Annex 4 — Germany country case study

BLOSSOM: Support to analysis for long-term governance and institutional arrangements

European Environment Agency

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European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark
Tel.: +45 33 36 71 00
Fax: +45 33 36 71 99
Web: eea.europa.eu
Enquiries: eea.europa.eu/enquiries

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The principle author of this report is **Bernhard Borsche** (Milieu Ltd).

Substantial input was provided by Tony Zamparutti and William Sheate.

Project Leader: William Sheate (Collingwood Environmental Planning Ltd)

Project Coordinator: Tony Zamparutti (Milieu Ltd)

The EEA project manager was Axel Volkery.

The following German experts provided guidance, reviewed drafts and contributed ideas.

- Dr Günther Bachmann, General Secretary of the German Council for Sustainable Development
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- Matthias Koller, Head of Section of Fundamental Aspects, Sustainability Strategies and Scenarios, Sustainable Resource Use at the Federal Environment Agency
- Ullrich Lorenz, Research Associate of the section Fundamental Aspects, Sustainability Strategies and Scenarios, Sustainable Resource Use at the Federal Environment Agency and national expert in EIONET-FLIS (European Environment Information and Observation Network — Forward Looking Information and Scenarios)

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The opinions and conclusions presented here are the sole responsibility of the consultants and do not necessarily reflect those of the EEA.

Acronyms

BLOSSOM	**B**ridging **LO**ng-term **S**cenarios and **S**trategic analysis — **O**rganisation and **M**ethods
BMBF	Federal Ministry of Education and Research
BMU	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
BMWi	Federal Ministry of Economics and Technology
BR	Federal Government
EEA	European Environment Agency
EU	European Union
Fona	Research for sustainability
SDS	(German) Sustainable Development Strategy
GG	German Basic Law
GGO	Joint Rules of Procedure of the Federal Ministries
SRU	German Advisory Council on the Environment
RNE	German Council for Sustainable Development
UFOPLAN	Environmental research plan
UBA	Federal Environment Agency
UK	United Kingdom
WBGU	German Advisory Council on Global Change

1 Introduction

1.1 Introduction

This report sets out the current status of the main institutional and governance arrangements for futures thinking in Germany with respect to environmental — and environment-related — policymaking. It is based on a review of documentation and other available resources and a set of interviews with high-level officials and experts in relevant government departments, agencies and institutions. The aim has been to understand better how futures thinking is undertaken in Germany, the relationships between different futures programmes and how these relate to, and influence, environmental policymaking. The report particularly tries to identify the success factors in ensuring futures thinking is embedded in environmental policymaking; however, barriers to success are also identified. It does not seek to explore the whole range of futures work, only those aspects of most relevance to environmental policymaking, and is focused on the institutional and governance structures, not the details of the futures studies or the quality of those studies. Further detail can be found in the Appendices.

This report, along with similar reports for 11 other EU Member States, formed the basis for a further cross-country analysis in 2010 to identify common themes and issues in institutional and governance arrangements, as well as distinctive aspects of different cultural and administrative traditions and approaches to futures thinking.

This study presents the results of an attempt to synthesise and evaluate current practices: it is meant to shed light on important developments and stimulate discussion but it is not meant to be understood as a comprehensive and concluding assessment of future-oriented studies or their impacts on decision-making.

2 The landscape for long-term thinking and governance in Germany

Forward-looking studies and thinking are used in several parts of the federal administration in Germany. This chapter provides an overview of key actors and responsibilities for long-term thinking and governance in environmental policy in Germany. It focuses on two areas related to environment where forward-looking studies and thinking have been used: Germany's Sustainable Development Strategy, which is a key vehicle for long-term thinking at the federal level; and energy and climate policy, in particular the development of the Energy Concept adopted in September 2010. The chapter also describes some other sectors where forward-looking think has been used and, notably, the use of foresight approaches to identify new priority fields for science and technology research. The foresight initiatives explore the needs of tomorrow to identify research priorities; among the needs addressed in this work are environmental issues.

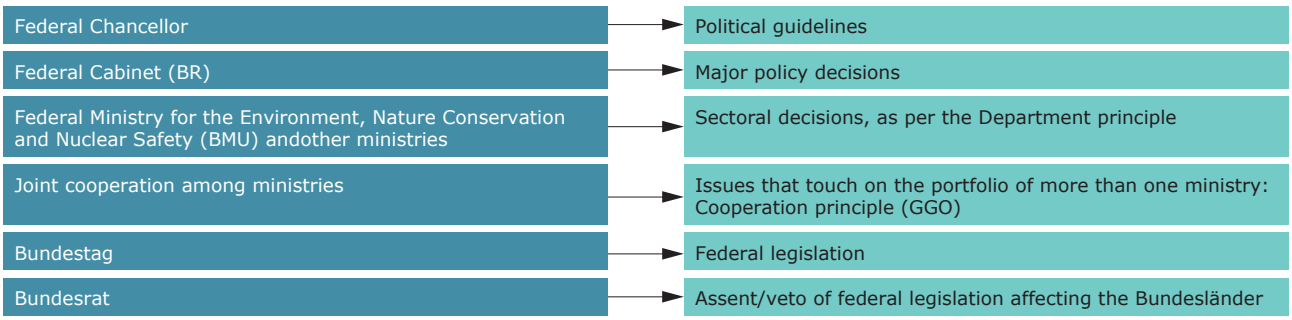
After a review of the overall institutional setting (Section 2.1), the chapter reviews the institutions that support these and other forward-looking initiatives. These include the Federal Chancellery; the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the Federal Environment Agency (UBA); and the Federal Ministry of Education and Research (BMBF), which is described in terms of its work in the area of technology foresight. Other topics include the resources available, the involvement of stakeholders, the role of the parliament and the approach to methodologies.

2.1 Overall institutional setting

Germany is a federal republic consisting of 16 states or *Bundesländer*. The basic or fundamental law, which is, in effect, the country's federal constitution, divides the legislative and administrative competences between these two levels. (This case study focuses on the federal level although it also provides some information on forward-looking studies at the *Bundesländer* level.)

Under basic law, the Federal Chancellor is responsible for setting political guidelines ([1]) (Figure 1). Important decisions must be adopted by the federal government (BR), i.e. the cabinet of ministers as a collective body. However, under the departmental principle followed in Germany, each minister leads his or her ministry independently and

Figure 1 Distribution of power and cooperation between key federal institutions



([1]) Article 65, sentence 1 GG.

he or she has sole responsibility ([2]). This principle gives ministers an important position in terms of defining the core aspects of policy in their field. This approach, together with top-down management and the strong role of the rule of law make for often rather hierarchical structures. Ministries tend to defend their 'turf' under the department principle if not required under government rules or decisions to work together ([3]).

As stipulated by Germany's basic law, environmental matters are, for the most part, an area of shared legislative competence between the federal level and the *Bundesländer*: this means that the *Bundesländer* are entitled to legislate if, and to the extent that, the Federal level does not. Their competence is de facto limited as the federal level has adopted a large number of sectoral environmental laws.

Legislative power at the federal level is held by the Bundestag (Federal Diet), which is made up of directly elected deputies, and the Bundesrat (Federal Council), the upper house, whose members are chosen by the governments of the 16 *Bundesländer*. The Bundesrat thus provides a forum for the *Bundesländer* to participate in federal legislative and administrative procedures. Although its powers are more limited than the Bundestag, the Bundesrat's approval is necessary for legislative acts where budget, organisational matters or administrative sovereignty of the *Bundesländer* is concerned, and these are numerous. This system creates the risk, however, that federal legislative processes becomes blocked if the two chambers have opposing majorities: in this situation, only issues that have cross-party consensus (as is the case for climate change objectives) move forward.

Forward-looking thinking in the government takes places within this setting. The Sustainable Development Policy (SDS), whose implementation is managed by the Federal Chancellery, has been a key process. Forward-looking thinking has been a key part of other policymaking processes, in particular in the areas of energy and climate change (Figure 2).

