 4-year** research projects, prepared by **interdisciplinary networks of 2 to 5 teams** belonging to at least two separate Belgian scientific institutions, including at least one university institution.

- The call is intended for **Belgian university institutions, public scientific institutes, non-profit research centres, and specialised consulting offices**. The participation of specialised consulting offices is limited to a maximum of 25% of the total budget requested by the network.

- The project may require punctual expertise which can be delivered in **subcontracting** form. Such subcontracting may under no circumstances amount to more than 10% of the total budget requested by the network.

- If it brings in an added value to the project and to the development of Belgian expertise, submitters may propose a cooperation with a **non-Belgian universities or research institutes** (except for international institutions such as the Joint Research Centre).
  This participation will take place on a **co-funding** basis. The funding of non-Belgian partners by PPS Science Policy will under no circumstances amount to more than 20% of the total budget requested by the network. The non-Belgian partner is responsible for the co-funding, from other sources, for at least the same amount as the amount asked from PPS Science Policy.[1]

- The research network must be able to tackle the problem addressed on the national scale. Hence, cooperation between partners from **different Communities or Regions** is encouraged.

- The personnel funded in the project **must be recruited under an employment contract**. Thus, no scholarship student can be taken on in the framework of the project.

- This call offers the possibility of using earth observation data via cooperation with the Space Research and Applications Service and for additional research in the framework of international commitments of the federal government via cooperation with the Service for International, Interfederal, and Interdepartmental Coordination of PPS Science Policy.

- Expressions of interest and proposals must be submitted in **English.** Proposals must be

[1] For the participation by the "Université du Luxembourg" or by a public research institute from the Grand Duchy of Luxembourg, the "Fonds National de la Recherche Luxembourg" disposes of a budget of 500.000 euro for co-funding the research activities of Luxembourgian partners. In order to know more about the conditions of co-funding by the "Fonds National de la Recherche Luxembourg", Luxembourgian candidates should contact Mr Carlo Duprel (carlo.duprel@fnr.lu, Tel: +352 26192537, Fax: +352 26192535, www.fnr.lu) as soon as possible and preferably before 10 March 2006.

accompanied by a summary in the coordinator's language. If the submitters deem it useful, a version of the proposal may also be submitted in the coordinator's language.

- The submitters are obliged **to comply with the modalities** laid out in this document. Otherwise PPS Science Policy will not consider their proposal.

- Interested parties must submit an expression of interest, using exclusively the form available on the PPS Science Policy website (http://www.belspo.be), no later than **Friday 17 March 2006. Only those who submit an expression of interest may later submit a complete proposal.** The expressions of interest will be used by PPS Science Policy **only** in order to **seek foreign experts for the evaluation of the research proposals.**

- The proposals must be sent **in five copies** to the following address:

PPS SCIENCE POLICY
RESEARCH PROGRAMME "SCIENCE FOR A SUSTAINABLE DEVELOPMENT"
CALL 2
WETENSCHAPSSTRAAT 8 RUE DE LA SCIENCE
1000 BRUSSELS

The proposals must **also be sent in electronic form** to:

SSD_call2@belspo.be

The proposals (paper and electronic versions) must reach PPS Science Policy no later than **Thursday 20 April 2006 at 3:30 p.m**.

- Closing dates:

Expressions of interest: Friday 17 March 2006

Research proposals: Thursday 20 April 2006 at 3:30 p.m.

1.1 Context

The following elements of the international, European, and national contexts may act as important beacons for maintaining economic growth, appropriate social development, and protection of the environment. They offer a frame of reference for the various actions planned within the Programme.

1.1.1 At the international level

- The Amsterdam Treaty, which notably emphasises the necessity of integrating the environmental dimension into the definition and implementation of the various policy guidelines of the European Union.

- The Lisbon Strategy, whose objective is to position the European Union as the world's most dynamic and competitive knowledge-based economy, via a balanced economic, social, and ecological renewal. An underlying assumption is that the development of a top-quality scientific potential is indispensable to creating a knowledge-based economy. The European Council (Brussels, March 2005) is giving renewed impetus to the Lisbon Strategy aimed at growth and employment in a context of sustainable development where the role of knowledge and innovation is reconfirmed.

- The strategy of the European Union for sustainable development – the Göteborg Strategy (internal and external dimensions), and its current reform.

- Belgium's various commitments in the framework of different international Conventions and Agreements[2], the recommendations formulated by various international organisations[3], and all the European directives, strategic plans, implementation plans... with which Belgium must comply in the areas involved.

- The efforts been made for some time now with regard to the creation of a European Research Area (6th Framework Programme, 7th Framework Programme), in particular the strengthening of cooperation at the level of research projects and programmes (Networks of Excellence, ERA-NETs).

- The positioning of international institutions such as the European Commission regarding basic research as an essential link within the innovation process. Combining basic research - targeted research - multidisciplinary approaches allows developments taking into account all parameters necessary for the creation of new services, new technologies and new products.

- The initiatives of the OECD and other international organisations concerning the dissemination of scientific information and data. The idea is that information and data exchange form the basis for

[2] Agenda 21, the Implementation Plan of the WSSD (World Summit on Sustainable Development), the Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, the Vienna Convention and the Montreal Protocol, the Convention on Long-Range Transboundary Air Pollution (LRTAP), the Convention on Biological Diversity (CBD), the Antarctic Treaty and the Madrid Protocol, the OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic Ocean, the Bonn agreement, the antipollution activities at European level, the IMO conventions (International Maritime Organisation), the Aarhus Convention, the Millennium Declaration of the UN, the Doha Declaration of the World Trade Organisation (WTO), the Frankfurt Charter, the Helsinki Agreement on Health and Environment…

[3] International Labour Organization (ILO), World Health Organisation (WHO), Organisation for Economic Cooperation and Development (OECD)...

the development of cooperations and give added value to individual actions. The participation of states implies that they support both the production of information (and hence research) and its structuring.

1.1.2 At the national level

- The priorities of the government coalition agreement of 10 July 2003, in particular those mentioned in the following chapters:

  - The chapter "Environment, Mobility, and Sustainable Development", in which the following problems are mentioned: environment, mobility, consumer protection, and food safety and, more specifically, the implementation of the Kyoto Protocol, research on and development of renewable energy sources, a renewed multidisciplinary approach to the mobility problem, active support to global biodiversity, progress on sustainable development policy, the development of an integrated product policy, protection of the North Sea...

  - The chapter "Two Hundred Thousand New Jobs" concerning the introduction of new measures to keep older citizens working, to improve the quality of work, and to prevent work-related accidents and occupational illnesses...

  - The chapter "Oxygen for Knowledge and Enterprise", in particular efforts devoted to new incentives for research and development, further liberalisation of energy markets, better protection of consumers (encouraging responsible consumption, discouraging excessive debt loads, etc.).

  - The chapter "A More Equitable World", postulating that Belgium wishes to introduce an active policy for fair world trade and will strive for a more humane globalisation.

- The Belgian position with regard to the European Spring Summit (Brussels, 25 and 26 March 2004), which among others asserted the following:

  - *"The revision of the Sustainable Development Strategy of the European Union by the end of this year will be an occasion to give a new impulse to priority environmental themes such as sustainable transport, climate, energy, natural resources, public health and biodiversity..."*

  - *"The European Union must continue to play a pioneering role on the international level with regard to environmental protection and must make the necessary efforts in order to strengthen international "governance" in the environmental area, to implement the Millennium Declaration and the objectives established in Johannesburg, to work on a common framework in order to assure the follow-up of the most important UN conferences and to strive for implementation of the Kyoto Protocol."*

  - *"Belgium is a proponent of the Commission's Environmental Technologies Action Plan, an ideal instrument for integrating the three pillars of sustainable development."*

- The Belgian position at the European Spring Summit *(Brussels, 22 and 23 March 2005)* recognizing, along with the other Member States, the necessity of re-launching the Lisbon Strategy. *To meet these challenges, Europe must build new competitive advantages by developing* ***synergies between the economic, social, and environmental dimensions;*** *it must lay special emphasis on* ***knowledge and innovation***.

- The governmental declaration of October 2005 and notably the points that concern **reviving our economy** (stimulating the entry of young people into and avoiding the early departure of older workers from the workforce, stimulating innovation and creativity, making the price of energy reasonable for everybody) and the **new social contract** (raising awareness about what constitutes a healthy, balanced diet, post-2010 discussions on revising the Kyoto Protocol, tax incentives in favour of the use of biofuels for reducing greenhouse gases generated by the transport and distribution sectors, continued work on REACH...).

- The 2005-2008 National Programme for Reforming the Lisbon Strategy, aiming for more growth and more employment, adapted by the « Comité de Concertation Gouvernement fédéral - Gouvernements des Communautés et des Régions » on 26 October 2005. This notably concerns **reinforcing synergies between growth and environmental protection**.

- The various policy plans and policy strategies which are being implemented or being prepared on the national and federal levels, such as the National Environment and Health Plan (NEHAP), the National Climate Plan, the National Ozone Plan, the Federal Sustainable Development Plan, the National Mobility Plan, the National Biodiversity Strategy, the National Nutrition and Health Plan...

- The various (sectoral and trans-sectoral) policy plans and policy strategies elaborated at the level of the Regions and the Communities.

- The decision of the Council of Ministers of 6 February 2004 to proceed in 2007 with the setting up of a Belgian summer base in Antarctica.

- The Government's commitment to achieving the '3% objective' concerning research and development, one of the pillars of the Lisbon Strategy.

- The position of PPS Science Policy within the Belgian research landscape, which offers possibilities for:

  - the analysis of trans-sectoral or horizontal themes corresponding to the competences of different federal departments;

  - the analysis of problems managed at different levels of authority (federal, Regions, Communities).

1.2 Objectives of the Programme and Implementation modalities

1.2.1 Strategic and operational objectives

From a **strategic** perspective, the objectives of the Programme are:

- to preserve and develop the scientific potential in various strategically important areas, with the objective of reducing scientific uncertainties and anticipating future needs for knowledge;

- to offer the authorities of the country the scientific support required for the preparation, implementation, and follow-up of a supranational, federal, regional, or local policy in and between these areas;

- to offer the Belgian research potential in the areas involved the possibility of integrating itself into the various research initiatives at the European and international levels, in particular within the European Research Area.

From an **operational** perspective, the proposed Programme will contribute to developing scientific knowledge and instruments (databases, models, concepts, indicators, etc.) aiming to:

- the analysis of processes: understanding, monitoring, evaluating, and forecasting processes and their mutual interactions which constitute the basis of the functioning of both anthropogenic and natural systems;

- the study of impacts: evaluating the effects of changes in/the evolution of processes and their mutual interactions at the environmental, social, and economic levels;

- the development, follow-up, and evaluation of (existing and/or future) policy measures, on the basis of criteria such as efficiency, feasibility, acceptability… Among other things, the research will study policy measures focused on prevention, adaptation, remediation, management…

1.2.2 Diversified implementation

To fulfil these objectives, the Programme provides a diversified approach which:

- combines **sectoral**, **trans-sectoral,** and **integrated** approaches to the concerned issues;

- encourages **interdisciplinary** research so as to offer support to decision-making on the basis of an integration of different dimensions, perspectives, etc. of the issues concerned and to promote dialogue and information exchange between scientists, decision-makers, and other involved actors;

- offers space for **oriented basic research** and **targeted research actions**:

  - **oriented basic research** will anticipate needs, especially at policy level, by playing a future-oriented and/or alarm-sounding role and by eliminating specific uncertainties, in order to offer a scientific basis for decision-making. Oriented basic research also contributes to (inter)national research efforts.

  - **targeted actions** aim to formulate, within a relatively short time span, answers to specific policy issues at the (inter)national level. This may involve applied research, exercises integrating scientific results, proposals for harmonising, standardising data and information…

- offers possibilities for the **internationalisation of Belgian research**, via:

  - the opening up of this Programme to foreign researchers;

  - initiatives promoting cooperation and synergies between national thematic research programmes, such as ERA-NETs (European Research Area –Networks). PPS Science Policy is currently involved in a number of ERA-NET projects[4]. This opens the way to developing and implementing joint transnational activities such as joint calls, project clustering, etc.;

[4] ERA-NET TRANSPORT (transport research), MARINERA (marine sciences), BIODIVERSA (biodiversity research), AMPERA (Accidental Marine Pollution), EUROPOLAR ERA-NET (polar research), SKEP (Science based knowledge for environmental policy), CIRCLE (Climate Impact Research Coordination for a Larger Europe). (http://www.cordis.lu/coordination/era-net.htm)

- support for the participation of Belgian researchers in international and supranational research programmes and networks, such as those of the European Science Foundation, the European Union, the International Energy Agency, the United Nations, the International Council for Science, etc.

- promotes **cooperation between research projects** funded within the different research areas of the Programme and/or in the framework of other initiatives of PPS Science Policy when these are mutually complementary or demonstrate common areas of interest (**clustering**). The aim is to ensure greater coherency in research and to give the research added value in specific fields.

1.3 Research priorities

The priority research areas of the present Programme are linked to the national and international context described above. The whole set of priority research areas was chosen because of the need to address the complex, global, interrelated problems underlying a sustainable development policy. This choice is a response to strategic needs, at different levels of authority, for policy-supporting research and to the challenge of maintaining and developing national scientific expertise in complex and strategically important areas.

The **priority research areas** are:

- **Energy**
- **Transport and mobility**
- **Agro-food**
- **Health and environment**
- **Climate (including Antarctica)**
- **Biodiversity (including Antarctica and the North Sea)**
- **Atmosphere and terrestrial (including freshwater) and marine ecosystems (including Antarctica and the North Sea)**
- **Transversal Research**: In order to better translate/operationalise the concept of sustainable development, in and between the priority areas, **transversal and generic research** is necessary.

The goal of the research actions is to support specific decision-making in relation to both sector-related and trans-sectoral problems. The Programme thus promotes **interactions between the priority research areas**, so as to respond to common and complex problems such as air pollution (tropospheric ozone, aerosols…), environment-health relations, the impacts of genetically modified organisms (GMOs), the life cycle of products and services, renewable forms of energy, the challenge of globalisation, the integrated management of coasts and basins...

The research must take into account the (complexity of) interactions between the priority research areas. This constitutes an essential guideline throughout the programme (calls for proposals, project selection and management, the valorisation of research results).

For this are planned:
- the integration of interactions and common themes in the appropriate calls;
- joint calls between priority research areas;
- the "clustering" of projects covering different aspects of common and complex problems.

Within these priority research areas, the Programme encourages the submission of proposals dealing with **standardisation**.

The priority research areas and their mutual interactions are described in **Annex I** to this document. Each research area is developed in detail in the corresponding call.

1.4 Continuity with SPSD I, SPSD II, the "Workers' Healthcare" and "Standardisation" programmes

The research programme "Science for a Sustainable Development" is the continuation of the first and second Scientific Support Plan for a Sustainable Development Policy (SPSD I (1996-2001) and SPSD II (2000-2005)).

Compared to SPSD I and II, the Programme integrates new themes, namely "Health and Environment" and "Standardisation". These themes build upon the previous programmes "Workers' healthcare" and "Standardisation and Technical Regulation", which both formed part of the "Scientific Support Plan for integrating the concepts of quality and safety of production environments, processes, and goods into a context of sustainable development" (1998-2003).

On the one hand, all submitters of research proposals **must take account of the research activities conducted in the previous programmes** (see www.belspo.be/fedra).

On the other hand, a **research proposal that is a continuation of a project** funded in the framework of the aforementioned programmes must **clearly describe the relationship of the new proposal to the previous project and its added value** with respect to it. PPS Science Policy will provide the experts in charge of the scientific evaluation of the proposals (see point 4.2) with the relevant English-language material (final and/or interim scientific reports, findings of evaluations, etc.).

These elements will be taken into consideration when evaluating the research proposals.

1.5 Complementarities with other research actions

The research will be performed taking into account:

- the other (previous and/or current) research actions of PPS Science Policy:
  - the research programmes Information Society, Belgian Coordinated Collections of Micro-organisms (BCCM), Social Cohesion, Agora, Earth Observation Research Programme (STEREO), Interuniversity Attraction Poles (IUAP), Technological Attraction Poles (TAP), Action in Support of the Federal Authority's Strategic Priorities, Society and future, etc.;
  - research within the federal scientific institutions.

- other research actions carried out at the federal, regional or community levels.

According to the priority research areas of the Programme, the calls for proposals will establish more direct links with some of these research actions (see e.g. point 3.4).

1.6 Indicative calendar of the calls for proposals

Taking into account the resources made available for the period 2005-2009, various calls for proposals will be launched with regard to the different research areas of the Programme, in conformity with the following indicative timetable:

	2005	2006	2007	2008	2009
Energy		call 2		(call 4)	
Transport and mobility		call 2		(call 4)	
Agro-food		call 2		(call 4)	
Health and environment		call 2		(call 4)	
Climate (incl. **Antarctica**)	call 1		(call 3)		
Biodiversity (incl. **Antarctica** - **North Sea**)		call 2	call 3	(call 4)	
Atmosphere, terrestrial (incl. **Freshwater**) **and marine ecosystems** (incl. **Antarctica** - **North Sea**)					
Atmosphere	call 1		(call 3)		
Terrestrial ecosystems		call 2		(call 4)	
Marine ecosystems		call 2		(call 4)	call 5
Transversal research		call 2		(call 4)	

Calls:

- **Call 1**: call closed
- **Call 2**: **current call: projects of 2 or 4 years**
- **Call 3**: publication planned in 2007; projects of 2 years (targeted research actions)
- **Call 4**: publication planned end 2007 - beginning 2008; projects of 2 years
- **Call 5**: publication planned end 2008 – beginning 2009; projects of 2 years (targeted research actions)

(Call 3) - (Call 4): the available budget for these calls will be very limited and possibly zero. Indeed the budget for these calls will depend, firstly, on the share of 4-year projects selected in the previous calls for the concerned research areas and, secondly, on the results of the intermediary evaluation of these 4-year projects (for more details, see point 3.1).

2. CONTENT OF THE PRESENT CALL

The present call fits within the research areas **Energy, Transport and Mobility, Agro-Food, Health and Environment, Biodiversity, Terrestrial and Marine Ecosystems, and Transversal Research** of the **research programme "Science for a Sustainable Development"**.

The call will encourage research synergies between these areas, leading to knowledge that will enlighten strategic policy-making. In this perspective the research should take into account the complexity of **interactions between the research areas**. Proposals addressing several themes will be encouraged. In this call the double arrow ⇔ is used to highlight links between different research areas. When a research topic is related to another area, use is made of the arrow sign ⇨.

Within the above-mentioned priority research areas, the Programme encourages taking **standardisation** into account. This concerns:

- prenormative research contributing to standard-setting;
- research making it possible to identify standardisation impacts, problems, and gaps;
- research analysing the role of standardisation as an instrument for each thematic policy aimed at sustainable development.

PPS Science Policy participates in several ERA-NET initiatives (see point 1.2.2). Some topics in this call may find a place within coordination activities prepared in these ERA-NET initiatives.
Relevant research selected in the framework of this call may later be integrated into the activities of these ERA-NET initiatives (for example by project clustering).

2.1 Energy

2.1.1. Context

The right to energy for all is an essential dimension of sustainable development ; energy has become a first necessity good allowing, among others, a life which conforms to human dignity. However, our increasing consumption creates environmental and health problems, especially in the developing countries.

The gross domestic energy consumption is increasing from year to year in Belgium, as in Europe and worldwide. If nothing is done to reverse the trend, the European Commission estimates that energy consumption could rise in Europe by another 10% over the next 15 years (the 2005 Green Book). According to the International Energy Agency (IEA), the world energy demand could be 20% higher in 2030 than in the early 2000's.
For Europe this leads to increased reliance on outside sources of energy, principally fossil fuels, with its consequences on supply security, the environment and health, geopolitical equilibria, the economy, fuel prices and on equitable access to energy. In the longer term, with the joint prospect of climate change and exhaustion of certain resources, these stakes could be increasingly felt. An active, sustainable energy policy implies taking all these stakes into account while managing the supply-and-demand policy.

2.1.2 Research Topics

The priority research topics of this research area are detailed below. Projects may address one or several

of these topics.

If the topic of the proposed research is directly related to activities carried out within an international project or programme, (notably those related to Implementing Agreements of the IED, http://www.iea.org/dbtw-wpd/Textbase/techno/index.asp), the proposal must explicitly state that this is the case and must show why and how the network or a part of it might or might not integrate into this international research[5] (see form 11 of the proposal submission file).

Sustainable Energy Policy

A sustainable energy policy must take different space and time scales into account. National and European energy policies and those of non-EU countries are interdependent. All of these interacting policies have political, economic, and social consequences that will differ according to the place and time studied.
A long-term vision of our future energy policy is needed at all levels: global, European, and national. Any short-term actions must stem from this long-term vision, as both technical and social transformations of energy systems (energy production, distribution, and use) take place over decades. Such changes imply realigning technologies, infrastructures, institutions, and lifestyles. Defining these long-term ambitions implies shifting from a reflection based on a traditional, largely economic policy to one based on sustainable development.

The present call will aim:

- to define future (2050-2100) world energy options, taking physical constraints (resource exhaustion, environment, technologies...) and social constraints (fairness...) into account. The reflection must of course focus on both supply and demand and take into account the situation of the emerging and developing countries;
- to analyse the role of energy in Belgian society (relationships between energy and employment, energy and poverty, energy and the development of industrial activities, energy as an economy-stimulating or economy-slowing factor, energy and the demand for services... taking into account the European and international contexts);
- to analyse the possible role of public authorities to set an example the role of example that the public authorities may play in terms of energy choices ;
- to reveal the role and weight of transversal policies (land management, sustainable construction, education, continued professional training, innovation policies...) in a long-term transition to a less energy-consuming society.
  Research on the role of land management and on transport policy for promoting sustainable development, which will necessarily extend to aspects not specifically related to energy (air quality, mobility, biodiversity, social cohesion, employment, climate change...) may be carried out in the framework of the « Transversal Research » and « Transport » thematic priorities;
  [⇨ Transversal Research] [⇨ Transport]
- to compare the costs of different energy vectors (fossil fuels, nuclear fuels, renewable energy sources, electricity, hydrogen...), taking into account not only the private costs (production, transport, distribution) but also a series of external costs such as environmental impacts throughout a product's life cycle, costs such as price volatility associated with energy dependence, geopolitical hazards (diplomatic, military, humanitarian...) while bearing in mind that costs may vary in time: some energies that are more expensive in the short term may turn out to be cheaper in the long term;

[5] The reasons motivating researchers to participate or not in such international programmes must be scientific, methodological, and/or organisational. Administrative aspects linked to Belgium's participation or not in such programmes are to be addressed by the Belgian government.

- to analyse present and future impacts on various consumers of the opening of the electricity market in Belgium, the diversity of the 'fuel basket', the reliability of electricity supply, the rational use of energy, the design or renovation of infrastructures (habitats, collective buildings, the various transport modes), land management…; to analyse present and future blackout risk and the societal costs of blackout events;
- to evaluate the potential for technological improvements and innovations in energy systems in the medium and long terms and to recommend policy measures making it possible to realise gradually this potential.

Energy Efficiency and Demand Management

In its Green Book on energy supply security published in 2000, the European Commission places great emphasis on the importance of acting on the energy demand. In 2005, the Commission renewed its initiative in this domain by publishing a new Green Book on energy efficiency. Economising energy - through improved energy efficiency and/or behaviour change - is the quickest, easiest, and most effective way to meet the challenges of our energy dependence and of limiting our greenhouse gas emissions. Reducing the energy demand is a real challenge to our manner of thinking and acting, but so are the alternatives (increased use of nuclear energy, an explosion of renewable energies...).

Transport alone represents a third of the total consumption of the European Union. What's more, it is in constant progression. It is thus a priority target sector for efforts to improve energy use. This sector will be the focus of the 'Transport' thematic area ***[⇨ Transport]*** Yet the research described below may include more general studies based on the analysis of energy consumption patterns in various sectors including transport.
Another priority focus will be a more rational use of energy in the building sector, which alone represents 40% of the energy consumed in the EU. What's more, Belgium is the European country where the energy loss from buildings is highest. Strong actions can/must thus still be taken at the level of building isolation, heating systems, and lighting systems and in order to stem the growing use of air conditioning or the introduction of technologies for placing electrical appliances on standby...
In a sustainable development perspective, the development of tools and measures for reducing energy demand needs to take into account the social situation of the households (income, composition...).

The studies proposed for this call will:

- evaluate past and present policies and measures and instruments for managing the energy demand and will recommend new policies. They will analyse impacts in terms of energy consumption but also budgetary impacts, impacts on employment, and social, environmental, and economic impacts. An additional focus will be the articulation of several policies (possibly established by different authorities). Comparisons with what is done in other countries may be appropriate;
- examine information and feedback tools (on invoices, labels, in price structures...) as means for encouraging reduced consumption and for improving knowledge of all members of society regarding their roles in energy issues;
- evaluate non-energy policies having an unfavourable impact on energy demand;
- study the social, cultural, and economic variables that influence household energy consumption (energy use behaviours, purchase and investment decisions...). Consumer preferences need to be better understood. Although consumers are generally in favour of more energy efficiency and renewable energy sources, this is not always reflected in their buying behaviour. Studies will focus either on a type of energy-consuming device or on household energy consumption as a whole, including transport. Research aiming to generate deeper knowledge on household consumer behaviour in general may be submitted in the framework « Transversal Research ***»; [⇨ Transversal Research]***
- analyse the roles of the different stakeholders involved in the construction and renovation of dwellings (building owner, architect, building contractor, tradesmen...) and in the sale of energy-

consuming devices (producers, advertisers, sales agents...) and propose ways to involve them more actively in managing the energy demand.

Renewable Energies (wind turbines, biomass, solar energy...)

Work aiming to improve supply security and energy system sustainability should lead to the significant emergence of renewable energies in the portfolios of most countries. Supported by adequate policy frameworks, renewable energies should contribute to a competitive, sustainable, and secure energy sector.
This implies setting milestones for research, demonstration, and industrial or even commercial deployment, where the know-how available in Belgium can be exploited through appropriate actions, policies, and measures, defined on the basis of a scientific evaluation of this know-how.

The studies carried out under this call will aim to analyse:

- the growth potentials of renewable energy sources in various sectors: habitat, transport, electricity production…(with, among others, the analysis of demonstration projects or of fruitful examples of dissemination of the technologies concerned in other countries);
- the conditions of and (national and international) barriers to their introduction in Belgium;
- the consequences of their development in terms of direct or indirect employment, supply security, greenhouse gas emissions...;
- policies and measures aiming to favour their development;
- the impact of renewable energies on the structure, maintenance, and management of electrical networks (network reinforcement, interconnections between decentralised units, balancing power, supplying the network with green electricity produced by small producers/consumers...).
- the life cycle of renewable energies.

Research may be carried out in collaboration with other research areas included in the present call:

- Research on the future role and impacts of new fuels or energy vectors in the transport sector, in collaboration with the « Transport » research area ***[⇔ Transport].***
- Research on the impact of bioenergy development on the agricultural world (employment, impacts on other cultures, environment...) in collaboration with the 'Agro-food' research area. ***[⇔ Agro-food];***
- Research on environmental impacts linked to the deployment or management of offshore energy, in collaboration with the research area «Marine ecosystems – North Sea ». ***[⇔ North Sea]***.

2.2 Transport and Mobility

2.2.1 Context

Transport is an indispensable link in economic development and plays an essential role in today's society (social participation, the social fabric, lifestyle…). Yet transport and mobility have undeniable harmful effects on population well-being and health, the environment, and economic development (energy, climate, air pollution, traffic accidents, degradation of nature and the urban environment, congestion, noise...). Various studies and policy documents, for example the European White Paper that is being revised for the moment[6], show that current trends in transport on various scales (local, regional, international, global) are not sustainable. Although progress has been recorded in specific directions or sub-issues, some improvements have been neutralised by the continuous growth of transport activity.

[6] White Paper "European transport policy for 2010 : time to decide", European Commission, http://europa.eu.int/comm/transport/white_paper/index_en.htm

Scientific research must contribute to reducing the tension between the increase in mobility (needs) on the one hand and the social, economic, and environmental problems associated with mobility. The aim is to provide scientific input in order to integrate the divergent and often contradictory objectives in a balanced way.

2.2.2 Priority Research Topics

Given the context of sustainable development, special attention in the domain of 'Transport and mobility' should be paid to:

- interactions underlying mobility, environmental, and road safety issues and, coupled with this, the importance of research into "packages" of measures and instruments (e.g. price policy, awareness raising, regulations, infrastructure policy...);
- possibilities, limitations, and effects of measures in the social, economic, and environmental domains;
- institutional aspects of sustainable development (e.g. horizontal integration of policy areas such as transport and environmental policies, energy policy, land development policy...);
- a reflection on a long-term vision of sustainable mobility and drawing a mobility policy fulfilling this, taking into account the time and space dimensions as well as social, cultural, and technological factors (by analogy with a long-term vision of energy policy, see item 2.1.2).

The research questions linked to this call are grouped into three sub-areas: *the 'mobility of people and goods'*, '*transport and the environment'*, and '*road safety'*. ***The perspective of sustainable development makes this division largely artificial: various research questions placed under one sub-heading have links with the others and must be treated in a transversal manner.***

Mobility of People and Goods

An efficient traffic and a balanced distribution among transport modes are important in the daily lives of individuals and for economic development. An understanding of processes, trends, determining factors, etc. is required in order to devise measures oriented towards a more sustainable mobility.

The research within the theme 'mobility of people and goods' could refer to all modes for both freight and passenger transport (road, rail, air and shipping; private/collective; motorised/non-motorised), unless specified otherwise.