The scientific background for policy strategies in these areas, including forward-looking studies, has been provided by a variety of institutions, including government ministries and agencies, research authorities, advisory councils, public research projects and commissioned research institutes. Indeed, a high reliance on expert analysis is a characteristic of German administration and this can be seen in the large number of scientific agencies and councils established by the federal government to act as policy advisors. These agencies and councils are less hierarchically structured and aim to collaborate with ministries and external actors to find common ground for their research and to produce synergies with other scientific and non-scientific authorities. However, it must be kept in mind that these agencies are subordinate to the ministries and do not issue policy decisions.

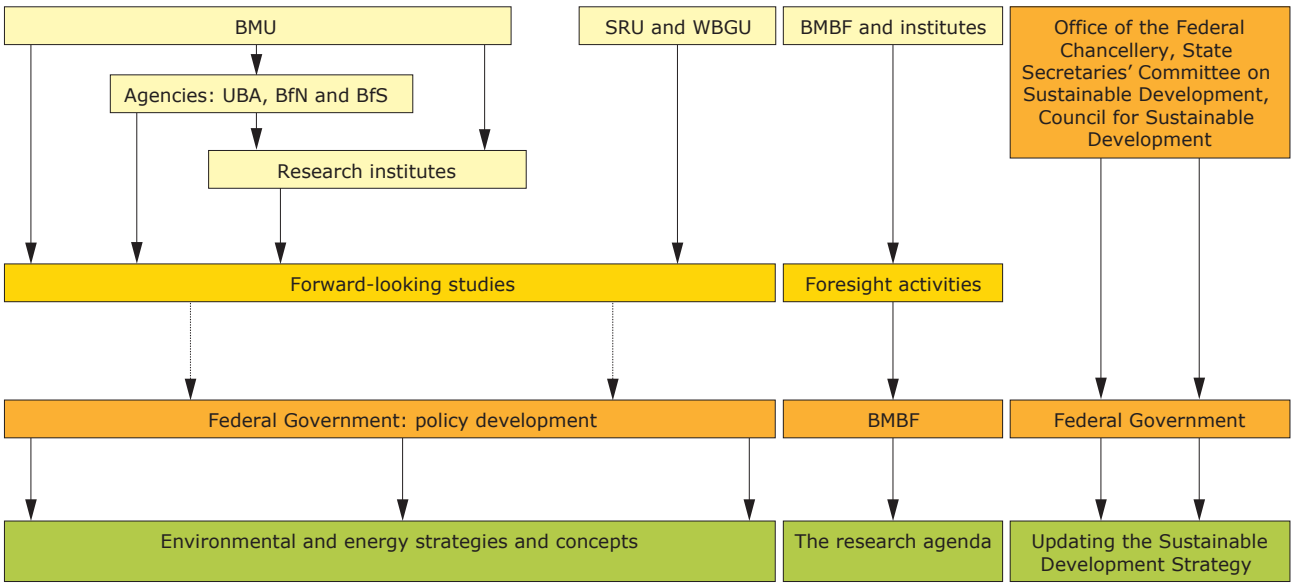
Nonetheless, the rigid ministerial structure limits cross-cutting approaches and interdisciplinary thinking. A further characteristic is a strong tradition of quantitative analysis. This may reflect a cultural tradition in governance. For example, Perlitz and Seger describe German corporate culture has having a 'high uncertainty avoidance', and as a result 'planning plays an important role to keep the future free of surprises'. These authors also point to a 'high respect for technology and production' in Germanic countries in relation to Anglo-Saxon countries ([4]). These cultural factors may be present in policymaking as well and could explain to some extent the preference for quantitative approaches.

2.2 Long-term thinking: frameworks and actors

The starting point for long-term policy considerations in the field of environment was the establishment of the first Environment programme 1971, which was evaluated and updated in 1976. This programme introduced the principle of precautionary 'long-range environmental planning' ([5]).

([2]) Article 65, sentence 2 GG.
([3]) Section 19 of the Joint Rules of Procedure of the Federal Ministries (GGO).
([4]) Perlitz, M. and Seger, F., 'European cultures and management styles', *International Journal of Asian Management*, 2004, p. 16.
([5]) Jänicke, Martin, *Environmental Policy*, available on the website of the Federal Agency for Civic Education (http://www.bpb.de/wissen/078128026493965496612237505967 46,0,0,Umweltpolitik.html).

Figure 2 Overview of the German approach to long-term thinking in environmental matters



This broad-based approach to long-range environmental planning was not maintained during the following years, and long-range planning was only applied to certain environmental fields. In 1995, at a climate summit in Berlin, for example, German climate protection policy established long-term targets to reduce carbon dioxide emissions between 1990 and 2005 by 25 %.

Germany's 2002 Sustainable Development Strategy now provides an important framework for forward-looking work. More recently, the preparation of government strategies in the fields of energy and climate change are noteworthy. These include the 2008 Adaption strategy for climate change ([6]) elaborated by the BMU and the '2007 Integrated climate and energy' programme ([7]), which includes a number of measures proposed by a forward-looking study of the Federal Environment Agency.

The main Federal environmental bodies working in these fields — the Federal Ministry of Environment, Nature Conservation and Nuclear Safety (BMU), the Federal Environment Agency (UBA), the Federal Agency for Nature Conservation (BfN), or the Federal Office for Radiation Protection (BfS) — have several offices or departments that work on forward-looking thinking. The BMBF has dedicated offices that work on technology foresight. These key offices are described in the following sections.

These offices as well as others in the government often commission forward-looking studies from independent research institutes or other actors. The German Federal Government does not, however, have a central body or programme that focuses on futures or forward-looking thinking as, for example, the 'Foresight' programme of the UK Government.

The following sections review these government bodies in the context of key forward-looking activities.

([6]) http://www.bpb.de/wissen/078128026493965496612237505967 46,0,0,Umweltpolitik.
([7]) http://www.bmu.de/klimaschutz/downloads/doc/40515.php

Box 1 Overview of Germany's Sustainable Development Strategy (SDS)

The SDS has a temporal scale of 2020. Structurally, the SDS contains four main thematic sections:

- a model of sustainability;
- 21 policy areas with long-term political objectives;
- 35 quantitative indicators with mid and long-term indicator-related quantitative targets to implement the model of sustainability;
- key focus points of the strategy for sustainable development;
- management rules for sustainable development.

The model of sustainability defined in the first section consists of four key elements: inter-generational equity and quality of life (both strongly linked to the environment), social cohesion and international responsibility (also linked to the environment).

The strategy's 21 policy fields and 35 indicators each cover a separate issue; they are directly linked to the key elements of the model of sustainability. For inter-generational equity, long-term environment-related objectives for several thematic fields are established: conservation of resources; climate protection; renewable energies; land use; and biodiversity.

For quality of life, long-term environmental objectives are established for three main thematic fields: mobility, agro-economy and air quality. The key focus points of the SDS cover a range of issues. These include energy efficiency, environmentally sound mobility, health, food and land use. The last section sheds light on Germany's role in the context of global sustainable development, including global environmental and resources protection.