The following research axes may be developed in the framework of this call:

- The impact of societal developments: social demographic trends; new forms of organisation of the economy; trends in leisure and tourism; globalisation (growth of international transport, particularly air and maritime transport...). ***[⇔Transversal Research]***
- The right to mobility is an important aspect of the social dimension of sustainable development: what are the various possible visions of the right to mobility? How does this concept translate into mobility policy at the different levels of competence that exist in Belgium? What values does mobility represent?
- Roles of the media, advertising, awareness raising, education... in mobility behaviour and the choice of transport modes. This question, proposed in a general manner under "Transversal Research", is exacerbated in the scope of the 'Transport' theme (e.g. the image of the car or bicycle, of public transport...; safety, health, and environmental arguments). ***[⇔ Transversal Research] [⇔ Health and Environment] [⇔ sub-areas Transport and the Environment; Road Safety]***
- Research into the role of habit formation and possibilities for influencing the formation of modal choice and mobility behaviour habits; identification of modal-shift-causing factors in the life

phases of individuals; identification of measures that may suppress barriers to modal shift

- Analysis of price policy (road pricing, taxation, the price of parking, subsidies...), regulatory policy, infrastructure policy... as they relate to the different transport modes and as regards their impact on competitiveness, innovation potential, modal shift, the environment, redistribution effects***... [⇔ sub-area Transport and Environment]***
- Research into the social, economical and environmental effects of modal shifts for both freight and passenger transport (including aspects related to health such as stress, positive effects of exercise...);***[⇔ sub-areas Transport and the Environment; Road Safety]***
- In matters of modal and intermodal transport (freight and passenger), it is possible to orient the research towards institutional aspects of interoperability and standardisation, efficiency and competitiveness, cost assessment, price policy, the availability and funding of infrastructures, the role of information***... [⇔ sub-area Transport and Environment]***
- New mobility concepts and new mobility services for passenger transport (at the boundary between public and private transport) and freight transport (including intra-urban freight transport): this includes concepts that may contribute to decoupling economic growth and development from transport ***[⇔ sub-area Transport and the Environment]***
- Research into possibilities for influencing by means of policy the logistic strategies of distribution companies and providers of transport and logistics services.
- Possibilities for and role of intelligent transport systems and technological innovations (dynamic traffic management; parking systems, navigation systems, information systems...) in achieving more sustainable traffic flows (including multimodal transport***). [⇔ sub-areas Transport and the Environment; Road Safety]***
- Impacts of anticipated, current, and past trends on possibilities for/limitations of using land management and urban planning as mobility policy instruments; elaboration of new concepts for integrating mobility policy, land management policy, and urban planning policy.
  [⇔ Transversal Research]

Transport and the Environment

In other sectors greenhouse gas emissions are decreasing, but in the transport sector they are still rising. In the absence of any intervention, global CO2 emissions from motor vehicles are expected to increase in an explosive manner between now and 2030. Despite reductions in other vehicle emissions and as a consequence of increased transport volumes, (local) air quality remains a focus of concern (PM, NOx, ozone...) as do other external effects such as noise, odour, vibrations... Transport is also the sector in which, by comparison with other sectors, global energy consumption is expected to rise most markedly. Consequently, the energy efficiency of transport systems must be encouraged by means such as modulated vehicle taxation, increased availability of other transport modes, other fuels, and vehicles that are more eco-efficient...

The research within the theme 'transport and environment' could refer to all modes for both freight and passenger transport (road, rail, air and shipping; private/collective; motorised/non-motorised), unless specified otherwise.

The research axes for this sub-area are as follows:

- In terms of impacts of transport on the environment and health (air quality, vibrations, space fragmentation…) of all the different transport modes, the research should support the effort to update and refine methods for evaluating gas emissions and assessing impacts... Recent developments in production processes, new technologies... should be taken into account: for example "well-to-wheel" emissions data for petrol, diesel fuel, and electricity, analysis of vehicle life cycles, evaluation of external costs, analysis of the impact of biofuels (production and vehicle emissions) on emissions other than CO2… ***[⇔ the other areas of the SSD Research Programme]***
- Analysis of possibilities for adapting the vehicle fleet (road, rail, air and shipping) to a more ecological composition (fuel and vehicle technology (e.g. particle filter for diesel vehicles), vehicle

power and volume...), taking into account the factors that determine the optimal time of replacement, socio-economic feasibility...).

- As new fuels are encouraged at all levels, research into their safety is required (production, distribution, use***...). [⇔ sub-area Road Safety ⇔Energy]***
- Studying (the evolution of) Belgian vehicle stock composition (Belgian vehicles and vehicles on Belgian roads), with emphasis on socio-demographic, economic, and technological aspects (e.g. vehicle technology relating to the EURO-norms, vehicle power and associated socio-demographic factors, the proportion of foreign cars on Belgian roads, including the technology of foreign cars and lorries***...). [⇔ sub-area Road Safety]***
- Research on policy instruments that may influence vehicle-buying behaviour (of companies, individuals, and public authorities).
- Research on the potential of technical inspection (e.g. the possibility of mapping effective vehicle emissions, optimal frequency, additional road checks...) and vehicle maintenance.
- Analysis and development of methods for measuring real traffic-linked emissions versus certification data, taking into account the experience gained outside Belgium.
- Studying potential measures/instruments favouring a safer, more environment-friendly driving mode. among (lorry) drivers***; [⇔ sub-area Road Safety]***
- Research on possible contributions of intelligent transport systems to the environmental impacts of transport ***[⇔ sub-areas Mobility; Road Safety]***

Road Safety

Road Safety has already improved considerably in recent years, but can be improved further in several areas. The Belgian accident statistics are still way above the European averages (for example concerning the number of traffic victims per 100.000 inhabitants, only the Czech Republic, Poland, Portugal and Greece count more victims, figures 2003)[7]. At different levels of authority various measures are prepared and transposed in order to avoid accidents or to minimise their consequences: technological applications, infrastructure, regulation, measures targeting behaviour and related communication efforts... All of these measures and possibilities must be analysed and evaluated in a sustainable development perspective. This means that beyond the intended effects on road safety, attention should also be paid to collateral effects (environmental, redistribution aspects...).

Given the restricted budgetary means, the research questions within this theme are focused on road transport, with attention for the different types of road users (private/collective; passenger/freight; motorised/non-motorised). Research into the environmental aspects of maritime accidents can be treated within the research domain 'North Sea'***. [⇔ North Sea]***

The research will focus on:

- updating and refining methods for estimating the social costs of road unsafety and for analysing the societal costs and benefits of road safety measures;
- improving and exploiting statistical data: possibilities for standardising the methodology used to collect real-world data to improve the analysis of accidents at the level, e.g., of demographic factors, the changing composition of the vehicle stock, road user behaviour...
- road safety aspects linked to relationships between different road-user categories such as: the conflict between increased vehicle power and the position of the most vulnerable users; new concepts related to infrastructures, traffic-slowing measures, visibility, segregation of user categories/modes, road user behaviour...;
- updating and refining research on the role of individual factors (inappropriate behaviours like driving under the influence, aggressiveness, fatigue, seatbelt use/non-use, speed, risk) and of environment perception...;

[7] International Road Traffic and Accident Database (IRTAD), Selected values for the year 2003 http://www.oecd.org/document/53/0,2340,en_2649_34351_2002165_1_1_1_1,00.html

- research related to measures linked to (evaluating) the aptitudes of different types of road users; impact on road safety of lack of experience and of the growing complexity of traffic (children, role of education);
- research on the role of awareness raising, regulations, and policing and of collaboration in the field between different levels of power (for all transport modes);
- analysing infrastructures/land management and possibilities for using them more efficiently e.g. through dynamic traffic management, controlled access to highways and dense-traffic areas; issues related to black points/zones and relevant policy aspects... possibilities linked to road infrastructure harmonisation, (at local, national, and European levels); ***[⇔ sub-area Mobility]***
- possibilities of intelligent transport systems and technological innovations in terms of road safety, with special emphasis on analysing behaviours/attitudes pertaining to these technologies (e.g. with a view to long-term behaviour adjustment); ***[⇔ sub-areas Mobility; Transport and the Environment]***
- in matters of freight transport: speed reduction measures, the impact of and compliance with regulations concerning driving and resting periods, interactions between vehicle speed, volume, and load;
- as roadwork generates dangerous situations, research may focus on the possibility of limiting roadwork by using more durable paving and marking technologies and materials**...** ***[⇔ sub-areas Mobility; Transport and the Environment]***

Research executed in the framework of this call should take the available information of the portal (clearing-house) of the Transport, Health and Environment Pan European Programme (THE PEP) of WHO Europe and the United Nations Economic Commission for Europe (http://www.thepep.org/CHWebSite/). Moreover, the results of these research projects could nourish this portal.

2.3 Agro-food

2.3.1 Context

Our relationships with food and its organisation have considerably evolved over time. From an almost immediate response to a basic need through primary agriculture, we have moved to an increasingly complex food chain involving more and more actors. Agro-food has become a sector as such. This corresponds with an evolution of our society, which on the one hand separates food production from food consumption and on the other hand seeks haste in all daily activities including the preparation of meals. This notably leads to a consumer demand for increasingly processed products.

One of the challenges on the horizon will be to take this evolution into account while managing to meet the need for quality food. In this area a considerable research effort is needed. The quality of food products and of the processes used to make them, both industrially and on the farm, is thus a priority objective of both European and national authorities.

The study of Agro-food issues is not limited to the intrinsic quality of products; it also includes aspects such as human health, environmental impacts, social and economic consequences for the sectors concerned, and how our production methods and consumption patterns affect developing countries. One of the challenges to be met is that of adjusting agriculture to societal expectations, particularly as concerns product quality and respecting and conserving the natural environment. This implies recognising the multifunctional role of agriculture.

Analysis of food production without studying consumption would not provide a sufficient basis for introducing or maintaining quality food accessible to all. Special attention should thus focus on the study of how consumption patterns evolve towards « sustainable food consumption » and to aspects of information and communication, especially targeting consumers, enabling people to make informed

choices in matters of food.

Some of these new issues require research in the priority areas detailed below.

2.3.2 Priority Research Topics in Agro-food Research

The present call concerns research on the food chain. This notion is to be understood in the broadest sense, and an integrated approach will be privileged.
This area includes the production of agricultural products, their sustainable processing into high-quality foods, and certain health effects of food consumption.

Projects that deal with different research priorities are encouraged, like f.i. the nutritional aspects of foodstuffs that are produced by different agricultural production methods.

Food-Chain Safety

First and foremost, consumers expect their food to be safe, healthy, and of good quality. This appears as a prerequisite to any kind of sustainable development. These concerns are also essential to producers (who are responsible for delivering food meeting these criteria), to the Federal Agency for the Safety of the Food Chain (AFSCA) and to the FPS Public Health, Safety of the Food Chain and Environment . Within the present call, proposals may thus include research in areas such as innovative analytical protocols, quick detection methods, predictive models... pertaining to the following research lines:

- Chemical safety (endocrine disruptors such as phtalates; heavy metals, toxins, contaminants, phytosanitary products, dioxins, hormones...)

- Microbiological safety (pathogenic micro-organisms, viruses...). Special emphasis will be laid on possibilities for anticipating and controlling emerging hazards in human and animal food, including the appearance of emerging pathogens (e.g. *Mycobacterium paratuberculosis*)

- The harmlessness of materials in contact with foods, the presence of substances due to food processing (cooking, irradiation...)

- The risks related to food additives (colouring matters, sweeteners,...) and technological auxiliaries (enzymes,...) utilised during the processing of foodstuffs

Integrated Quality Systems

This research will aim to support the development of sustainable production systems based on appropriate ethical, environmental, economic, and societal considerations and taking into account concerns related to farm animal welfare.

Special attention will be paid to short-chain systems, local production, small producers, traditional producers, and SMEs so as to enable them to meet legal requirements in a manner compatible with the means at their disposal.

In the framework of thus sub-area, studies will focus particularly on:

- environment and quality management systems: HACCP, ISO, LCA, BRC , early warning systems, labels, specialised good practice guidelines (e.g. good farming practices), self quality control for traditional producers …;

- authentication and traceability; care will be taken to ensure that products can be associated with their sources, while protecting products with a declared origin (geographic origin and production system). Another aim is to support communication regarding the presence of GMOs and allergens, notably by adequate labelling; ***[⇔ Health and Environment]***

- tools for limiting the environmental impact of agro-food-related activities: impact of GMOs from human and animal consumption on the environment, pesticide and fertiliser reduction, lowering levels of heavy metals and greenhouse gas emissions... ***[⇔ Ecosystems] [⇔ Biodiversity]***

Evolution of the production and consumption patterns and their consequences

Besides the quality of the production and the safety of the food chain, there are broader concerns about the evolution of the production and consumption patterns and their consequences. In this topic attention is paid to *"Mondialisation", "Emerging production and consumption methods"* and *"Multifunctionality of agricultural production"*.

Mondialisation :
Concerning the global and international context of food production and consumption the programme includes : ***[⇔ Transversal Research]***

- Research into the social, economic and environmental impacts in the developing countries of our production and consumption patterns (dilemmas of choice, awareness raising a.o.);
- Research into the field of tension between the role of agriculture for the local food supply and the role of agriculture as a producer of export products, with emphasis on the social, economic and environmental impacts.

The below-mentioned topics "*Emerging production and consumption methods"* and *"Multifunctionality of agricultural production"* have their place in the framework of a sustainability-promoting broadening of farm activities. This broadening may concern each of the production's four dimensions: horizontal expansion or up scaling, vertical broadening or de-specialisation, lateral or functional broadening and temporal broadening or accelerated innovation. In this context the following specific research topics, including production and consumption, may be addressed:

Emerging production and consumption patterns
New, unconventional harvesting and production methods and their social, economic, and environmental impacts: ***[⇔ Transversal Research]***
- Analysis of the advantages and drawbacks of innovative production of goods and provision of services (« diversification »), also as regards quality and safety
- Studying alternative production, transformation and distribution methods and other uses of production factors (e.g. minimised pesticide use in the framework of integrated production, alternative fishery methods a.o.***) [⇔ Health and Environment]***
- Examining the feasibility of conversion to crops having a higher added value, (e.g. the development of biofuels***); [⇔ Transport]***
- Research on new markets (e.g. for organic farming and for alternative fish and aqua products)
- Innovative research in relation to food consumption aiming health, f.i. the consumption of fruit and vegetables ***[⇔ Health and Environment]***

Multifunctionality of production:
Incorporating activities not strictly related to farming, such as:
- activities creating added value linked to farming, such as direct sale or farm-based processing of produce;
- the production of "commodity and/or "non-commodity" goods and services: participation in public nature management programmes, cooperation in environment and/or quality management

programmes, managing the quality of natural systems, biodiversity conservation, landscape protection***; [⇔ Biodiversity]***

- passive forms of diversification such as offering third parties access to production factors and infrastructures, functions related to open spaces, recreational and educative activities, tourism, etc. ***[⇔ Ecosystems]***

Food and Health Aspects

Here research will focus on two health-linked aspects as one of the topics of sustainable development: on the one hand food allergies and intolerances and on the other hand functional and novel foods.

Food allergies and food intolerances

The prevalence of food allergies is on the rise, especially in industrialised societies where these allergies have a strong long-term influence on the quality of life of affected individuals (particularly young children).

In addition, there is a real need to know more about the causes of allergies and food intolerances and the underlying mechanisms (notably as regards cross-allergies).

This research will aim:

- to study food allergy and food intolerance risk factors (food composition, multiple interactions between consumption, individual vulnerability, lifestyle, and other socio-economic factors) and their impacts on food production and consumption, health costs...;
  [⇔ Health and Environment]

- to propose food allergy prevention measures (awareness raising, education, promoting healthy food at the consumer and producer levels...).

« Novel and functional foods »

Although recommended daily nutrient intakes are covered by a diversified, balanced diet, there is currently a proliferation of « novel foods » (derived from biotechnology) and so-called « functional foods » (having one or more potential beneficial effects on one or more specific body functions).

Studies should provide in-depth knowledge of the popularity of these new products, their sustainability, and their impacts, and should also contribute to understanding changing lifestyles, buying and consumption habits...

In this context special attention will be paid to:

- analysing the role and place of functional foods in the diet (macro and micronutrients, antioxidants, trace elements, pre- and probiotics, vegetable oils…), examining the long-term stakes and implications; studying what is expected of such foods; increasing knowledge and filling gaps regarding health claims and labelling , with a focus on crucial aspects of food additives and supplements;

- for « novel foods » (GMOs...): examining their acceptance and development potential . Do these products really fit within sustainable development and can they really solve the global food issues?
  [⇔ Transversal Research]

- ethical, social, and environmental aspects of these novel foods and functional foods.

2.4 Health and Environment

2.4.1 Context

Although people unanimously recognise the importance of health as a factor of individual well-being and as a socio-economic factor playing a determining role in economic growth and sustainable development, **the question of the link between human health and the environment**[8] remains vast and hard to grasp. It is at the crossroads between two competences: intersectoral decision-making and pluridisciplinary scientific research.

Environmental health is linked to the evolution of individual and collective behaviours, consumer patterns, and modes of production of goods and services. All of these factors may generate new and sometimes unexpected effects on the environment and health.

There are no unanimous estimates of environment-related disease, but some sources linked to the European Union's ENV HEALTH strategy advance the figure of 25% to 33% and strongly encourage the creation of action plans and the adoption of measures at Member State level. There is no longer any doubt about the vulnerability of certain populations (children, women of childbearing age, and also workers, the elderly...); this is an incentive to apply the precautionary principle in areas where data are still lacking.

It is this important to continue the research effort in this area and to increase the knowledge base needed to understand, reduce, and prevent the many hazards linked to **physical, chemical, and biological environmental exposures** (including **organisational hazards** encountered in the workplace).

The contribution of science to the elaboration and implementation of appropriate environmental health policies is a challenge this programme aims to meet. The programme is expected to provide policymakers with the knowledge that is indispensable to making, implementing and appraising decisions, reducing uncertainties in the area, and maintaining a scientific potential and prospective research. It will be a contribution to an integrated and a global approach of environmental health in order to avoid a greater dilution of the measures.

2.4.2 Priority Research Topics

2.4.2.1 Special Features of this Call

Research under this call should have all or some of the following **6 features**:

A sustainable development context

As both quality of life and a safe environment are essential to the socio-economic equilibrium of society, environmental health research will play a major role in informing the necessary measures to be taken in this area. **Research on emerging hazards and on the health of future generations is a priority research line in the present call**, as are **studies focusing on other vulnerable populations** (notably the elderly: cf. 4) and **studies talking a national** (North-South) **and international approach to the issues**.

A defined environment

Environmental health research will look at the environment from **two angles**:

[8] The whole set of biological, chemical, physical, and social factors liable to influence the well-being of living beings and their activities (cf.2).

- **The indoor environment**: exposures encountered inside the home and in infrastructures devoted to living, leisure, and work (**indoor pollution**);

- The **outdoor environment**: exposures linked to water, soil, and air quality (**outdoor pollution**).

An over-arching approach

Sources of exposure to environmental pollutants (climate, atmosphere, places where people live, work, play, and relax, lifestyles, production and consumption patterns) are numerous. So are the **exposure modes** (inhalation, ingestion, contact, irradiation), the **pathways followed by pollutants in the environment,** and **the health effects of pollutants**.

Transfer or migration of pollutants may occur among the various compartments of the environment (notably between atmosphere, habitat, and air conditioning or between cultures and food products) or there may be **cumulated** exposures. In environmental health, there are no hermetically sealed exposure compartments.

In relation to ecosystem disturbances (floods, heat waves, atmospheric pollution...) as generators of harmful health effects the issues are again multicausal and multifactorial.

Although some pollutants and exposure sources are currently well known (mercury, chrome, lead, cadmium, benzene, styrene, cobalt, asbestos...), **others are much less known:** dioxin, PCB, PCF, DDT, aerosols, acrylates, phtalates, nanoparticles, asbestos substitutes, food additives, air conditioning, harmful ozone and UV... **The same applies to the complex interactions among environmental hazards** (including hazards linked to the organisation of work as a generator of physical and psychological stress) **and their impacts on health.**

An approach taking effect timescales into account

Although it has been possible to establish some links between health and certain environmental factors, we do not always have **a long-term vision of these effects**. On the one hand, pollutants exert cumulative effects on an organism as time goes by; what's more, as time is also a an individual vulnerability factor (cf. 5), it contributes variously to how susceptible an organism will be to environmental impacts.

Released into the environment, pollutants have life cycles and transformation cycles with different effects on health. And what about effect latencies, chronic effects, and/or long-term effects of pollutants and radiation (ionising and non-ionising radiation) identified as carcinogenic, mutagenic, or toxic, multi-environmental, bioaccumulable, and persistent? What about multiple exposure levels, even low, over many years?

An approach focusing on vulnerable populations

Other components must also be taken into account to explain the harmful health effects of environmental exposures: an individual's developmental state and specific metabolism, individual vulnerability and genetic susceptibility, behaviour and lifestyle, socio-economic factors...

- **Children** are particularly vulnerable to environmental exposures. They require specific attention, as do **pregnant women and foetuses in the womb**.
- **Workers,** especially in high-risk sectors (known, suspected, or little-known hazards)**:** the nuclear sector, (petro)chemistry, nanotechnology, biotechnology, the medical and agricultural sectors... (including SMEs with their particular relationships to health and safety). All sources of exposure,

be it physical, chemical, or biological, require prevention policies that may often be rigorous and that involve all levels of workplace organisation. Consequently, research focusing on these populations should establish a link with organisational hazards.

- **Ageing populations.** Research under Health and Environment will also focus on ageing populations. Elderly people are physically more vulnerable and may suffer from functional impairments that fragilise them, making them more vulnerable to environmental hazards.

Standardisation as a risk management tool

Health and environmental policies have often dealt with safety standards, exposure norms, and conditions for storing/recycling toxic products. It appears that current measures do not offer sufficiently protection of human health and of the most vulnerable populations (cf.1 and 5). The programme will encourage research on standardisation as a source of scientific support to the development of new standards. It will also aim to develop accompanying measures for current standards or for the required transposition of EU directives into national legislation.

2.4.2.2 Research Orientations

The priorities defined **in the Health and Environment call** derive from the 6 above-mentioned features, from reflections accompanying the elaboration of regional plans (LARES, MINA3, Plan Air), national plans (NEHAP), and European plans (CEHAPE, PINCHE) concerning health and the environment, and from the strategies on which these plans are based (SCALE, REACH).

The expected research proposals will be limited to understanding hazards, their emergence, and their health effect(s) and to developing methods for assessing, managing, and anticipating risks. They will find their place within one of the following orientations:

- **Continuing the study of specific exposure sources and their health impact(s)** among which: environmental allergens, neurotoxicants, and carcinogens[9], ionising radiation, electromagnetic fields, climate change, factors affecting air quality (including air conditioning); nanotechnologies and their effects on health and the environment**.** Special attention will be paid to cancer risks, respiratory and allergic diseases, occupational diseases but also diabetes and obesity. Workplace viewed as a specific environment facilitates pinpointing relationships between cause and effect more clearly than a general environment, **as well as taking exposure response lags into account** ; ***[⇔ the other research areas]***
- **Assessing more effectively the overall impacts of the environment on health, taking cocktail effects, mixed exposure effects, and cumulative effects.** Special attention will be paid to cancer risks, respiratory and allergic diseases, occupational diseases but also to diabetes and obesity. Workplace viewed as a specific environment facilitates pinpointing relationships between cause and effect more clearly than in a general environment **as well as exposure-response lags into account *; [⇔ The other research areas]***
- **Studying the use of biomarkers as an environmental health assessment tool**; ***[⇔ Agro-Food; Terrestrial and Marine Ecosystems]***
- **Addressing issues concerning access to and harmonisation of environmental health data through the development of concrete and pragmatic methods, tools, or measures that could offer, from an environmental-health point of view, possibilities to (re)work information collected for other goals**; ***[⇔ Agro-food; Transport; Biodiversity; Terrestrial and Marine Ecosystems]***
- **Studying hazards linked to organisational changes in the workplace and their impact(s) on health.** Special attention will be paid to assessing measures that have already been adopted in

[9] CMRs (substances that are carcinogenic, mutagenic, or toxic to reproduction) or POPs (persistent organic pollutants). The projects must concern one or more of the substances **identified as priorities in the POP/OSPAR conventions.**

favour of prevention or remediation as regards psychosocial factors previously identified as generating physical or psychological stress in workers: notably keeping ageing population at work, conciliation private life with life at work, musculoskeletal disorders, psychosocial hazards and human error;

- **Studying the socio-economic impacts of environmental health hazards and relevant proposed or adopted measures** (cost/benefit analyses of real/hypothetical substitution measures, fairness...); ***[other research areas]***
- **Studying risk perception as an essential basis for the development of communication and risk management tools**; ***[⇔ the other research areas]***
- **Developing hazard prevention, hazard reduction, and precautionary environmental health measures** (this would be an additional study associated with a more general project analysing environmental risks); ***[⇔ Agro-food; Transport; Energy; Biodiversity; Terrestrial and Marine Ecosystems; ⇨ Transversal Research]***
- **Contributing to a prenormative approach and to the development of accompanying measures** for new regulations in the area... (notably with respect to the adoption of the REACH, OSPAR, and POP conventions). ***[⇔ Agro-Food; Transport; Energy; Biodiversity; Terrestrial and Marine Ecosystems; ⇨ Transversal Research]***

The approach **should be multifactorial and pluridisciplinary**. The intervening disciplines may include biology, chemistry, toxicology, and biomedicine (except epidemiology[10]) as well as the human and social sciences.

2.5 Biodiversity (incl. Antarctica and North Sea)

2.5.1 Context

Biodiversity is the variety of all life forms on Earth: plants, animals, fungi and microorganisms, the genes they contain, and the ecosystems they are part of. Elements of biodiversity are being lost at an alarming rate, a crisis to which no solution can be found without defining, developing, and urgently implementing strategies and policies that anticipate, prevent, and reduce the causes of biodiversity decline.[11]

The contribution of science to the elaboration and implementation of policy is fundamental. Science is expected to enlighten decision-makers on the economic, social, and environmental consequences of biodiversity changes and to guide them in the development of more adequate policies for the conservation and sustainable use of biological resources.

Given the high stakes, the urgency, and the complexity of biodiversity-related issues, it is important to carry out science that is (1) framed, planned, and coordinated at the international, European, national, and regional levels, (2) integrated and multidisciplinary, calling upon a wide range of expertise spanning both the natural and the socio-economic sciences.

The present call is designed to meet these criteria:

- The priority research topics of this call are based on: the framework established by the international biodiversity programme DIVERSITAS (http://www.diversitas-international.org); the research priorities identified by the European biodiversity platform EPBRS (http://www.epbrs.org); the research needs

[10] Epidemiological research and database composition are not included in the present call.

[11] At the World Summit on Sustainable Development held in Johannesburg in 2002, world leaders committed themselves to achieving by 2010 a significant reduction in the current rate biodiversity loss. At the Gothenburg European Summit in 2001, Belgium, together with the other EU countries, had even committed itself to halting the loss of biodiversity by that same deadline.

linked to priority policies defined in the Belgian biodiversity strategy (in the final phase of elaboration); the *target review* carried out by the Freshwater Biodiversity Forum of the Belgian Biodiversity Platform (http://www.biodiversity.be/thematic-forums/freshwater-ecosystems) the SCAR scientific programme EBA – Evolution and Biodiversity in Antarctica - http://www.scar.org/researchgroups/lifescience/eba; the exploitation potential of the rich expertise that exists in Belgium.

- A special effort will be devoted to synthesising and integrating the generated knowledge and for making the data produced accessible, notably via the Global Biodiversity Information Facility (http://www.gbif.org). The Belgian Biodiversity Platform will be the key partner in these developments (http://www.biodiversity.be)

2.5.2 Priority Research Topics

The priority research focuses will be the in situ biodiversity of marine ecosystems (the North Sea, the North Atlantic and the Southern Ocean) and the in situ biodiversity of terrestrial and freshwater ecosystems (the temperate regions and Antarctica).

Research priorities fall into three categories: analysis of the biodiversity status, assessment of current and future pressures and impacts, and support to measures for the conservation and sustainable use of biodiversity.

Role, status and evolution of biodiversity

Knowledge on the status, distribution, trends, and evolution of species and habitats is still quite fragmentary. Yet such knowledge constitutes the scientific base for the study of links between ecosystem functioning and biodiversity and for the development of measures promoting the conservation, management, and sustainable use of biodiversity. This research will aim:

-to develop, improve, validate, harmonise, standardise, and integrate inventory methodologies applied to the study of biodiversity distribution, status, and evolution. Different biological levels will be taken into account (genetic level, species level...) as well as the taxonomic and functional aspects of biodiversity. Methods will be developed and priority components, target groups, and habitats will be chosen so that the research integrates into and complements efforts at the European and international levels. The work will notably make practical use of collections and the associated databases; it will exploit acquired expertise in taxonomy and systematics, bioinformatics, geographic cartography, phylogeny, population genetics...

-to strengthen knowledge pertaining to the analysis of (natural and man-induced) biodiversity changes and to the structure and dynamics of marine, freshwater, and terrestrial ecosystems. ***[⇔ Ecosystems]***

-to better understand structural and functional interactions within a species, between species, between different trophic levels, and within habitats. To analyse relationships between the functioning of and services offered by ecosystems ***[⇔ Ecosystems]***

-to develop and improve tools and pertinent-scale models for understanding and predicting biodiversity changes. These outputs should integrate socio-economic scenarios and the possible impacts of major pressures***. [⇔ Ecosystems]***

-to improve knowledge on the genetic diversity, systematics, taxonomy, ecology, and conservation biology of forest, agricultural, and aquatic resources in a perspective of conservation and in-situ and ex-situ management. Studies on animal and plant genetic resources originated outside Belgium and

conserved and/or documented in Belgian research institutions will be included.

Pressures on biodiversity

The principal causes of biodiversity loss include habitat destruction and fragmentation, chemical and organic pollution of soils, air, and water, the propagation of invasive exotic species, climate change, and the overexploitation of biological resources. They are often the direct or indirect consequences of human activities such as agriculture, forestry, fishing, water management, tourism, trade, transport, urban and energy development... Research is needed in order:

- to identify, understand, quantify, and predict the impact of anthropic pressures - studied individually or in combination - on the structure of biodiversity and on ecosystem functioning. This includes:
  - the impact on biodiversity of changes in land and sea use ***[⇔ Ecosystems]***
  - relationships between reduced ecosystem quality (eutrophication, acidification, soil degradation...) and ecosystem biodiversity***; [⇔ Ecosystems]***
  - direct and indirect links between unsustainable use of natural resources (groundwater, forest tree species and forest products, overfishing...) and biodiversity loss; ***[⇔ Ecosystems]***
  - biodiversity risks associated with the propagation of invasive exotic species (profile of invaders, modes of introduction and dispersal potential)
  - the impact of climate change, including extreme events, on habitats and species; ***[⇔ climate]***
  - impacts of habitat fragmentation, connectivity, and habitat destruction on biodiversity structure;
  - the impact of habitat fragmentation and the alteration of the number and distribution of species on the propagation of pathogens and vector-borne diseases.

- to better understand the capacity of species to resist and adapt to these (combined) pressures and the resilience of habitats and ecosystems subjected to them; ***[⇔ Ecosystems]***

- to develop methods that distinguish impacts of anthropic pressures from impacts of natural pressures. ***[⇔ Climate]***

Support to measures for the conservation, management and sustainable use of biodiversity

Research must help to define, steer, and evaluate current and future policies and measures aiming to conserve, manage, and promote the sustainable use of biodiversity. In particular, it must help:

- to develop, improve, evaluate and compare methods for monitoring, conserving biodiversity preventing its decline, or restoring affected species, populations, or ecosystems.This notably requires assessing the efficacy and feasibility of ecological networks or protected marine area networks, the "favourable conservation status" levels of different species, the validity of using biotechnology for conservation purposes.
  These studies will exploit diverse expertise: ecological (assessing the minimal viability of species and habitats...), social (perceptions, preferences, attitudes), and economic (cost-effectiveness). Risks linked to combined pressures such as extreme climate change and the propagation of invasive species will be taken into account in the analyses;

- to evaluate the effects on biodiversity of legislation, sectoral policy instruments, and different forms and levels of governance. To identify gaps, action levers, and potential obstacles to implementation;

- to develop risk assessment and risk management protocols and methods applicable to the use of GMO cultures and its consequences for biodiversity; ***[⇔ Agro-food]***

- to carry out methodological research for the development of participative activities involving various actors required for implementing biodiversity management plans: landowners, hunters, fishermen, farmers***...; [⇔ Agro-food; [⇔ Transversal Research]***

- to develop tools and concepts for measuring direct and indirect values linked to the conservation of biodiversity as well as tools insuring a fair and equitable sharing of the benefits arising out of its utilisation***. [⇔ Ecosystems; [⇔ Transversal Research]***

2.6 Terrestrial (Including Freshwater) Ecosystems and Marine Ecosystems of the North Sea

An ecosystem is a system consisting of an association or community of living organisms (biocoenosis) and its geological, pedological, aquatic and atmospheric environment (biotope).