2.2.1 The Federal Chancellery and the Sustainable Development Strategy

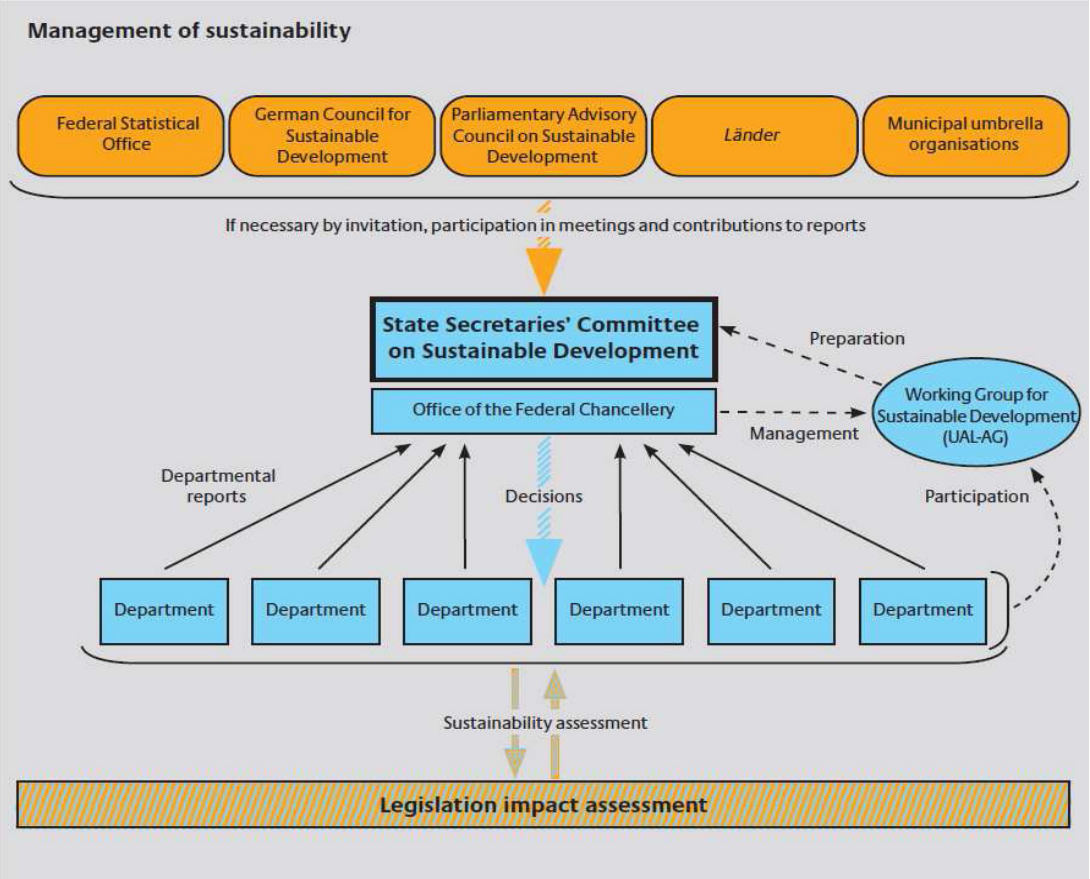
Work on Germany's Sustainable Development Strategy (SDS) began slowly in the mid 1990s with the input of two parliamentary study commissions, the work of NGOs and the organisation of stakeholders' discussion groups chaired by the Ministry for the Environment (Box 1). However, the resulting strategy proposal was never formally adopted. In the 1998 election, the governing coalition of Christian Democrats and Liberals was voted out of power. The adoption of a sustainable development strategy was an element of the coalition agreement for the next government (Social Democrats and Greens), which was completed and adopted in April 2002 ([8]).

The Office of the Federal Chancellery holds the main administrative responsibility for the implementing and updating of the SDS. Policymaking for the strategy is coordinated through the State Secretaries' Committee on Sustainable Development, headed by the Chief of the Federal Chancellery. This committee is responsible for coordinating and monitoring the process of implementation, for setting guidelines and for bringing it to the government's attention if the strategy's implementation is not on track. The Committee's members are the state secretaries of all 14 current ministries. The UAL-AG ([9]), a permanent working group that consists of high-level officials from each ministry, addresses common and conflicting interests of the ministries and prepares the meetings of the Committee.

([8]) 'Germany Case Study, Analysis of National Strategies for Sustainable Development' (unedited version), 2004, Environmental Policy Research Centre of the Freie Universität Berlin (FFU) and the Environmental Policy Research Centre of Freie Universität Berlin for the (IISD) (http://www.iisd.org/pdf/2004/measure_sdsip_germany.pdf).7 http://www.bmu.de/klimaschutz/downloads/doc/40515.php

([9]) UAL refers to *unterabteilungsleitung*, the hierarchy beneath the head of departments.

Figure 3 Management of sustainability



Source: Federal government, 2008 ([10]).

Several bodies contribute to and advise the SDS process. A key contributor is the Council for Sustainable Development (RNE), whose work includes proposals for further development of the SDS. Moreover, this council, which was established by the government in 2001, assists in communicating the theme of sustainability to the public. At present (mid 2010), it consists of 15 members that represent different interests in society, e.g. business, environmental associations, churches, trade unions and other groups. The administrative office of the general secretary, set up with the establishment of the Council, includes one secretary, one media and seven research consultants. The Cabinet appoints the Council every three years. An overview of the management structure of the national SDS is shown in Figure 3.

The implementation of the SDS and the achievement of its objectives are regularly reviewed. The Federal Cabinet and the Chancellery conduct a general review of this strategy every four years ([11]) and

([10]) Taken from the Peer Review Background Report, 2009 (http://www.nachhaltigkeitsrat.de/uploads/media/Peer_Review_Background_Report.pdf).
([11]) Progress Report 2008 with regard to the national sustainable development strategy (http://www.bundesregierung.de/nn_658608/Webs/Breg/nachhaltigkeit/Content/StatischeSeiten/teaser-entwurfspapier.html).

Table 1 Progress made in the accomplishment of environmental indicators/objectives of the national SDS ([12])

Trends identified by the Indicator Report 2010	Indicator	SDS objectives	Indicator report 2008 ([13])	Indicator report 2010
Resource protection				
 ([14])	Energy productivity	Twofold increase in energy productivity by 2020 (= 200) in comparison to the base year 1990 (= 100)	2007: increase of 40.1 % in energy productivity (= 140.1) compared to 1990	2009: increase of 40.5 % in energy productivity (= 140.5) compared to 1990
	Raw material productivity	Twofold increase of raw material productivity by 2020 (= 200) in comparison to the base year 1994 (= 100)	2007: increase of 35.4 % in resource productivity (= 135.4) compared to 1994	2008: increase of 39.6 % in resource productivity (= 139.6) compared to 1994
Climate protection				
	Greenhouse gas emissions (six greenhouse gases corresponding to the Kyoto Protocol)	21 % reduction of emissions by 2010 (= 79) compared to the Kyoto level 1990–1995 (= 100) and 40 % reduction of emissions by 2020 (= 60) ([15]) compared to the same level	2006: reduction of 18.4 % of emissions (= 81.6) compared to 1990–1995	2008: reduction of 22.4 % of emissions (= 77.6) compared to 1990–1995
Renewable energies				
	Share of renewable energies in primary energy consumption	Increase in the proportion of renewable energy sources from 1.3 % to 4.2 % of primary energy consumption by 2010 and 10 % by 2020	2007: 6.7 %	2009: 8.9 %
	Share of renewable energies in gross electricity consumption	Increase of the proportion of renewable energy sources from 3.1 % ([16]) to 12.5 % of gross electricity consumption by 2010 and to 30 % by 2020	2007: 14.2 %	2009: 16.1 %
Land use				
	Land use for housing and transport	Restriction of the daily land-take for housing and transport use to 30 ha per day by 2020	2006: 106 ha/day	2008: 95 ha/day
Species diversity and landscape quality				
	Inventory of 59 selected bird species as indicator for species diversity and landscape quality	Stabilisation on a high level by 2015 (= 100) based on the estimated level of 1975 (= 101)	2006: Ca. 70 % of the target value of 2015 (= 70) was reached	2008: 69 % of the target value of 2015 (= 69) was reached
Farming				
	Nitrogen surplus from agricultural land	Reduction of nitrogen surplus from agricultural land to 80 kg nitrogen/ha pa by 2010	2005: 104 kg/ha pa	2008: 103 kg/ha pa
	Organic farming	Percentage of agricultural areas used for organic farming: 20 % (no specific time target)	2007: 5.1 %	2008: 5.4 %
Air quality				
	Level of air pollution with regard to the pollutants SO_2, NO_X, VOC, NH_3	Reduction of the emission of these pollutants by 70 % by 2010 (= 30) in comparison to the base year 1990 (= 100)	2006: reduction of 44.8 % (= 55.2) was reached	2008: reduction of 55.3 % (= 44.7) was reached

Note: Criteria for the evalution (first column):

 Target has been accomplished or the remaining stretch will be accomplished until the target year.

 Indicator develops in the right direction however in the target year a stretch of 5 to 20 % remains taking into account the average annual development.

 Indicator develops in the right direction however in the target year a stretch of more than 20 % remains taking into account the average annual development.

 Indicator develops in the wrong direction, the stretch to the target grows taking into the average annual development.

the Federal Statistical Office of Germany monitors achievement of the 35 indicators for its long-term objectives every two years (Table 1 provides highlights of the results of the latest indicator reports 2008 and 2010 for environmental objectives) ([17]). In addition, the Council for Sustainable Development published the so-called traffic-light report, which provides an overview of progress towards these 35 objectives, in 2008 ([18]). In a further evaluation, the Cabinet mandated the Council to organise a peer review of the SDS, which was carried out during 2007–2009: experts from other countries were invited to scrutinise and evaluate the strategy and its implementation. The results were published at the end of 2009 under the title *Sustainability 'Made in Germany' — We Know You Can Do It* ([19]).