Today the biotic and abiotic processes that underlie the functioning of marine and terrestrial ecosystems are deeply affected by multiple anthropic and natural pressures.

The issues are complex and interlinked. They need to be approached in an integrated manner on various spatio-temporal scales, at the level of different components (land, marine, and atmospheric) and their interfaces.

Research will aim, via process **studies** (understanding, monitoring, and predicting chemical, biological, and physical processes) and **impact studies**, to propose measures, instruments, and/or recommendations for reducing pollutant sources, setting standards, and developing and assessing **policies and integrated management measures**, including their socio-economic implications.

The research will be carried out in conjunction with and as a complement to the research conducted within the Biodiversity priority area. Synergies are also envisaged with the areas Agro-food and Health, Energy, and Transport.

2.6.1 Terrestrial (Including Freshwater) Ecosystems

2.6.1.1. Context

As a life-supporting environment and a vital resource, terrestrial ecosystems (including freshwater ecosystems) are currently threatened by natural and anthropic pressures. Biodiversity loss, erosion, eutrophication, groundwater contamination, nitrogen pollution, salinisation, and greenhouse gas emissions are all direct or indirect consequences of human activities (domestic and agricultural activities, tourism, land management...)

Links between different pressures and their consequences must be identified in order to develop and implement adapted and lasting solutions to observed problems.

This call:

a) aims to build knowledge and to fill gaps with a view to improving the sustainable management, use, and lasting protection of terrestrial ecosystems. The idea is to conduct studies based on an over-arching and integrated approach to terrestrial ecosystems (including the aquatic continuum: streams, lakes, water tables, wetlands, reservoirs, river banks… all the way to the brackish waters of estuaries and coastal waters). Studies will examine short- and long-term impacts of human activities as well as processes and their interactions and the components, functions, and limit capacities of ecosystems;

b) integrates synergistically into relevant research activities at the European and international levels: Framework programmes of the European Commission, the Earth System Science Partnership (ESSP) and notably its Global Water System Programme (GWSP), the International Geosphere Biosphere Programme (IGBP)...

c) aims to support the sustainable management of terrestrial ecosystems and should notably support the implementation of:

- Framework Directive 2000/60/CE pertaining to **inland waters** (surface, transitional, coastal, and underground). The idea is to conduct research aiming to prevent and reduce pollution of these waters, to promote their sustainable use, to protect their environment, and to improve the state of aquatic ecosystems; in particular at the level of the Meuse and Scheldt geographical districts.
- the **Ramsar Convention** on the protection of **wetlands**;
- Diverse international conventions on the ecosystems, notably the United Nations Framework Convention on Climate Change and its **Kyoto Protocol** (LULUCF) : in particular the impacts analysis of land use and land use changes as well as aspects related to forestry activities (afforestation, deforestation and reforestation);

d) contributes to international synthesis and assessment exercises, e.g. the Millennium Ecosystem Assessment, IUCN, EEA...

The relevant research priorities are grouped into three categories: **process studies**, **impacts** of anthropic pressures, and **support to ecosystem management**.

2.6.1.2 Priority Research Topics

Process studies

To understand and measure the dynamics of ecosystem functioning, it is indispensable to clearly understand the roles and interactions of various key processes (e.g. energy, hydrological, and bioenergy flows; processes linked to greenhouse gas emissions and sequestration, to soil production and fertility...) and the different ecosystem components (e.g. within an aquatic continuum, a field or a forest, along the coast, or at another land-water or land-air interface...).

Studies submitted in the framework of the present call must focus particularly on **increasing knowledge** in order to **identify**, **understand**, **monitor,** and **predict**.

- **Understanding** the mechanisms governing and links between the various compartments of ecosystems (atmosphere, hydrosphere, lithosphere), i.e.:
  - the mechanisms of transport, transformation, and retention of nutrients, chemical elements (carbon, nitrogen, water…), and pollutants (heavy metals, pesticides, aerosols, greenhouse gases, ozone precursors...), and the links between these processes;
  - the links between ecosystem functioning (hydrological flows and biogeochemical flows…) and biocoenosis structure and dynamics (coupling between biogeochemical cycles and the functioning of trophic networks, greenhouse gas storage and emission and

microbiocoenoses...) ***[⇔ Biodiversity];***

- **Monitoring** the short-, medium- and long-term evolution, functioning, and quality of various ecosystems as well as the relationships between freshwater quantity and quality via the development of new surveillance tools, the harmonisation or improvement of existing tools, and the choice of pertinent indicators. This research will be carried out in the framework of ongoing developments at the European and international levels.
- **Predicting** ecosystem evolution and the dynamics and interactions of processes thanks to the development of models and tools at pertinent scales, taking economic, social, and environmental (notably climatic) pressures and scenarios into account.

Studying the impacts of various pressures

Various **natural** and **anthropic pressures** (climate change, exploitation, water management, pollution, land-use and land-cover changes, deforestation, erosion...) have a strong influence on the functioning of terrestrial ecosystems. They affect key processes that govern each ecosystem component.

Identifying these pressures and studying and predicting their effects over time and space are indispensable prerequisites to formulating measures for sustainable resource management (integrated management).

It is thus indispensable to conduct research focusing on the spontaneous **adaptation** of ecosystems to change, the **impacts of change, and risk assessment.**

- **Adaptation, vulnerability, and resilience:** Understanding and predicting ecosystem sensitivity, adaptive capacity, and vulnerability (limit thresholds), dynamic responses of ecosystems to pressures of various origins, and the mechanisms of ecosystem regeneration (resilience). ***[⇔ Biodiversity]***
- **Identification and impacts of anthropic and natural pressures:** Identifying natural and anthropic pressures and determining on pertinent scales their (separate and combined) impacts on ecosystem quality and functioning**.** ***[⇔ Agro-food]***
- **Hazard assessment and management:** Assessing, modelling, and quantifying hazards affecting ecosystems (pollution, eutrophication, algal blooms, soil acidification, variations in greenhouse gas emissions...); hazard prevention (early warning and detection systems...) and, when necessary, hazard management.

Response, management support

Precise knowledge of how terrestrial ecosystems respond to the above-mentioned perturbations is indispensable to the establishment of integrated management systems aiming to solve problems and prevent or reduce as much as possible the impacts of new perturbations.

It is thus important to provide decision-makers with the tools they need to **plan** (prevention, attenuation, adaptation) and **evaluate** action plans and policies.

- **Planning**: Evaluating (fiscal, environmental, and land management) measures for reducing pollution sources; comparative cost/benefit studies of measures and technologies (clean technologies), identifying standards, choosing the most adequate model for describing different key processes, taking the context into account

- **Quantifying** the value of services offered by various ecosystems (water, wood, and food supply, genetic resources, climate and flood control, cultural services, recreational services, support services...)
- **Assessment**: Evaluating (feasibility, efficacy) sectoral and environmental measures (development of industrial activities, activities linked to tourism or agriculture, implementation of Natura 2000, energy and transport policies...) and their consequences in relation to sustainable ecosystem functioning.
- **Evaluation**: Monitoring of the respect of the directives related to ecosystems management and protection and evaluating the possible measures to take in case of non-respect of those.

2.6.2 The North Sea Ecosystem

2.6.2.1 Context

The North Sea plays an important role in our country's cultural, social, and economic well-being. The North Sea Ecosystem is characterised by high productivity and highly diversified habitats but also by heavy ship traffic, intensive fishery, a number of offshore activities such as oil and gas extraction, the presence of cables and pipelines, sand and gravel extraction, dredging activities, and in the near future, the presence of wind turbine parks. What's more, the North Sea is surrounded by densely populated countries displaying a high level of industrialisation and/or agricultural activity as well as intense recreational use of coastal areas.

Sustainable management and exploitation of the North Sea requires adequate scientific support. On the one hand there is a need for research aiming to deepen existing knowledge of North Sea ecosystem structure and functioning and of the processes that take place there, including responses to anthropic and natural pressures. On the other hand research should focus on a better understanding of the direct and indirect socio-economic impacts of human activities on the ecosystem.

Alongside the Belgian part of the North Sea, other regions having a direct or measurable influence on the North Sea (the Channel, the Scheldt Estuary, the Southern Bight, the Central North Sea) also deserve attention. Another important study area is the passage between the ocean and the North Sea.

In determining the main axes of the research to be conducted in this framework, account has been taken of the Federal Sustainable Development Plans, of the relevant Belgian legislation (e.g. the Law on Protection of the Marine Environment, the Law on the Exclusive Economic Zone (EEZ)...), of relevant obligations (under the OSPAR convention, the Washington Conference, the "Programme of Action for the Protection of the Marine Environment from Land-Based Activities", the UN Convention on the Law of the Sea, the Bonn agreement, the antipollution activities at European level, the IMO conventions (International Maritime Organisation)…), of the European Marine Strategy, of the recommendations and major axes of research programmes and initiatives undertaken within international (intergovernmental) organisations such as the Intergovernmental Oceans Commission (IOC) and the « marine board » of the European Science Foundation (ESF), and in ERA-Net projects like MarinERA and AMPERA...

2.6.2.2 Priority Research Topics

Process studies

In order to take scientifically valid measures, it is necessary to better understand the key physical, chemical, and biological processes that govern the North Sea ecosystem (nutrient flows, food webs, sediment-transport processes, contaminant flows...) and the roles played by different ecosystem

components in these processes.
Research should make it possible to establish structure-function relationships for the North Sea ecosystem by gaining deeper knowledge of these processes so as, on the one hand, to better understand them and, on the other hand, to be able to monitor and model them.

In this context, special attention should be paid to:

better understanding of:

- carbon and nutrient transfer and transport processes (C, N, P, Si***) [⇔ Freshwater Systems]***
- sources, flows, and destinations of organic and inorganic contaminants***; [⇔ Freshwater]***
- speciation of organic and inorganic contaminants in the various compartments (sediment, water, air, sediment/water and water/air);
- sediment systems and sediment transport systems and the whole range of processes having an impact on these systems (physical, geomorphological, and biogeochemical processes, including interactions with biota)
- interactions and relationships between biodiversity, ecosystem functioning, and biogeochemical flows ***[⇔ Biodiversity]***
  In this framework, special attention should be paid to
  - the functional roles of various ecosystem components in relation to metabolism in food webs
  - links between structural properties and ecosystem functioning (e.g. food-web efficiency), taking physicochemical variations into account.
- ...

process monitoring, notably by:

- developing in situ biosensors (in the broadest sense) for monitoring biological and chemical properties of the sea;
- developing reliable and validated analytical techniques;
- determining pertinent indicators of changes and trends, e.g. for the monitoring of restoration projects;
- developing early warning systems based on marine data for timely detection of negative impacts of anthropic activities.
- …

making predictions through:

- (further) development and validation of models that can both describe and predict ecosystem responses to change;
- the validation of models with field measurements; studying the sensitivity, quality, and limitations of models; further development of time series;
- the development and integration of 3D component models;
- interaction with and/or coupling of (biogeochemial) models (including river/stream freshwater models) developed in this country and/or in neighbouring countries, e.g. the development of protocols for comparing different models***. [⇔ Freshwater]***
- ...

<u>Impacts of anthropic and natural pressures</u>

In addition to understanding the processes occurring in the marine ecosystem, a sustainable management policy requires knowledge of both the anthropic and natural factors that influence the ecosystem (pollutant inflow, natural resource exploitation, climate change, accidental pollution, …), their impacts, and the responses or possible adaptations of the ecosystem. Alongside impacts on ecosystems, account should also be taken of socio-economic impacts of ecosystem changes.

In this context special attention should be paid to:

- determining acute and chronic impacts of pollutants[12] (alone or in combination) on the marine ecosystem and biota;
- possible impacts of contaminants on the food chain or public health; ***[⇔ Agro-food, Health and Environment]***
- determining the impact of changes in the marine ecosystem (e.g. eutrophication, accidental pollution…) on living and non-living marine resources; ***[⇔ Biodiversity]***
- establishing qualitative and quantitative relationships between nutrient enrichment and responses of the marine environment, such as changes in the structure of planktonic and benthic communities (better account should be taken of dynamic interactions between these communities); ***[⇔ Biodiversity]***
- impacts of climate change on the marine ecosystem; ***[⇔ Biodiversity]***
- responses and possible adaptations of the marine ecosystem to change, including the impact of restoration measures, attention being paid to both the socio-economic and biological value of the marine ecosystem;
- impacts of (combined) human activities (offshore construction, ship traffic, sand and gravel extraction, fishing...) on the ecosystem, taking into account, for certain activities, ongoing or planned monitoring programmes…; ***[⇔ Energy, Transport]***
- studying the socio-economic consequences of changes in the marine environment (habitat destruction, changes in the composition of biological communities, accidental pollution, algal blooms...).
- …

Evaluating and developing integrated policy and management measures

On the basis of knowledge of the marine ecosystem and of its responses to various influences, it should be possible to develop integrated policy and management measures for preventing or reducing negative impacts and also to evaluate measures that have been taken.

In this context special attention should be paid to:

- simulating the consequences of various pertinent reduction scenarios and programmes and of ecological restoration measures;
- defining pertinent quantitative and qualitative indicators (this includes managing the data and information leading to their definition) pertaining both to sectoral North Sea activities and to the quality of the North Sea system. Analysis of their utility and policy value;
- developing and evaluating measures guaranteeing the integrated management and sustainable exploitation of the sea and coastal area, taking international commitments, current (national and international) legislation, and the various levels of competence into account;
- developing best practice protocols for economic activities in the EEZ;
- developing tools for evaluating and predicting the consequences of the (combined) application of sectoral policy measures (e.g. pertaining to industrial activities, agriculture, energy, transport, tourism…) on the functioning of the marine ecosystem.
- study of methods which allow one to estimate the damage suffered by natural persons or legal entities when they are victims of changes in the marine ecosystem (accidental pollution, destruction of habitats,…) and studies which make it possible to determine the restoration costs and the sanctions which the authority can impose on those who cause such disturbances or who are not complying with the legislation
- …

[12] Priority should be given to the substances listed in annex 2 of the OSPAR strategy concerning dangerous substances and/or in the Water Framework Directive.

2.7 Transversal Research

2.7.1 Context

The ambition to achieve sustainable development must contend with a crucial issue: **equating the human population with the available space and resources**. This means analysing a region's geographic and climatic framework with its whole range of economic, social, and cultural production. For this a transversal approach is needed. Hence, cross-topic analysis is wanted.

Proposals focusing on certain common issues of the various priority research areas may be presented under this heading. Rather than taking a sectoral or specific approach, the idea is to address an issue in a transversal manner, from the diverse possible angles (cf. «Mixed Action» pilot projects) so as to provide a scientific analysis of a societal problem related to sustainable development.

Furthermore, just as integration at the level of the decision process is a major challenge (Amsterdam Treaty, Göteborg Summit), so is an integrated approach at the level of scientific research, ensuring that research serves the goals of "prudent management of the environment and development" (Agenda 21, chap. 35).

Research projects under this heading will thus aim to give scientific support to the effort to find a balanced integration between policy objectives according to their social, economic, and environmental impacts (biodiversity, transport, well-being, mobility, climate, natural resources, competition, landscape, employment, fairness, land management, energy, pollution, noise…). The aim is to reach a consensus, to establish the most profitable balances, and to link economic and social development to environmental protection, natural resource conservation, and quality of life.

2.7.2 Priority Research Topics under Transversal Research

Transversal and generic research is thus needed. It should address **the following problems**:

- Changing unsustainable production methods and consumption patterns
- Globalisation and its implications
- Spatio-temporal dimensions of sustainable development
- Societal trends and mutations and taking into account their implications
- Creation and analysis of tools supporting sustainable development policy, particularly of tools promoting better synergy of the social, economic, and environmental pillars of sustainable development (e.g. indicators...)
- Standardisation and its contribution to sustainable development.

To reinforce the programme's coherence, the transversal topics will be addressed in relation to the 7 priority research areas, without excluding other areas that might also contribute to elaborating a more operational concept of sustainable development.

Changing unsustainable production methods and consumption patterns

- Seeking a form of economic development (competitiveness, employment...) that is compatible with sustainable management of human and environmental resources (decoupling, dematerialisation, qualitative growth, resistance to change, quality of labour...)
- Production processes taking economic, environmental, and social impacts into account
- Analysis and evaluation of new, renewable raw materials
- Analysis and adjustment of product and process standards meeting social and environmental

criteria

- Seeking sustainable consumption patterns at the individual and collective levels (well-being, health, employment, quality of life, over indebtedness, redistribution, pollution, wastes, natural resources...). Studying the impact of a consumption pattern change on the three pillars of sustainable development
- The multifunctionality of the primary, secondary, and tertiary sectors, i.e. agriculture, industry, and services, and the new sustainable-development-linked market segments open to them
- Prospects for sustainable tourism
- The role in the economy of ethical and solidarity savings and investment.

Globalisation and its implications

Addressing the new issues linked to globalisation requires adequate scientific support.
These new issues are defined notably in terms of:

- geostrategy,
- North/South relations (notably the study of different development models),
- the use of natural resources (notably the social and environmental impacts in the rest of the world of our import of finished and semi-finished products[13]),
- climate change,
- inequality and poverty,
- between production and consumption, the issue of exchanges and trade, their place within a globalised economy, and their role in a sustainable development perspective,
- links between trade, investment, and development (« conventional » trade versus commerce fair trade, solidarity trade, and/or ethical trade, economical, social and environmental impacts of the level of direct foreign investments, export credits, etc.).

Spatio-temporal dimensions of sustainable development

- Spatial dimensions related to the sustainable use of ecosystems, stressing the importance of policies related to land management, habitat, infrastructures, land cover... Analysis of impacts (positive, negative, or win-win) of relevant policies already implemented or to be implemented
- Resource management with an analysis of our current reliance on exhaustible resources, analysis of short-, medium-, and long-term bottlenecks, analysis of links between resource use, energy use, and environmental pollution, particularly in vulnerable regions
- Housing as a living environment, housing construction and renovation and their energy, social, transport, and lifestyle implications, etc.
- Characteristics of a sustainable urban plan, urban-rural relationships, and peripheral urbanisation in relation to mobility and energy consumption.

Societal trends and mutations and taking into account their implications

Our society is continuously changing both in terms of its composition (nuclear versus extended families, population ageing, more generations and fewer intergenerational ties, etc.) and in terms of lifestyle (work, leisure, transport, etc.). It would be interesting to analyse these mutations and to know how they are likely to affect sustainable development. This could notably include the study of:

- time management in relation to consumption and production patterns (free time, combining a private and a professional life, enterprise flexibility, returning to more free time and related

[13] See in particular the need for knowledge described in the European strategy for a sustainable use of natural resources (COM(2005) 670 of 21.12.2005)

impacts...);
- links between environmental policy and the creation of new types of jobs;
- societal mutations (demographic trends, (im)migration, etc.) in the present and in the future and their implications in a sustainable development perspective
- future changes to be expected in the organisation of families and the way of living.

Creation and analysis of tools supporting sustainable development policy

- The different visions of sustainable development and their implications in terms of policy and scenarios of the future
- Creating tools for supporting policies for improving the integration between the social, economic, and environmental pillars of sustainable development
- Ethical aspects linked to sustainable development, notably as concerns the responsibility of different actors, access to resources, sharing profits linked to the use of resources...
- The role of decision processes in the implementation of sustainable development and the instruments and processes that enable the integration or the construction of long-term visions
- The analysis of possible convergences between the different strategies that are elaborated on the European level (strategy of Lisbon, strategy for sustainable development a.o.) and their translation into a national strategy for sustainable development ;
- Challenges related to communication between scientists and public and/or private administrators in the framework of sustainable development, notably in relation to the requirement of « transdisciplinarity », the coproduction of knowledge and policies built on a scientific base;
- The role of advertising and the media in awareness-raising in a sustainable development perspective.

Standardisation and its contribution to sustainable development

- How can standard-setting be a lever of sustainable development policy?
- Identifying the different impacts of (ex ante et ex post), problems of, and gaps in standardisation in a sustainable development perspective.

3. PROFILE OF THE PROPOSALS

3.1 Duration and Budget

The present call offers room for 2- or 4-year research projects.

Taking into account the resources made available, the projects selected within the framework of the present call will start at the end of 2006 or the beginning of 2007.

The overall available budgets, for the entire duration of the programme, for each of the priority research areas of the present call are given in the table below.

The average budget per partner, for the entire duration of the project, amounts to maximum 80.000 € per year. Moreover, the total project budget is limited in accordance with the maximum amounts presented in the table.

in thousands euro	**Total budget**	**Maximum budget per proposal**		**Maximum average budget per partner/year**
	2006-2009	**2-year project**	**4-year project**	
Energy	5.500	400	800	80
Transport	4.550	400	800	80
Agro-food	4.550	400	800	80
Health and Environment	4.550	400	800	80
Biodiversity	8.900	600	1.200	80
Terrestrial and marine ecosystems	15.588	600	1.200	80
Transversal research	8.000	400	800	80

In principle the Programme foresees, for each of these priority research areas, two or three calls (see table in point 1.6). The next calls will only be open for 2-year research projects.

Attention:

- The available budget for call 4 (see table in point 1.6) related to the priority research areas of the present call will be very limited – and possibly zero, since the initial contract for 4-year projects selected within the framework of the present call will only be concluded for two years. The budget for the second phase is attributed in the event of a positive intermediary evaluation (the principles of the phasing of projects and the intermediary evaluations are described in point 4.3.2).
  The budget for call 4 thus depends, firstly, on the share of 4-year projects selected in this call and, secondly, on the results of the intermediary evaluation of these projects.

- For the research areas "Biodiversity" and "Marine ecosystems of the North Sea" a third call is planned (call 3 and call 5 in the table, point 1.6), which will only be open for oriented research actions.

3.2 Networks and Coordination

3.2.1 Network

Each proposal must take the form of an **interdisciplinary network,** composed of 2 to 5 funded teams belonging to at least two separate Belgian scientific institutions, of which at least one is a university institution.

The network partners must conduct complementary activities related to a common issue and its integration.

All funded teams will jointly share all obligations and responsibilities during the implementation of the project. The contributions of the different network partners may differ according to the content. Accordingly, different partners may receive different shares of the total budget and devote different numbers of man-months to the research, provided they all bear in mind the principles of a network project.

The call is intended for **Belgian university institutions, public scientific institutes, non-profit research centres, and specialised consulting offices.** The participation of specialised consulting offices is limited to a maximum of 25% of the total budget requested by the network.

The project may require punctual expertise, which can be delivered in the form of **subcontracting**. The cost of this subcontracting may under no circumstances exceed 10% of the total budget requested by the network.

If it brings in an added value to the project and to the development of Belgian expertise, submitters may propose a cooperation with **non-Belgian universities or research institutes** (except for international institutions such as the Joint Research Centre):

- This participation will take place on a **co-funding** basis. The funding of non-Belgian partners by PPS Science Policy will under no circumstances amount to more than 20% of the total budget requested by the network. The non-Belgian partner is responsible for the co-funding, from other sources, for at least the same amount as the amount asked from PPS Science Policy.

- For the participation by the "Université du Luxembourg" or by a public research institute from the Grand Duchy of Luxembourg, the **"Fonds National de la Recherche Luxembourg"** disposes of a budget of 500.000 euro for co-funding the research activities of Luxembourgian partners. In order to know more about the conditions of co-funding by the "Fonds National de la Recherche Luxembourg", Luxembourgian candidates should contact Mr Carlo Duprel (carlo.duprel@fnr.lu, Tel: +352 26192537, Fax: +352 26192535, www.fnr.lu) as soon as possible and preferably before 10 March 2006.

The research network must be able to deal with the problem tackled on the national scale. In this context, cooperation between partners from **different Communities or Regions** is encouraged.

The personnel funded in the project **must be recruited under an employment contract**. As a consequence, no scholarship student can be taken on in the framework of the project.

3.2.2 Coordination

A **coordinator** (belonging to a Belgian research institute in accordance with point 3.2.1, § 4) must be designated in each proposal. In addition to his/her scientific and management qualifications, the project coordinator must be able to synthesise and integrate the research results so as to promote applications and support to decision-making. The specific role of the coordinator is:

- to coordinate all activities to be carried out in the framework of the project;
- to coordinate the internal meetings between the network members;
- to coordinate the meetings with the Follow-up Committee and production of the reports on these meetings;
- to coordinate the production of the interim and final project reports intended for PPS Science Policy;
- to inform PPS Science Policy of any problems that might interfere with the proper implementation of the project;
- to coordinate the synthesis and translation of research results, with a view to applications and support to decision-making;
- to coordinate the publication and dissemination of research results.

3.3 Follow-up Committee, Valorisation, and Data

3.3.1 Follow-up Committee

Each selected project is accompanied by a Follow-up Committee. The objective of this committee is to provide **active follow-up** of the project and to promote **valorisation of the research**. It will carry out this role via the exchange and provision of data and information and by giving advice, suggesting valorisation avenues... This committee is convened once or twice a year (or more, if necessary).

The Follow-up Committee is composed of **potential users of the results,** such as representatives of public authorities at the national, regional, European, or international level, social actors, scientists, industrial actors... The members of the Follow-up Committee are non-funded partners.

In the research proposal, the submitters must describe the profile of the members of the Follow-up Committee (institutions and a list of possible members). The actual composition will be established in consultation with PPS Science Policy. The committee will consist of at least 5 people.

3.3.2 Valorisation

Each research proposal must include **concrete proposals for valorising** the research. This might involve, for example, the organisation of thematic debates and meetings, proposals for disseminating and popularising the results, proposals to integrate data into computerised databases on the national and international levels, the elaboration of targeted messages intended for experts, policy makers, or managers regarding the content of specific results, including its limitations, the related uncertainties, the hypotheses and methods used, etc. The target groups of these valorisation proposals must be explicitly described.

3.3.3 Use and management of data

Concerning the use of existing data or the collection of new data, proposal submitters should take the following guidelines into account:

- Whenever possible, the partners should make use of existing (administrative or non-administrative) databases to meet the needs of their research. For this they must check beforehand whether the data are accessible, at what cost, and how much time it will take to acquire the data. Should it appear after the start of the research that due to partner negligence or insufficient knowledge of the field the data files will *not* be available in time, this may constitute a reason for PPS Science Policy to cancel the contract.
- If the proposal requires collecting new data (e.g. via a survey), the team must justify with **clear and convincing arguments** its choice of methodology, referring to the objectives of the study and specifying why this particular form of data collection is required and preferable to other approaches. This means the proposers must provide sound and detailed argumentation in support of the chosen methodology (sampling, etc.) and highlighting its added value as compared to existing databases. In addition the partners must provide the budget required for this data collection.
- As the data collected in the framework of the proposed research must be available to other users for other purposes, the proposal must clearly indicate when and in what format the data are made accessible, specifying which categories of users are likely to benefit from access to the data.

3.3.4 Intellectual Property

The research contract (see point 4.3) provides that all results deriving from the implementation of the project will become the intellectual property of PPS Science Policy rightfully and in full. The project network will accordingly transfer the results to PPS Science policy. By "results" must be understood all project achievements, all collected data, all source codes and object codes of developed programmes, all interim results, all specifically developed methodology, and more generally everything that results from the various stages and the entirety of the implementation of the project.

This transfer does not include what is or will be in the public domain nor anything in the possession of the network or one of its members prior to the start of the project. These elements are hereafter called the "excluded elements".

In order to meet the future contract requirements, proposals must thus:

- describe how the entirety of the results will be transferred to PPS Science Policy;
- specify the "excluded elements".

In this context, the researchers must bear in mind that for the North Sea, Biodiversity, and Antarctica research areas, the analysis and measurement data must be transferred to specific data banks such as IDOD/BMDC (http://www.mumm.ac.be/datacentre), AMD (Antarctic Master Directory (http://gcmd.gsfc.nasa.gov/KeywordSearch/Home.do?Portal=amd&MetadataType=0), Biodiversity Platform (http://www.biodiversity.be).

3.4 Interactions with other PPS Science Policy initiatives

3.4.1 Space Research and Applications Service

Like other sources of information, remote sensing from space can contribute to better understanding and monitoring the evolution of the ecosystem Earth. Scientific expertise in this area is being progressively developed in Belgium, particularly through the various phases of the programmes TELSAT, STEREO I and II, and VG. Research within these programmes ranges from thematic basic research to pre-operational applications.

In order to make possible the conversion of earth observation data to useful "information", a multidisciplinary approach is necessary which requires close cooperation between the above-mentioned programmes and the programme "Science for a Sustainable Development".

This cooperation is translated into the following specific modalities:

- provision of earth observation data to the research teams on the basis of a justified request;
- reinforcement of the capacity to support the user community in general, via maintenance of an 'EODesk-type' information and help service: http://telsat.belspo.be.

3.4.2 Service for International, Interfederal, and Interdepartmental Coordination[14]

Certain projects (or parts of projects) may give rise to ulterior **complementary research** in the framework of **a specific international cooperation**. In order to be eligible for this type of project extension at a later stage, candidates must already include in the proposal, at this stage, a declaration of intent (section 4 of the submission file; see point 4.1.2). In this declaration they must list the potential foreign partners and describe the added value to be brought in by this cooperation.

This complementary research must be situated within the context of:

- either the federal government's commitments related to research in the framework of international organisations, such as the various relevant organisations of the United Nations/UNESCO (the Intergovernmental Oceanographic Commission (http://ioc.unesco.org), the World Heritage Programme); the World Conservation Union (http://www.iucn.org); Diversitas (http://www.diversitas-international.org); NATO - CCMS (Committee on the Challenges of Modern Society); the International Energy Agency (Implementing Agreements), etc.;
- or the bilateral agreements for science and technology with Argentina, Brazil, Bulgaria, China, Russia and Vietnam.

These complementary research projects will have a maximum duration of 2 years and can result from a request from one or several partners of the network.

The funding of this type of complementary project can cover both the research activities of the Belgian partners and the planned stay of foreign collaborators.

[14] Note: the possibility of including a non-Belgian partner in the network (see point 3.2.1) is different from the possibility of complementary research in collaboration with the Service for International, Interfederal, and Interdepartmental Coordination, as described in point 3.4.2.

4. PROCEDURES

This paragraph describes the procedures for submitting a proposal, the project selection procedures, and the principal contractual obligations applying to selected projects.

4.1 How to answer this call for proposals?

The submission takes place in two steps, first by filing an expression of interest and then by filing a research proposal.

Only those who submit an expression of interest before the stipulated deadline may later submit a complete proposal.

4.1.1 Expressions of interest

Interested parties must submit an expression of interest, using the form intended for this purpose. These expressions of interest will be used by PPS Science Policy **only** in order to **seek foreign experts for the evaluation of the research proposals**.

Expressions of interest are submitted in **English**.

Interested parties are asked to use **exclusively** the form available at the PPS Science Policy website:

http://www.belspo.be

The expression of interest must be sent in electronic form to the following address:

SSD_call2@belspo.be

The expression of interest must reach PPS Science Policy no later than:

Friday 17 March 2006

PPS Science Policy will ignore expressions of interest submitted after the closing date.