2.2.2 *The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)*

The BMU is responsible for determining environmental policy and promoting environmental protection ([20]). The Federal Minister for the Environment heads the ministry and a permanent state secretary is subordinated to him. The minister also appoints two parliamentary state secretaries to support his work. Under the management level, the ministry is divided into six directorates-general:

- Central Functions and Strategic Aspects of Environmental Protection;
- Climate Protection, Environment and Energy, Renewable Energies, International Cooperation;
- Safety of Nuclear Installations, Radiological Protection, Nuclear Fuel Cycle;
- Water Management, Waste Management, Soil Conservation;
- Environmental Health, Emission Control, Safety of Installations and Transport, Chemical Safety;
- Nature Conservation and Sustainable Use of Natural Resources.

The directorate central functions and strategic aspects of environmental protection has a division whose work includes sustainability strategies (Division ZG III 1: General and Strategic Aspects of Environmental Policy, Environmental Protection and Sustainability Strategies, Technical Supervision of the Federal Environment Agency).

The BMU has commissioned forward-looking studies in particular to support policy development in the areas of climate change and renewable energy. In particular, the BMU has played a key role in the background studies that supported Germany's recent strategy for climate change adaptation and for energy.

Climate change adaptation
The BMU prepared the *German Strategy for Adaptation to Climate Change*, which was adopted by the federal government in December 2008. This strategy was developed using models to project climate change impacts to 2100, together with research results presented in the Fourth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC). Four models were used to project climate impacts for Germany. The Max Planck Institute for Meteorology developed scenarios of climate change impacts for the UBA using a dynamic regional model (REMO). Also, on behalf of the UBA, Climate and Environment Consulting Potsdam GmbH, a company owned by the Potsdam Institute for Climate Impact Research, ran a regional statistic dynamic climate model, WETTREG. Projections from two other regional models —

([12]) This table and the included evaluation of the trends are based on the Indicator Report 2010 by the Federal Statistical Office (http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Publikationen/Fachveroeffentlichungen/UmweltoekonomischeGesamtrechnungen/Indikatorenbericht2010,property=file.pdf), Data relating to this report in English is available online (http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/EN/Content/Publikationen/SpecializedPublications/EnvironmentEconomicAccounting/Datarelating2010,property=file.pdf).
([13]) The Indicator Report 2008 (http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Publikationen/Fachveroeffentlichungen/UmweltoekonomischeGesamtrechnungen/Indikatorenbericht2008,property=file.pdf).
([14]) The symbols used in this evaluation correspond to the symbols used in the Indicator Report 2010.
([15]) Germany offers to contribute 40 % reduction of emissions of greenhouse gases compared to the level of 1990–1995 by 2020 in case of a post-2012 international climate protection agreement.
([16]) Indicator Report 2008 refers to a reference value of 3.4 %.
([17]) The latest Indicator Report of the Federal Statistical Office from 2010 is available online (http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Publikationen/Fachveroeffentlichungen/UmweltoekonomischeGesamtrechnungen/Indikatorenbericht2010,property=file.pdf).
([18]) Traffic-light report — Status of the 21 indicators of the national sustainable development strategy on the basis of the indicator report 2006 of the Federal Statistical Office (http://www.nachhaltigkeitsrat.de/uploads/media/Broschuere_Ampel_texte_Nr_22_April_2008_01.pdf).
([19]) The English/German version of the report of the peer review is available online (http://www.nachhaltigkeitsrat.de/uploads/media/RNE_Peer_Review_Report_November_2009.pdf).
([20]) Always with the restriction that the Bundestag must make all the essential decisions.

Box 2 Energy scenarios for an energy concept of the federal government

This study focuses on energy and takes into account an outlook to 2050. In this study, nine quantitative scenarios were considered.

Key variables for the scenarios included:
- demographic changes and the number of private households,
- macroeconomic development and industry structure,
- final energy consumption of private households, businesses, trades, services, the military, industry and traffic as well as non-energy-related consumption,
- developments in the sectors of electricity and district heat generation.

These factors, together with the results emissions related to energy production and consumption, are calculated by the models used in the study. The scenarios for final energy consumption are based on a modular system structure, including detailed models for the energy consumption sectors: private households, services, industry and traffic. The sector modules are bottom-up models that foresee sectoral final energy consumption divided into energy carriers and consumption purposes on the basis of appropriate guidance variables.

The European electricity market model DIME (Dispatch and Investment Model for Electricity Markets in Europe), forms the basis for calculations in the electricity and cogeneration sectors. It is a dynamic optimisation model that identifies the minimum costs for meeting European demand for electricity, and the potential and reality for cogeneration of electricity in Germany, taking into account technical and economic parameters. An energy-environment-economic model, PANTA RHEI, was used to make macroeconomic calculations. This model combines macroeconomic figures taken from official statistics with data on the energy markets, making an overall interdependent analysis.

The baseline scenario reflects development on the assumption that electricity trends will continue along the current projected path, e.g. no changes to the present legal framework and the lifespan of nuclear power stations ends in 2022. Energy efficiency increases are assumed to be moderate, without any observed major technological progress that could alter the trend. In this scenario, compared to 1990 levels, greenhouse gas emissions will have been reduced by 62 % by 2050.

In contrast to this, the eight target scenarios outline an alternative future for the energy sector that is characterised by renewable energies and the leveraging of large efficiency potentials. They also examine the effects incurred by a potential extension to the operational lives of existing nuclear power plants. In this examination, the assumptions vary, particularly regarding the length of the extension period. These scenarios indicate the technical and economic trends that are likely to emerge, and highlight the challenges and scope for political options for action.

All target scenarios enable the federal government to meet its climate protection targets reaching a reduction in greenhouse gas emissions of at least 80 % by 2050 in comparison to 1990 levels.

CLM (Climate Local Model) and STAR (statistical regionalisation model) — were also used.

Energy

The Ministry of Environment Nature Conservation and Nuclear Safety, together with the Ministry of Economics and Technology (BMWi), supported a key forward-looking study to support the federal government's new Energy Concept (i.e. strategy). Following the 2009 elections, the new coalition in the federal government had agreed to prepare such a strategy on the basis of 'scenario-related guidelines for clean, reliable and affordable energy supply'.

As part of the preparations for the concept, the two ministries jointly commissioned a research consortium ([21]) to prepare an energy scenario study ([22]). The method and the scenarios of this study are summarised in Box 2. The Government Energy Concept was adopted on 28 September 2010 ([23]) and entailed a 10-point-quick-launch

([21]) The consortium was comprised of the PROGNOS research institute, the Institute of Energy Economics at the University of Cologne (EWI) and the Institute of Economic Structures Research (GWS).
([22]) http://www.bmu.de/files/pdfs/allgemein/application/pdf/energieszenarien_2010.pdf
([23]) http://www.bmu.de/files/pdfs/allgemein/application/pdf/energiekonzept_bundesregierung.pdf

programme, including legislation, credit programmes and information campaigns.

In addition to the joint study to support the Energy Concept, the BMU has commissioned a range of studies on energy futures, including the regular series of 'guidance' studies that started in 2000 (Box 3).

2.2.3 Federal Environment Agency (UBA)

Under the technical supervision of the BMU, the UBA provides scientific support on environmental issues to the federal government, including for the implementation of environmental legislation. It also provides environmental information to the public. One of the five divisions below the president and the vice-president of the Federal Environment Agency deals with environmental planning and sustainable strategies. This division consists of three departments. The portfolio of one of these departments includes sustainable strategies, sustainable resource use and instruments and one of its sections (Division I, Section I, 1.1: Fundamental Aspects, Sustainability Strategies and Scenarios, Sustainable Resource Use) acts as a hub for sustainability scenarios and forward-looking approaches.

The UBA's research work is in part commissioned by the BMU and in part based on its own internal agenda. The agenda of the UBA comprises conceptual and applied forward-looking work. The UBA undertakes some studies itself and also commissions studies by research institutes (Table 1), using financial resources from the Environmental Research Plan.

The UBA has prepared and published a range of forward-looking studies (Box 4). Two early studies were in the area of sustainability: the *Sustainable*

Box 3 Summary of the energy guidance studies for the BMU in 2007, 2008 and 2009

The guidance studies for 2007, 2008 and 2009 each present target scenarios that describe how Germany can reduce greenhouse gas emissions. These scenarios are further developed in each successive study. From 2008, these target scenarios also incorporate Germany's 2020 targets concerning the reduction of CO_2 emissions, the improvement of energy efficiency and the development of renewable energy for the year 2020 and show the necessary structural changes to reach these targets.

The studies incorporate three complementary strategies:
- improved energy use efficiency in all sectors;
- improved conversion efficiency by means of a significant expansion of cogeneration of heat and power, and more efficient power plants;
- substantial use of renewable energy.

The guidance scenario 2008 contains an update of previous scenario work and presents a series of alternative scenarios: the E (efficiency) group of scenarios and the D (deficiency) group:

The E group involves successful implementation of all efficiency targets:
- Scenario E1: expansion of renewable energies as in the guidance scenario 2008 but with an even greater increase in efficiency, especially in the electricity sector, and a further expansion of cogeneration of heat and power;
- Scenario E2: energy demand and structure remain the same as in scenario E1, plus further development of renewable energy technology;
- Scenario E3: same as Scenario E2 but after 2020, a further growth in renewable energy use in the transport sector.

The D scenarios fail to reach efficiency targets:
- Scenario D1: expansion of renewable energy as in guidance scenario 2008, but efficiency measures are not as effective;
- Scenario D2: same as Scenario D1 but, in addition, a strong investment strategy for coal.

The guidance study 2009 begins a new scenario-building process that will last until the end of 2011 and will introduce new structural and methodological approaches. This process, starting with the 2009 study, aims at the elaboration of scenarios that describe 'no-regret strategies' for the expansion of renewable energy in Germany against the background of national and European objectives for climate, for energy supply security and for international cooperation.

The 2007, 2008 and 2009 studies were prepared by the Institute of Technical Thermodynamics (DLR) with (for the 2009 study) a private company, Engineering Consultants for New Energies (IfnE).

Box 4 The UBA studies Sustainable Germany (1997) and Sustainable development in Germany (2002)

These two studies assess sustainable development in Germany in terms of the interdependency of ecological, economic, social and cultural development; the prioritisation of the precautionary principle; and the identification of broad environmental objectives and strategies. The first study focused on the fields of energy use, mobility, food production, material flow management and consumption patterns. The second, follow-up study, also included tourism, industrial production and resource conservation.

In both studies, scenarios were based on quantitative assumptions and figures which were then projected up to the year 2010. In addition, the studies proposed mainly quantitative indicators to verify the progress made.

The studies project three scenarios: 'business as usual'; the 'efficiency scenario'; and the 'structural transformation and awareness-raising' scenario. The first scenario was based on the assumptions that the current trends would continue. The 'efficiency' scenario assumes substantive improvements in the technical efficiency of the production processes.

In the 'structural transformation and awareness-raising' scenario, moves towards sustainable development are observed in all parts of the society: the legal and administrative framework, the behavioural patterns and the technical developments are aligned to a structural change towards sustainability.

Germany study in 1997 and the *Sustainable development in Germany* study in 2002. These studies show the strong attention to the issue of sustainability in the late 1990s and early part of the new century. They also have a strong quantitative focus, which has been a key characteristic of many Germany futures studies. The agency has carried out a range of forward-looking studies since then. One example is its study on *Sustainable Construction and housing* study in 2010 (Section 2.6).

2.2.4 Federal Ministry for Education and Research (BMBF)

This ministry currently has seven divisions, one of which deals with strategies and policy issues and another with basic and sustainable research. The strategy division currently follows the BMBF's foresight process.

Since 1991, this ministry has undertaken a series of technology foresight initiatives to identify and assess the promise of new research fields and to assist in setting its in-house agenda (Table 2).

Its first initiative in this field was *Technology at the beginning of the 21st Century*, a project that started in 1991 with a review of the international literature concerning technology foresight. This process, inter alia, aimed at developing the in-house expertise of research administrators for foresight work and at identifying, assessing and interrelating critical technologies.

The *Long-term Foresight Survey on Science and Technology* followed in 1993: it tested the applicability and acceptability of the Delphi method in Germany (the short project name was Delphi '93). The third process was the 1996 *Survey on the Development of Science and Technology* (Mini Delphi), an exploratory approach to develop the Delphi method further in reaction to criticism of the first German Delphi survey: this study sought more detailed data with regard to international concerns. A further study on science and technology followed in 1996 under the project name Delphi '98. It was intended to be an update of already existing data and focused on the national situation in response to requests from German industry.

Futur was conducted as an open process, involving more varied participants and not only experts, by using the Internet as a platform to discuss certain topics. However, the first round failed, in part because too few people knew about and participated in the process ([24]). The BMBF restarted Futur in 2001, redefining its methodology and expected outcome, and putting a new research consortium in charge of developing and managing this process ([25]); Futur continued until 2005 before it was phased out. An interviewed member of the former research consortium cites the international evaluation that the formulated goals and the achieved results of this process had been too unspecific and that the

([24]) Kerstin Cuhls, 'Development and perspectives of Foresight in Germany', *Technology Assessment, Theory and Practice*, 2003, p. 20 ff. (http://www.itas.fzk.de/tatup/032/cuhl03a.htm).

([25]) An overview of the BMBF Foresight tradition can be found in the article by Kerstin Cuhls, 'Development and perspectives of Foresight in Germany', *Technology Assessment, Theory and Practice*, 2003, p. 20 ff. (http://www.itas.fzk.de/tatup/032/cuhl03a.htm).

Table 2 Overview of the BMBF's foresight initiatives

Time	Exercise	Methodologies
1991–1992	Technology at the Beginning of the 21st Century	Relevance tree, critical technologies list, small survey, panel workshops
1992–1993	Delphi '93	Translation of the fifth Japanese Delphi survey, Delphi survey, Japanese-German comparisons
1994–1995	Mini Delphi	Expert panels, Delphi survey in a Japanese-German comparison, conference
1996–1998	Delphi '98	Expert panels with workshops and virtual work, Delphi survey, analyses, conference about implementation, newsletters
2001–2005	Futur	Mix of workshop approaches: open space conference, focus groups, futures workshops, scenario writing
2007–2009	The BMBF Foresight Process (Elaboration of future-oriented research fields)	Workshops, online survey, desk research, interviews, conferences, expert teams
2010	Strategic Dialogues	Follow-up workshops and strategic dialogues

Source: Based on Cuhls

costs for the various workshops and conferences were assessed as too expensive by the BMBF. Nevertheless, the developed strategies led to the establishment of the 'Bernstein centres' that are competence centres for research in the field of neuroscience, and to other research projects.

The ministry initiated a new BMBF Foresight process in 2007 ([26]) with the aim of exploring cross-cutting research fields relevant for the future with an outlook to the next 10 years and beyond. These include fields related to the environment and to sustainable development: some of the work has been taken up by the Fona project (Box 5). The BMBF's strategy division and Fraunhofer managed this process, which is supported by several research institutes. With a view to avoiding the problems identified in the Futur process, four major objectives were set by the BMBF at the beginning of the process. These objectives were the background for the methodological foundation. Results were published in 2009 and are implemented with the support of strategic dialogues in BMBF and a system that is tracking some of the future fields that were identified.

Box 5 The Fona project

In the context of the SDS, the Federal Ministry of Education and Research (BMBF) initiated the Fona research project (research for sustainable development) in 2001. Fona provides project funding and also develops dissemination and implementation strategies and innovative structural measures. Moreover, in 2009 the Institute for Advanced Studies on Sustainability was founded (IASS). The BMBF bears the largest part of the Institute's expenses. The Institutes hosts up to 50 fellows (guest researchers) who pursue research on freely chosen subjects in the area of climate change, earth systems and sustainability. Both projects provide a platform for forward-looking research.

2.2.5 Advisory councils

The BR and the BMU are advised by the independent German Advisory Council on the Environment (SRU) that focuses on national issues and the German Advisory Council on Global Change (WBGU) that focuses on international environmental issues. Both Councils have released future-oriented studies with regard to renewable energy.