Only those who submit an expression of interest in time may later submit a complete proposal.

4.1.2 Proposal submission

General guidelines

The proposal is submitted by an **interdisciplinary network** in accordance with the conditions set forth in point 3.

The submitter is asked to use **exclusively** the forms that are downloadable from the internet site of PPS Science Policy (http://www.belspo.be).

No annexes to the submission file will be taken into consideration during the evaluation and selection procedure.

Each proposal must be submitted in **English** in **5 copies**[15].

The proposal must be sent to the following address:

PPS SCIENCE POLICY
RESEARCH PROGRAMME "SCIENCE FOR A SUSTAINABLE DEVELOPMENT"
CALL 2
WETENSCHAPSSTRAAT 8 RUE DE LA SCIENCE
1 000 BRUSSELS

The proposal must also be sent in electronic form to the following address:

SSD_call2@belspo.be

The proposal (paper and electronic versions) must reach PPS Science Policy no later than:

Thursday 20 April 2006 at 3:30 p.m.

PPS Science Policy will disregard proposals submitted after the above-mentioned closing date and time.

Forms

Each proposal form includes four separate sections. Section 4 is optional and applies only if the proposal includes an additional proposal for research in the framework of the activities of PPS Science Policy's Service for International, Interfederal, and Interdepartmental Coordination (see point 3.4.2).

[15] If the submitters deem it useful, a version can also be submitted in the coordinator´s language.

Section 1 - Administrative data
Section 2 - Description of the proposal
Section 3 - Qualification and experience of the participants
Section 4 - International cooperation - **optional**

The forms can be obtained from the PPS Science Policy website at the following address: **http://www.belspo.be**

4.2 Evaluation and selection

4.2.1 Bases for the evaluation

Proposals submitted in the framework of this call will be evaluated externally by foreign scientific experts qualified in the research field involved.

Only **complete submission files** (the English-language version) are presented for evaluation. **No annex** to the submission file will be taken into consideration during the evaluation and selection procedures.

The present text of the call for proposals serves as the basis for evaluating and selecting the proposals.

4.2.2 Evaluation criteria

The general evaluation criteria to be taken into consideration by the experts are the following[16]:

Compliance with the aims, content, and characteristics of the Programme in general (see point 1) and of the present call in particular (see point 2).

Scientific quality

- Clarity of the objectives and tasks, relevance of the method, positioning with respect to the state of the art in the proposed area
- Scientific originality of the proposed research, the innovative character of the expected results, strengthening of existing expertise, contribution of the proposed research to ongoing research in the area involved.

Scientific support to decision-making

- The link between the project's potential scientific results and the scientific support required in order to prepare and implement a supranational, federal, regional, or local sustainable development policy.

16 The proposals for complementary research within the framework of an international cooperation will form the object of a simultaneous but separate evaluation by the same experts, according to criteria the most important of which are the added value of the cooperation and the scientific qualities of the foreign partner.

Quality of the network

- Experience and international contacts of the submitters
- Added value of the network
- Complementarity of the partners' skills
- Clarity of the division of tasks between partners
- A balanced distribution of funds among the partners
- Realism of the requested resources (duration, budget, personnel)
- Added value of foreign partner's contribution

Quality of the management and coordination

- The coordinator's scientific quality and management, synthesising, and communication skills.

Interdisciplinarity

- An interdisciplinary approach in order to meet the requirements of the sustainable development concept, in particular cooperation between natural sciences and human sciences.

Elaboration of the proposal in a sustainable development context

- How and to what extent social, economic, and environmental dimensions are integrated into the proposal;
- How the proposal takes into account the relevance and/or applicability of fundamental sustainable development principles (the precautionary principle, the prevention principle, the principle of vertical and horizontal policy integration, the polluter pays principle, the subsidiarity principle, the principles of solidarity, social justice, and participation...), particularly in the formulation of policy advice.

Valorisation

- Pertinence of proposals for disseminating and making available the information, especially in a perspective of support to policy decision-making;
- The member profile and role of the Follow-up Committee.

Added value with regard to projects funded under previous programmes (SPSD I, SPSD II, "Workers' Healthcare", and "Standardisation") (see point 1.4)

4.2.3 Selection

The research project selection procedure will take place in two phases: a scientific evaluation, followed by a strategic choice. The scientific evaluation is performed by foreign scientific experts qualified in the research areas of the submitted proposals. The strategic choice is made between the scientifically best-ranked and best-grounded projects.

4.3 Contractual Obligations

4.3.1 Contracts

For the selected proposals a contract is drawn up between PPS Science Policy and the network of funded teams.

For this, the submitters of the proposal will be asked at the end of the evaluation and selection procedure to concisely formulate the specifications on the basis of which the contract is to be drawn up. This **technical annex** to the contract will be drawn up in consultation with PPS Science Policy and will take into account the recommendations formulated by the foreign experts and the Programme Committee. Adaptations to the original proposal may relate to the content of the research, the composition of the network or Follow-up Committee, the choice of the coordinator, the proposals for valorising the research, etc.

PPS Science Policy grant the selected projects the **funds required** for their implementation. PPS Science Policy shall reimburse at most, and up to the amount specified in the granted budget, the real costs substantiated by the people responsible for the contract provided those costs are directly related to the implementation of the project.

4.3.2 Intermediary Evaluation

All research projects are subject to one or several intermediary evaluations, whose modalities are specified in the research contract. All projects are evaluated after 1.5 years; four-year projects will be evaluated a second time after 3.5 years. These evaluations, conducted by foreign experts, concern the project's scientific quality (methodology and interim results) and strategic impact, in the light of its initial objectives. The evaluation will result in recommendations for the continuance (or discontinuance) of the project.

In the case of four-year research projects, initially only a two-year contract will be concluded, which in the event of a positive intermediary evaluation will be extended to four years.

4.3.3 Reports

The contract will define the various reports to be submitted to PPS Science Policy. These reports are to be included in the project work plan and the cost of preparing them (including translations) is to be covered by the project budget.

4.3.4 Data, Results, and Ownership

The research contract provides that all results deriving from the implementation of the project will become the intellectual property of PPS Science Policy rightfully and in full. The project network will accordingly transfer all results to PPS Science policy. By "results" must be understood all project achievements, all collected data, all source codes and object codes of developed programmes, all interim results, all specifically developed methodology, and more generally everything that results from the various stages and the entirety of the implementation of the project.

This transfer will include neither what is or will be in the public domain nor what is in the possession of the network or of one of its members prior to the start of the project.

The network of funded teams retains the right to publish or to valorise the results in whatever form it chooses, subject to prior authorisation by PPS Science Policy.

For archiving and further dissemination, all project (meta)data/results will be submitted to PPS Science Policy and/or to indicated data centres, according to modalities specified in the contract between PPS Science Policy and the network of funded teams.

5. CONTACT INFORMATION

All additional information can be obtained at the following telephone numbers and e-mail addresses:

Secretariat
Mrs A. Delis +32 (0)2 238 37 61
deli@belspo.be]
Mrs V. Michiels +32 (0)2 238 36 13
mich@belspo.be

Energy
Mrs A. Fierens, +32 (0)2 238 36 60
fier@belspo.be

Transport
Mrs M. Blanken, + 32 (0)2 238 35 57
blan@belspo.be
Mrs H. Van Dongen, +32 (0)2 238 34 92
vdgn@belspo.be

Agro-food
Mrs Ch. Mathieu +32 (0)2 238 34 93
mat@belspo.be
Mr M. Van Heuckelom, +32 (0)2 238 35 55
vheu@belspo.be

Health and environment
Mrs E. Bourgeois, +32 (0)2 238 34 94
boug@belspo.be

Biodiversity
Terrestrial and marine ecosystems
Mr D. Cox, 32 (0)2 238 34 03
coxd@belspo.be (North Sea)
Mr D. Harmegnies, +32 (0)2 238 36 89
harm@belspo.be (Freshwater)
Mrs M. Vancauwenberghe, 32 (0)2 238 36 78
vcau@belspo.be (Antarctica)
Mrs A. van der Werf, +32 (0)2 238 36 71
vdwe@belspo.be (Biodiversity and Terrestrial ecosystems)

Transversal research
Mrs M.C. Bex, +32 (0)2 238 34 81
bexm@belspo.be
Mr M. Van Heuckelom, + 32 (0) 2 238 35 55
vheu@belspo.be

Service for International, Interfederal, and Interdepartmental Coordination
Mrs B. Decadt +32 (0)2 238 35 70
deca@belspo.be

Space Research and Applications Service
Mr J. Vandenabeele +32 (0)2 238 35 23
vdab@belspo.be
Eodesk: http://telsat.belspo.be

ANNEX I. Description of the research areas and their interactions (excerpt of the Memorandum to the Council of Ministers)

This annex contains an excerpt from the Memorandum to the Council of Ministers, approved on 4 March 2005, which briefly describes the content of the research programme "Science for a Sustainable Development". This annex concerns:

A. The 7 priority research areas of the Programme (energy, transport and mobility, Agro-food, health and environment, climate, biodiversity, atmosphere and terrestrial and marine ecosystems);
B. Standardisation within the priority research areas;
C. Interactions between priority research areas;
D. The "Transversal Research" part.

This description offers an overall picture of the content of the Programme and constitutes the starting point for elaborating the calls for proposals. Each element of the Programme is worked out in detail in the involved calls (see point 1.6), taking scientific developments and the evolution of needs in the area of policy support into account. Research proposals must therefore be based on the calls for proposals and not only on this excerpt from the Memorandum to the Council of Ministers.

A. Priority Research Areas

1. Energy

The domestic gross consumption of energy in Belgium is rising from year to year, just as it is in Europe and throughout the world. In Europe this is leading to an ever-increasing dependency on fossil fuels, which has pernicious consequences for the security of energy supplies, the environment and health, geopolitical equilibria, fuel prices... An active energy policy, a top-priority sector for every economy, cannot be carried out without a policy for simultaneously managing demand and supply.

Within the Programme the priority research topics are:

- **Rational energy use** (REU) with the study of the social, cultural and economic variables which influence the energy consumption of households, the study of technical variables such as those influencing the energy efficiency of buildings, the study of communication instruments to promote changes in behaviour, the evaluation of the REU programmes and other policy instruments, the study of the role of new processes that can improve energy efficiency, such as soft chemistry (new materials and superconductivity)...

- **Alternative and/or renewable forms of energy** (wind, biomass, sun, hydrogen, etc.) with the analysis of growth possibilities (by amongst others comparing successful examples of dissemination of various technologies abroad), barriers to their introduction and the consequences of their development (employment, security of the network, emission of greenhouse gases, etc.), analysis of the role of biotechnology, etc., in a sustainable development perspective.

- **Organisation of energy systems over the medium and long terms:** socio-economic study of the potential of technological improvements of energy systems (use of residual heat during energy transformation in centralised versus decentralised systems, reduction of losses during energy transport and energy production, vulnerability, dependency on a single form of energy versus usability of a diversified range of sources, integration of cogeneration including on a non-industrial

scale, combination of energy sources for multiple objectives (e.g. fuel cells for both heating and transport) in order to increase efficiency and effectiveness).

- **Energy policy** with firstly the analytical or future-oriented study of such varied and interdependent themes as energy prices, energy supply security, liberalisation of the markets, expansion of the market, geopolitical considerations... and secondly the analysis of the role of energy in Belgian society (relationships between energy and employment, energy and poverty, energy and the economy, etc.).

2. Transport and Mobility

In various policy documents at the (inter)national, regional and local levels, sustainable transport and sustainable mobility are translated into concrete objectives such as: access to mobility, accessibility, traffic safety and traffic liveability, reduction of the external effects of transport... The objective is to reduce the tension between the increasing (needs for) mobility and the social, economic and environmental challenges entailed by it.

In the framework of this Programme, the following priority research topics - and their mutual interactions - are addressed:

- **Mobility and modal choice**
  - Mobility in time and space: land-use planning, urban planning, demographic trends; new forms of organisation in the economy, leisure, globalisation (increase in international transport), congestion...
  - Social and cultural aspects: right to mobility, trends in travel behaviour and modal choice (habit formation, price, impact of advertising and awareness-raising...)
  - The future of inter-modal and multimodal transport (in the framework of logistics, freight and passenger transport): interoperability, standardisation, competitiveness, cost evaluation, pricing policy, supply and financing of infrastructures...
  - Possibilities for and role of intelligent transport systems and technological innovations in arriving at a more sustainable mobility.

- **Transport and the environment**
  - Environmental impacts of transport: air quality, noise, odours, vibration, fragmentation of space...
  - Environmentally friendly technologies (for the various modes of transport): analysis of technical and socio-economic problems as well as possible solutions for the application of alternative energy sources (electricity, hydrogen, bio-energy (such as bio-ethanol), etc.);
  - Role and possibilities in the area of technical inspection and vehicle maintenance, environmental labels, the purchase, replacement and recycling of vehicles, environmentally friendly driving behaviour...

- **Traffic safety**
  - Social costs of traffic unsafety;
  - Analysis of behaviours; analysis of determining factors; relationship between types of road users;
  - Improvement and utilisation of statistical data;
  - Possibilities in the area of awareness-raising, training, regulations, enforcement, infrastructure measures, land-use planning...
  - Freight transport and safety;
  - Possibilities for and role of intelligent transport systems and technological innovations in the area of traffic safety.

The research concerns the analysis of both **processes and impacts** and the analysis, development, and evaluation of **policy measures**. The research must contribute to the **development of tools to support decision-making**. Specific attention should be paid to institutional aspects (e.g. the integration of transport and environmental policy, the European context, etc.); mutual interactions between mobility, environmental, and traffic safety issues; possibilities, impediments, and effects at the social, economic and environmental levels.

3. Agro-food

The quality of both foodstuffs and the processes used for their production in industry or agriculture is a priority objective of the European and national governments.

In order to be able to guarantee this striving for quality, a great deal of research must be done, covering a variety of aspects, among others human health, impacts on the environment, as well as socio-economic dimensions of the sectors involved.

In order to be able to respond to these challenges, the following research topics are addressed in the Programme:

- **Food safety**: chemical safety and microbiological safety, pathogenic micro-organisms (priorities of the Federal Agency for the Safety of the Food Chain - FASFC), resistance to antibiotics, viruses, materials in contact with foodstuffs; study of and change in the current modes of consumption towards a sustainable food consumption.

- **Food allergies and food intolerances**: food-health interactions, study of the causes, identification tests, impact studies, behavioural analysis...
  Especially in Belgium one is seeing an alarming increase in food intolerances and food allergies, particularly among young children.

- **Food and "novel foods"**: the study of diet, macro- and micro-nutrients, antioxidants, and oligo-elements, pre- and probiotics, health foods, vegetable oils, GMOs, the use of little-known biological resources...
  Putting on the market "novel foods" combining nutritional effects and marketing, raises questions which must be answered by introducing a legal framework (directives and standards).

- **Integrated systems for quality management:** the study of environmental and quality management systems (HACCP (Hazard Analysis and Critical Control Point), LCA (Life Cycle Analysis), systems for rapid warnings about foods, standards, labels, specialised guides for best practices, traceability, authentication, reduction of pesticides, fertilisers, heavy metal contents, and the emission of greenhouse gases...).
  Systems for quality management must also be adapted to the problems facing small producers (SMEs, artisans, etc.), who in our country are important partners in this economic sector.

- **Upcoming production methods - multifunctionality of production:**
  - New cultivation and production methods beyond the dominant methods of production and their social, economic and environmental impact.
  - Increasing the added value of existing products, a different use of production factors, collaborating on environmental protection and/or quality programmes, the production of "non-commodity" goods, making production factors and infrastructure available to third parties...
  - The analysis of agricultural environmental measures: caring for the quality of natural systems, the maintenance of biodiversity, landscape protection, tourism...
  - Study of the possibilities for valorising agricultural surpluses, among others via biofuels.