In 2008, for example, WBGU published a report on a related subject, *World in Transformation — future-oriented bioenergy and sustainable land use*. The Council is currently working on a report, *Transformation,* which describes a pathway to a climate-friendly society and contains concrete proposals for structural changes to the energy system.

The SRU this year has prepared a written opinion on *100 % renewable energy supply until 2050: climate-*

([26]) http://www.bmbf.de/_search/searchresult.php?URL=http%3A%2F%2Fwww.bmbf.de%2Fde%2F12673.php&QUERY=foresight

Box 6 Summary of the study Energy Concept 2050: A vision for a sustainable energy concept on the basis of energy efficiency and 100 % renewable energies

This study takes as a starting point the goal of limiting global temperature rise to a maximum of 2 °C: to move towards this goal, it sees the need to reduce energy-related carbon-dioxide emissions in the EU and in Germany by at least 90 %, consequently completely restructuring the energy system.

The study's scenario is based on a significantly more efficient use of energy and the complete coverage of energy demand through renewable energy. In order to reach these goals, the study identifies the following priorities for 2050.

- Transformation of the energy system from a central, demand-driven supply structure to a decentralised, intelligent, demand- and supply-driven structure.
- A significant increase in energy efficiency, e.g. by using better thermal insulation, improving energy conversion and using more efficient technology, e.g. electric instead of combustion engines.
- To ensure a stable energy supply system, a combination of renewable energy sources are needed including wind power and hydroelectricity, photovoltaics, solar thermal power plants (in southern Europe and north Africa), solar thermal heat generation, recycling of biomass residues, geothermal and wave energy.
- Electricity becomes the main type of energy distribution, including transport and, as efficiency improves, significantly reduces the need for heating.
- Development and integration of large storage capacity in the energy supply system. At the same time, the combination of renewable energy sources, including electricity exchanges with other countries in case of overcapacity or shortfalls, and an intelligent grid will limit storage needs.

The study is not to be confused with the government's September 2010 Energy Concept, which is a policy strategy; nonetheless, the study, which was published in June 2010, sought to inform the process that led to the government policy announced in September 2010.

friendly, safe, affordable (preliminary version was prepared in May 2010).

2.2.6 *Institutes, NGOs and private companies*

A range of research institutes are active in futures studies. Some of them are partly funded by government resources, including the Fraunhofer-Gesellschaft (Fraunhofer Society) and its associated institutes and the Institute for Technology Assessment and System Analysis (ITAS) that is integrated within the research programme of the Helmholtz Association of German research centres. Others are completely self-financed, including the Institute for Futures Studies and Technology Assessment (IZT) and the Institute for Applied Ecology (Öko-Institut e.V.). Some research institutes also collaborate with each other on a permanent basis, e.g. the Renewable Energy Research Association is a consortium of Fraunhofer and other research institutes.

The federal government, including the BMU and the UBA, has commissioned these and other institutes to conduct forward-looking studies. For example, the BMU called on the Renewable Energies Research Association to develop a concept for German energy supply in the year 2050 based solely on renewable sources; their study is described in Box 6.

Some research institutes also carry out work on futures studies without governments links. For example, the Foundation for Future Studies, sponsored by the British American Tobacco Co., sponsors and publishes studies on a range of topics concerning both Germany and Europe ([27]). Another foundation, the Strecker Foundation, has, together with other private bodies, supported work on the future of music in Germany (Pechmann) ([28]). A research consortium consisting of the Institute for Applied Ecology, Prognos AG and Dr Ziesing drafted the study 'Blueprint Germany, Strategy for a climate safe 2050: thinking from the target' that was commissioned by the World Wildlife Fond (WWF) and published in September 2010 ([29]).

Many German companies use forward-looking thinking. While little of this work is published,

([27]) http://www.stiftungfuerzukunftsfragen.de
([29]) The study is available online (http://www.polsoz.fu-berlin.de/polwiss/forschung/systeme/ffu/veranstaltungen_downloads/10_salzburg/kirchner.pdf).
([28]) http://www.foresight-musik.de

wDeutsche Bank Research has released several futures studies. One example is its Germany 2020 study, which presents scenarios of the country's future economy and society (Hofmann et al., 2008). This study includes a website for public dissemination of the main results (http://www.expeditiondeutschland.de/en).

2.2.7 Forward-looking work at Bundesländer level

While this case study focuses on futures thinking at the federal level in Germany, it should be noted that several *Bundesländer* as well as smaller sub-national areas have also undertaken forward-looking initiatives. Notably, the *Bundesländer* have established their own sustainable development strategies. Moreover, the topic of long-term forward-looking studies has been addressed via joint federal-*Bundesländer* working groups such as the Joint Working Group on sustainable development.

The *Bundesländer* have also carried out work in the area of technology foresight. For example, a conference organised by BMBF showed how three areas in Eastern Germany used foresight work to support local innovation strategies, and in some cases also for cross-border cooperation with other regions in EU Member States (Braun, 2007). The three areas studied were Upper Lusatia in Saxony, Havelland-Fläming in Brandenburg and South Thuringia.

Mecklenburg-Western Pomerania undertook a foresight study on prospects for healthcare research, as part of the Upgrade Blueprint project supported by the European Commission, which developed a methodology for foresight to be used at regional level in other parts of the EU (Richwien and Pechmann, 2007, Directorate-General for Research, 2004).

In Rhineland-Palatinate, an alliance of companies, associations and other actors based in this *Bundesländer* created the Initiative for the Future (ZIRP) in 1992. Its project, Future Radar 2030 ([30]), focused on the issue of demographic change, in particular the declining population as forecasted for the coming decades. The study looked at the implications, at strategies for addressing upcoming problems as well as the emerging market opportunities (Kolz and Hadnagy, 2007). A later study by ZIRP looked at infrastructure in the perspective of 2030 (ZIRP).

2.3 Resources, staffing involved

It has not been possible to identify the resources or staff dedicated to futures research and studies within the BMU and the UBA. The main reason is that no budget lines are specifically directed for futures studies or forward-looking analyses: rather, funds for these activities are part of the overall research budgets of ministries such as the BMU or agencies such as the UBA. Within the UBA, for example, it is not possible to directly identify resources or staff dedicated to forward-looking projects as these are conducted not only in the division responsible for sustainability strategies and scenarios, but also in the sector-related divisions, where they are developed and applied as a scientific tool. However, all costs of forward-looking research projects awarded to third parties (Environmental Research Plan) are accessible to the public online, where they can be retrieved from the UBA's database on environmental research projects ([31]).

It is also noteworthy that, according to the interviewees, positions or financial resources have not been allocated specifically for the development and implementation of the SDS in the Federal Chancellery, federal government or the Bundestag.

2.4 Stakeholders and external relationships

This section looks at stakeholder involvement in three broad areas: Germany's sustainable development strategy; studies for the BMU and the UBA; work on technology foresight.

2.4.1 Sustainable development strategy

Public participation played an important role in the process of elaborating the strategy. Two rounds of a public dialogue were conducted: before and after the presentation of the draft SDS in 2001/2002, citizens and social groups were asked to contribute their ideas and proposals via the Internet or mail. Both rounds were accompanied by direct consultations with specific organisations, including municipalities, industry associations, agriculture associations,

([30]) Further information is available online (http:www.zukunftsradar2030.de).
([31]) The projects being put out to tender in 2010 can be derived from the UFOPLAN 2010 (http://www.umweltdaten.de/service/ufoplan2010.pdf); UBA's database on environmental research projects provides detailed information on the projects and their budgets (http://doku.uba.de/).

trade unions, environmental groups, development organisations, consumer groups, scientific representatives and churches.

Public dialogue is also an important part of the process of updating and developing the strategy every four years. The public dialogue for the update of the SDS in 2012 started in September 2010.

Economic and social groups also provide input through their representatives on the Council for Sustainable Development, which advises the government on sustainability (Section 2.1.1).

The Committee of State Secretaries on Sustainable Development provides a forum for the coordination of government ministries for the implementation of the SDS; it also can engage in dialogue with representatives of the interests in society to address problems with the strategy.