4. Health and Environment

The "Health and Environment" part is based on the finding that trends in both individual and collective behaviours, in how people work or consume and produce goods and services, have new and sometimes unexpected effects on the environment and health. Indeed, it is estimated that 20% of all illnesses can be attributed to environmental factors, and one finds that certain population groups run an increased risk.

If we look at the WHO´s definition of health[17], we find that it integrates physical, psychological, and social well-being. Working in the health field thus entails that none of these aspects is neglected. This is a comprehensive issue where account must be taken of the numerous risk factors and their cumulative effects.

The research to be carried out under the Programme supports the elaboration or the adaptation of national or European policy strategies, policy plans, and programmes (NEHAP, the Government policy on well-being, CEHAPE, the programme for reducing plant protection agents and biocides in Belgium[18], etc.).

In this context the research will concentrate on 2 lines of research and is limited to understanding hazards, their development, and their cumulative effects on health, as well as the development of methods for evaluating, managing, regulating and reducing risks:

- **Health risks related to biological, chemical, or physical exposures**
  A horizontal and/or sector-related approach is taken to address health issues. This research spans the entire programme (transport, energy, climate, Agro-food, the terrestrial environment, the aquatic environment, the atmosphere) and must make it possible to attain greater insights into threats for human health. For example, the repercussions on health of food production and consumption will be worked out in synergy with the Programme's Agro-food theme (cf. sub themes "Food allergies and food intolerances" and "Food and novel foods").

- Since **the work environment** is a specific environment, it offers possibilities for better delineating some causal relationships than would be the case in a general environment. The research performed in this context can determine the pressure and impact of exposures more precisely and reach more reliable and faster decisions for various aspects of the problematic, particularly concerning the development of methods. Some research can fit into the study of a general environment, such as research on workplace contamination or the (bio)monitoring of employees exposed to existing or new hazardous products, to pesticides/biocides...

  Well-being in the workplace is also studied by addressing organisational aspects, namely the study of psychosocial risks, musculoskeletal problems, and human errors. The research performed here will analyse, for different population groups (among others women and older employees), the following dimensions: organisational changes and their consequences, the limitations of the work organisation in specific involved sectors (government departments, agriculture and SMEs, etc.), subject to technological innovation and to the principles of highly demanding European regulations in terms of "quality systems", standardisation, or the evaluation and management of chemical hazards.

5. Climate

17 A general condition of physical, mental, and social well-being that does not consist merely of the absence of any disease or handicap.

18 Decision of the Council of Ministers of 10 December 2004.

The priority research lines take into account (among others) the recommendations of the Intergovernmental Panel on Climate Change (IPCC) and the European Council's Working Party on International Environmental Issues - Climate Change (WPIE/CC) and support the implementation of the Climate Convention, the Kyoto Protocol, and the definition of new post-Kyoto reduction targets. Research on climate change is carried out on various geographic scales: national, European, and global, with specific attention paid to Antarctica.

Research is necessary for:

Understanding the climate system

- Studying the evolution and causes of climate change (natural versus anthropogenic origin);
- Better understanding the mechanisms and factors which influence the climate system (biogeochemical cycles, aerosols, stratospheric ozone, the ocean CO_2 balance...);
- Contributing to the international efforts to identify the various "pathways" which allow the reduction targets to be reached (cf. art 2 UNFCCC);
- The development of projections of future climate evolutions on the basis of climate modelling on the global and regional levels;
- Introducing scientific elements for evaluating the level of "dangerous interference" (art. 2 of the UNFCCC).

Analysing impacts, adaptation, and vulnerability (particularly in Belgium)

- Evaluating the impact of the climate change in combination with other pressure factors on hydrological cycles, sea level, the availability of water reserves, and their management in various sectors (agriculture, transport, energy, etc.);
- Evaluating the risks and the impacts of extreme climatic events on ecological systems and vulnerable socio-economic sectors;
- Evaluating from a scientific and socio-economic perspective the adaptive measures which are necessary in order to anticipate this impact.

Supporting the preparation and evaluation of measures to mitigate climate change

- Evaluating from an economic, social, environment and legal perspective the measures relating to:
  - the sequestration potential in terrestrial and marine ecosystems;
  - reducing greenhouse gas emissions in Belgium (taking into account the three Regions in Belgium and their mutual interactions, as well as relations with neighbouring countries);
  - reducing greenhouse gas emissions outside Belgian borders in the framework of Joint Implementation (JI) and Clean Development Mechanisms (CDM)...;
  - integrating climate policy into other areas, including development cooperation and foreign trade.

More sector-related studies (such as in the area of energy, transport, etc.) performed in the framework of these priority research areas can supplement the global instruments developed here.

6. Biodiversity

"Biodiversity" or "biological diversity" means the entirety of the living world. Along with the diversity of species (flora, fauna, micro-organisms), this also includes genetic diversity within a given species and the (terrestrial and aquatic) environments in which species live. Because biodiversity is the very basis of life on earth, with a broad offer of goods and services (production of food and fibres, carbon storage, nutrient cycles, resistance against climate, etc.), an increased loss of biodiversity such as that currently observed constitutes one of the major problems that we face. Europe and its Member States have undertaken to "halt the loss of biodiversity before 2010". This goal can only be attained with reliable and coordinated science.

In the framework of this Programme, the goal of the "biodiversity" research area is:

- to understand the causes of the loss of biodiversity: the impact of invasive species, fragmentation of the landscape, climate change, nitrogen pollution, etc.;
- to analyse the conditions and trends of populations, species, habitats and to evaluate ecological services which these species and systems provide;
- to identify priority responses concerning conservation, restoration, and the sustainable use of biodiversity and to provide scientific instruments for assessing the feasibility and efficiency of these responses.

This Programme addresses the *in situ* biodiversity of the marine ecosystems of the North Sea, the North Atlantic Ocean, and the Southern Ocean, as well as that of terrestrial ecosystems and Belgian freshwater areas. In a perspective of sustainable utilisation and conservation, the *ex situ* biological resources kept on our territory are also being studied.

7. Atmospheric, terrestrial (including freshwater), and marine ecosystems

In this research area, attention is paid to the three compartments of the earth system - i.e. the atmosphere (the troposphere and stratosphere), terrestrial ecosystems (incl. freshwater ecosystems), and marine ecosystems - and their mutual interactions.

The atmosphere is to be studied at the global as well European and local levels, to support air quality protection policy: LRTAP, the Vienna Convention and the Montreal Protocol, the Climate Convention (UNFCCC), and the Kyoto Protocol. Each of these agreements requires implementation in Belgium, which among others is based on research on the synergy or conflicts between conventions.

The study of terrestrial ecosystems will focus on our territory and also includes the research relating to surface water and river banks and valleys, so as to support the implementation of the European Water Framework Directive.

The marine ecosystems to be studied include the North Sea and Antarctica, where research is important for the implementation of (inter)national conventions and agreements signed by Belgium (including the Antarctic Treaty, the Madrid Protocol, the Belgian Law on the Protection of the Marine Environment, the Law on the institution of an EEZ (exclusive economic zone), the OSPAR Convention).

Research within these three compartments concentrates on the **"drivers" of ecosystem processes and on environmental policy problems**, such as changes in land use (soil erosion, acidification, depletion…) and biological and chemical interference (eutrophication, photochemical ozone and aerosols in the troposphere, the greenhouse effect, the thinning of the stratospheric ozone layer...) as a result of anthropogenic activities.

Since generally the same anthropogenic activities cause these problems and given the mutual interactions of and links between these various problems, there is a need for an integrated approach to both research and policy.
Research will attempt via **process studies** (understanding and quantifying chemical, biological, and physical processes) and the development of tools (quality monitoring systems, simulation models, etc.), to propose measures, instruments, and/or recommendations for the reduction of sources of pollution, the establishment of standards, the development and evaluation of integrated **management and policy measures**… Where possible, the studies will be supplemented with a socio-economic evaluation of the results.

Relevance of Antarctica research

Antarctica and the surrounding Southern Ocean (SO) are global climate regulators: as a "biological pump", the SO can help to mitigate the effects of increasing CO_2 discharge into the atmosphere; the further melting of ice sheets and glaciers as a result of climatic warming will have a significant effect on the total sea level increase, anthropogenic chemicals above Antarctica degrade the protective ozone layer... Research provides important information on climate evolution, the dynamics of ice caps and glaciers, and biogeochemical processes in and between the atmosphere and the SO, which in turn leads to understanding and modelling sea level and climate change.

Through its physical isolation, its extreme environment, and its unspoiled state, Antarctica also constitutes a unique ecosystem with special species and populations, that can serve as a model for understanding universal biological (ecological, physiological and biogeographical) processes. Research contributes to better understanding the complexity of biotic communities under extreme conditions and yields potential medical and industrial applications. Biodiversity research in Antarctica is also the basis of the proposed international measures for the protection of Antarctica and its surrounding oceans.

Relevance of North Sea and North Atlantic research

The North Sea is characterised by a very high productivity and highly diversified habitats, but it is also a sensitive ecosystem under heavy pressure from intense human activities. In order to arrive at a sustainable management and a sustainable exploitation of the North Sea, there is a need for research that focuses on deepening existing scientific knowledge about the structure and functioning of the North Sea ecosystem (including biodiversity) and the processes which take place within it, including responses to anthropogenic pressures and a better understanding of the social/economic impacts of direct and indirect human activities on the ecosystem.

Along with the Belgian part of the North Sea and in particular the coastal area, the areas through which it is directly influenced (the Channel, the Scheldt Estuary) and/or where the effluents of this part of the North Sea can have a measurable impact (the Southern Bight and the central North Sea) also deserve attention. The transition between the ocean and the North Sea is also an important area of study.

B. Standardisation within the priority research areas

The Programme encourages, within the priority research areas and if this appears relevant, the submission of proposals on standardisation.

Standardisation is a powerful means of achieving technical progress and developing the economy; it can contribute to a better quality of life in general by raising quality, safety, reliability, and efficiency levels. Standards have a positive effect on the entire society (business organisations, governments and economic leaders, suppliers and buyers of products and services, and finally consumers and users in general).

At the economic and social levels, standardisation is an instrument that harmonises and facilitates transactions, inspires trust, limits risks, and supports the dissemination of innovation.

Standardisation is also an essential instrument supporting the implementation of European environmental policy choices. The implementation of environmental policy (in the areas of noise pollution, waste, soil, biomonitoring, discharge of pollutants, etc.) requires appropriate standards for

tests, sampling, and analysis, since it is essential that environmental quality be comparably measured worldwide. This is the task of international standardisation.

Moreover, there is an increasing awareness of the importance of standards and how they are designed. The Commission (DG Enterprise and DG Environment) is preparing a communication on the integration of environmental aspects into European standardisation. The CEN is striving to fit all environmental aspects horizontally into all of its standards, even as they are being developed within a sectoral framework. The objective of all this is to ensure that no unnecessary barriers are introduced and to keep the negative impact on the environment as low as possible.

The research to be carried out in this framework must meet the following criteria:

- The research should fit within the priority research areas proposed in the Programme;
- It should be prenormative research making it possible to contribute to the development of standards;
- The research should make it possible to contribute to the identification of impacts, problems, and gaps related to standardisation in a sustainable development context;
- The research should analyse the role of standardisation as an instrument for a sustainable development policy.

C. Interactions between priority research areas

A trans-sectoral, integrated approach to research is needed for several reasons: to evaluate the impacts of a problem or the validity of a measure, strategy, or technology at the social, economic, and environmental levels; to take into account in an optimal manner the complexity of a problem, the reality in the field, and the institutional context; to contribute towards adequately fulfilling national and international commitments.

The Programme will therefore encourage **interactions between priority research areas**, making it possible to tackle common, complex problems such as:

- *air pollution (ozone, particles…),* a problem common to the areas energy ↔ transport and mobility ↔ atmosphere, terrestrial and marine ecosystems ↔ climate ↔ health;
- impacts associated with *genetically modified organisms* (GMOs), a, issue interfacing with Agro-food ↔ consumption ↔ health ↔ terrestrial ecosystems ↔ biodiversity;
- *the work/leisure relationship* interfacing with ↔ energy ↔ terrestrial and marine ecosystems ↔ biodiversity ↔ health;
- *product and process life cycles,* interfacing with terrestrial ecosystems ↔ atmosphere ↔ biodiversity ↔ energy ↔ Agro-food ↔ working conditions;
- *renewable forms of energy*, associated with the areas of energy↔ agriculture ↔ terrestrial and marine ecosystems ↔ climate;
- the *global character of challenges:* production and consumption ↔ transport and mobility ↔ energy ↔ health ↔ biodiversity ↔ climate;
- the *integrated management of coasts or catchment areas, which is linked to the research areas* energy ↔ agriculture ↔ transport and mobility ↔ terrestrial and marine ecosystems ↔ climate ↔ biodiversity ↔ production and consumption;
- ...

The research must take into account the (complexity of) interactions between priority research areas. This constitutes an essential guideline throughout the Programme (calls for proposals, project selection and management, valorisation of research results).

For this are planned: integration of interactions and common themes into appropriate calls, *joint calls* between priority research areas (e.g. energy – transport, agro-food – biodiversity, health – climate,

health – Agro-food), the "*clustering*" of projects covering different aspects of common, complex problems...

D. "Transversal Research"

In order to better translate/operationalise the concept of sustainable development within and between the priority research areas, **transversal and generic research** is necessary. Accordingly, the Programme includes "Transversal Research" dealing with the following questions:

- Changing unsustainable production and consumption patterns;
- The role of the spatial and temporal dimensions of sustainable development;
- Devising and analysing instruments supporting a policy of sustainable development, in particular instruments aimed at a better balance between the social, economic, and environment-related pillars of sustainable development.

Sustainable development is all about **equating the human population with the available resources and space**. This implies analysing the links between the geographic or climatic framework of a region and all of the region's economic, social and cultural productions. This requires a transversal approach and can be analysed via the different research themes.

In order to strengthen the coherence of the Programme, the transversal research topics should preferably be addressed in relation to the 7 proposed priority research areas, without excluding other areas that might contribute towards operationalising the sustainable development concept (e.g. residential construction).

Under this heading the following research topics are addressed:

- **Spatial dimensions of the sustainable use of the ecosystems**, underscoring the importance of policies for land-use planning, habitat, infrastructures, etc.;
- **Production patterns**, taking into account the economic, environmental, and social impacts throughout the production chain
- **Striving for sustainable consumption** at both the individual and collective levels (well-being, health, employment, quality of life, excessive debt burden, redistribution, pollution, waste, natural resources, etc.)
- **Time management in relation to consumption profiles and production methods** (leisure, combining a private and a professional life, flexibility of companies, etc.);
- **Globalisation of the economy** and its consequences, particularly with respect to geostrategy, North-South relations, the use of natural resources, climate change, inequality, and poverty
- **Social changes** (demographic development, (im)migration, etc.) and their implications in a sustainable development perspective
- **The quest for an economic development** (competitiveness of companies, employment...) **compatible with the sustainable management of human and natural capital** (uncoupling, dematerialisation, qualitative growth, etc.)
- **Ethical aspects linked to sustainable development,** notably in relation to the responsibility of the various actors, access to resources...
- Different **visions of sustainable development** and their implications
- **The role of decision-making processes** in striving for sustainable development
- **The multifunctionality of the primary, secondary and tertiary sectors,** i.e. agriculture, industry, and services
- The **role of standardisation** as an instrument for a sustainable development policy;
- **Resource management**; this includes analysing the present dependency on finite resources, analysis of bottlenecks over the short, medium and long terms, studying links between resource

use, energy consumption, and environmental pollution, and conducting further research on how to reduce the discrepancy between environmental stress and the environmental carrying capacity, the ecological footprint, and the ecological debt.