The Council for Sustainable Development organises annual conferences where stakeholders and political actors are invited to discuss specific topics in the framework of the SDS. Its elaboration of recommendation is often based on innovative forms of public dialogues, including forums on corporate social responsibility.

2.4.2 Studies for the BMU and the UBA

Both the Ministry for Environment (BMU) and the Federal Environment Agency (UBA) have commissioned forward-looking studies on an ad hoc basis rather than part of ongoing programmes. As a result, the role of stakeholders can vary from one study to another.

The UBA uses a range of participative approaches in its studies, including stakeholder dialogue, internal and external scientific exchange, technical dialogues, round tables and status seminars.

Some initiatives have used a participative approach. For example, in the early development of the UBA study on sustainable construction and housing, a workshop brought together scientists, representatives of German federal and state ministries, trade unions and environmental associations, credit system experts, housing industry and urban land-use planners. Workshop discussions drew up the broad outlines of the study's two scenarios (the reference scenario and the sustainability scenario).

2.4.3 Technology foresight led by the Federal Ministry for Education and Research

Delphi techniques have been used in the 1990s to bring outside opinions into the technology foresight programmes for the ministry. Foresight plans and results have also been discussed in workshops and conferences. The first Futur process was based on open-space conference, focus groups and futures workshops. An initial attempt at wider approaches using an Internet forum in 1999 was, however, not successful as participation was low.

The results of the 2007 foresight programmes were made available to the public in 2010 and a strategic dialogue was initiated. This dialogue aims to support the BMBF in integrating results of the Foresight process in the development of policy measures. While the results are open for public comment, the dialogue will focus on specific experts and representatives: an actor analysis will be conducted for each topic field to be covered in the dialogue. On this basis, a core team will be appointed, which can be complemented by a wider expert circle. Each strategic dialogue will develop a content-related priority setting through a specific combination of workshops, conferences and/or online forums.

2.5 Role of the Federal Parliament

The Bundestag played an important role in the development of Germany's Sustainable Development Strategy through the 1998 report of its Enquete Commission 'Protection of Man and the Environment — objectives and framework conditions of a sustainable development'. The Commission's report, *Sustainability concept — from the model to implementation*, helped to launch the development of this national strategy.

The Bundestag has continued to play a role on sustainability issues with the establishment of its Advisory Council on Sustainable Development in 2002. Currently, the Council consists of 22 members from all parliamentary groups. The Council's task is to follow the implementation of the national and European SDS, to develop recommendations for

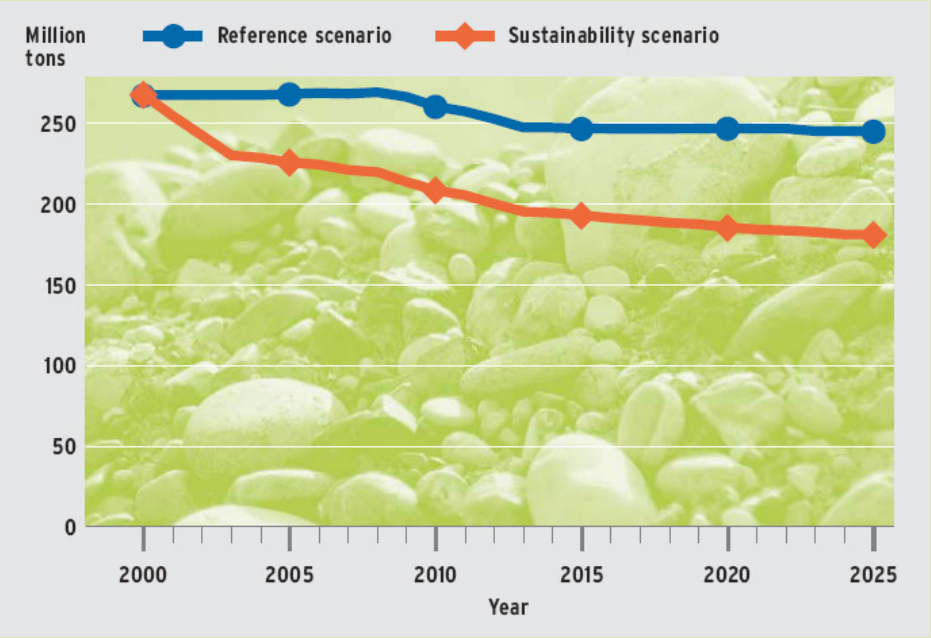
Box 7 The UBA study Sustainable construction and housing

This study, undertaken by the Institute for Applied Ecology for the UBA, looks at housing patterns in Germany to 2025, focusing on a range of environmental impacts including material flows. The study also investigated questions related to policy action:

- What is the current extent of the environmental impact?
- Are the actions being taken sufficient to achieve sustainable development?
- To what extent are individual actions able to reduce the environmental impact?
- Which stakeholders are responsible for implementing actions?
- How can obstacles be overcome?
- How much can the demand for natural resources be reduced in an ideal case?

The UBA study Sustainable construction and housing developed two scenarios to 2025, a reference and a sustainability scenario. A round-table discussion with experts and stakeholders was used to define the two main scenarios. Quantitative modelling then developed the results of these scenarios in quantitative terms across a range of impacts, including greenhouse gas emissions, air pollution and resource use. For example, modelling software was used to calculate the amount of raw materials consumed in construction in Germany over the study period for the two scenarios (Figure 4).

Figure 4 Material consumption for construction and housing in Germany to 2025



Source: UBA.

and to give advice to parliamentary committees. The Council can also identify topics for study and submit related recommendations and reports to the responsible committee of the Bundestag, and thereby initiate a comprehensive debate on this subject in the committee. Another task of the Council is to contribute to and promote public debate on sustainability.

From early 2010, the Council has examined new laws in terms of their sustainability. The Council is now mandated to scrutinise each law before its

first reading in the Bundestag and, in particular, to review its impacts in terms of sustainable development and the targets of the SDS. The results of this process are summarised in a statement and attached to each law. If the parliamentarians come to the conclusion that the law negatively affects the SDS, they can require the responsible committee to revise its provisions in the follow-up procedure. While a committee must respond to any such request, it is not required to change the law in question in accordance with the recommendations of the Council ([32]).

Thus, the Bundestag is taking a growing role vis-à-vis the Sustainable Development Strategy. Neither the Bundestag nor the Bundesrat, however, appear to have carried out other work related to forward-looking thinking.

2.6 Relative balance between quantitative and qualitative approaches

Quantitative approaches are frequently used in German forward-looking studies, a point noted by several officials interviewed for this case study. This has been the case in particular for studies related to environment, including those on climate change and energy. The use of climate models in the preparation of Germany's Strategy for Adaption to Climate Change is one example.

Interviews with officials in the UBA indicated that that this agency at least has, over the past decade, made a greater use of qualitative approaches. The UBA's study on sustainable construction and housing provides one example (Box 6).

In contrast, the Ministry for Education and Research has mainly used qualitative approaches such as Delphi surveys in its foresight initiatives- (Section 2.2.4) similar to approaches that have been used for foresight studies in other case study countries as well.

It can also be noted that many of the studies for the German Federal Government — both quantitative and qualitative — take a normative approach: they present scenarios oriented towards a policy goal, such as the reduction of greenhouse gas emissions through greater use of renewable energy. This reflects a strong focus on policy discussions and is seen in the various studies mentioned in Section 2.2 that supported the policy discussion for Germany's new Energy Concept.

Federal institutions have carried out a high number of studies in recent years. Table 3 lists important studies ([33]) conducted in the areas of sustainability, climate change and energy. It also indicates, where information is available, which of these studies used quantitative and qualitative approaches.

([32]) Website of the Council for Sustainable Development (http://www.nachhaltigkeitsrat.de/news-nachhaltigkeit/2010/2010-04-15/parlamentarier-beginnen-mit-nachhaltigkeitspruefung-neuer-gesetze/).
([33]) This list is not exhaustive.

Table 3 Examples of forward-looking studies on sustainable development and on renewable energy and climate change prepared or underway at Federal level in Germany

Title	Publi-cation date	Thematic focus	Initiated by	Conducted by	Tempo-ral scale	Quantitative/ qualitative approach	Methodology and types of scenarios/ analysis
Sustainability							
Development of integrated scenarios concerning the achievement of the environment-related targets of the national strategy for sustainable development	2012 (in prep.)	• SDS and its environment-related targets	UBA	Scenario Management International AG (SCMI)	2050	Qualitative	• Explorative • Participatory
Scenarios for an integrated sustainable policy using, as an example, the sustainable city 2030	2012 (in prep.)	• Integrated sustainable policy • Sustainable cities	UBA	Institute for Futures Studies and Technology Assessment (IZT) and Institute of Urban Affairs (Difu) and Otto Suhr Institute of Political Science (ffu)	2030	Qualitative	• Normative • Participatory
Sustainable construction and housing — a needs-based approach to the future	May 2010	• Sustainable housing and construction • Climate change mitigation, land use and raw materials consumption	UBA	UBA in cooperation with the Institute for applied ecology	2025	Quantitative and qualitative	• Stakeholder consultation • Modelling
World in Transformation — future-oriented bioenergy and sustainable land use	2008	• Bioenergy • Sustainable land use • Climate change	WBGU	WBGU	2050	Quantitative focus	Computer modelling (LPJmL model used; based on the dynamic global vegetation model LPJ)
Sustainable Development in Germany — Towards an Environmentally Friendly Development	2002	• Follow up of the 1997 study: expands its focus to tourism, industrial production and resource conservation	UBA	UBA	2010	Quantitative and qualitative	n.a.
Sustainable Development in Germany — Progress and Prospects	1997	• Sustainability • The study covers energy use, mobility, food production, material flow management and consumption patterns.	UBA	UBA	2010	Quantitative and qualitative	n.a.
Climate change mitigation and renewable energy							
Transformation	2010 (in prep.)	• Climate change • Renewable energies	WBGU	WBGU	n.a.	n.a.	n.a.
Energy scenarios for an energy concept of the Federal Government	August 2010	• Energy	BMWi and BMU	Prognos AG, EWI and GWS	2050	Quantitative approach	• Target scenarios • Computer modelling

Table 3 Examples of forward-looking studies on sustainable development and on renewable energy and climate change prepared or underway at Federal level in Germany (cont.)

Title	Publi-cation date	Thematic focus	Initiated by	Conducted by	Tempo-ral scale	Quantitative/ qualitative approach	Methodology and types of scenarios/ analysis
Energy goal for 2050: 100 % renewable electricity supply	July 2010	• Renewable energy, electricity	UBA	UBA and Fraunhofer Institute	2050	Quantitative and qualitative approach	• Based on the story and simulation method • Computer modelling
Energy Concept 2050: A vision for a sustainable energy concept on the basis of energy efficiency and 100 % renewable energies	June 2010	• Energy efficiency • Renewable energy	BMU	Research consortium	2050	Quantitative focus	• Target-scenarios • Computer modelling
100 % renewable energy supply until 2050: climate-friendly, safe, affordable	May 2010	• Renewable energy	SRU	SRU	2050	Quantitative focus	• Target scenarios • REMix model of the Institute of Technical Thermo-dynamics used for projections
Guidance scenario 2009: Long-term scenarios and strategies for the expansion of renewable energies in Germany taking into account the European and global development	2009	• Renewable energy • Climate change	BMU	Institute of Technical Thermodynamics and engineering consultants for new energies	2050	Quantitative focus	• Target scenarios • Computer modelling • Development of new methods in the ongoing process
Climate models used in the *German Strategy for the Adaptation to Climate Change*	2008	• Adaptation to climate change	BMU	Several institutes	2100	Quantitative	• IPPC climate models • Regional models: REMO, CLM, WEETREG and STAR
Guidance study 2008: Update of the 'expansion strategy for renewable energies' against the background of Germany's and Europe's climate protection targets	2008	• Renewable energy • Climate change	BMU	Institute of Technical Thermodynamics	2050	Quantitative focus	• Target scenarios • Computer modelling
Guidance study 2007: expansion strategy of renewable energies, Implementation and reassessment until 2020 and 2030 and with an outlook for 2050	2007	• Renewable energy • Climate change	BMU	Institute of Technical Thermodynamics	2050	Quantitative focus	• Target scenarios • Computer modelling

Note: n.a. - information not available (it has not been possible to assess the quantitative or qualitative methods of all studies listed).

3 Analysis

3.1 Relationship among futures programmes

Several parts of the German Federal Government undertake forward-looking analysis. Their studies are carried out through a broad range of programmes, including many ad hoc initiatives. *Bundesländer* governments and independent private bodies also prepare some forward-looking studies. Despite the range of activity, few formal or direct links have been identified among the various programmes reviewed here, and the officials interviewed did not highlight important links among them. Nonetheless, indirect relationships can be identified, in particular among studies related to sustainable development and those concerning renewable energy.

The Sustainable Development Strategy and the issue of sustainability more generally have provided a strong thematic link among many studies, even if formal links are not always clear. The UBA's study on sustainable construction and housing is one example of a study that explores sustainability issues, while not being formally linked to the SDS.

Furthermore, there is a close link between the SDS and forward-looking studies conducted or commissioned by the BMU and the UBA that concern the environmental aspects of the SDS. This is the case for the study on *Scenarios for an integrated sustainable policy*, which focuses on urban sustainability.

Another strong thematic link is found around the themes of renewable energy and climate change. Several recent forward-looking studies have looked at these issues. The BMU has commissioned the series of yearly guidance studies on renewable energy, and it also encouraged the Renewable Energy Research Association to formulate a vision of energy supply based solely on renewable energy, and the Advisory Council on the Environment (SRU) submitted a written opinion in 2010 on this topic. The German Advisory Council on Global Change (WBGU) prepared a report on bioenergy and sustainable land use in 2008. A research consortium developed a set of scenarios for the preparation of the government's Energy Concept. Some of these studies have built on each other's results. The high number of studies on this topic clearly reflects the strong, ongoing policy debate in Germany regarding energy (Section 3.2.1).

3.2 Impact on environmental policymaking

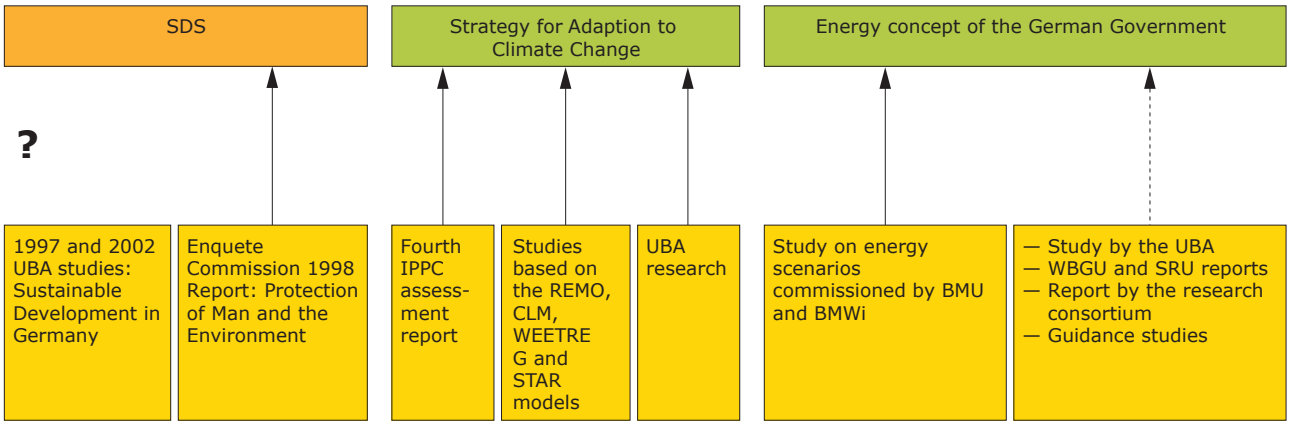
The links between forward-looking studies and policy documents have been seen most strongly in the fields of climate and energy. The links in other policy areas are less clear, though the broad Sustainable Development Strategy appears to have inspired work on forward-looking analysis as well as some more specific policy actions. Figure 5 provides an overview of the links that have been observed between major policies related to the environment and forward-looking analysis. In addition, technology foresight has played an important role in shaping Federal research priorities, including some related to sustainability such as the Fona project.

3.2.1 Energy and climate policies

Several links have been identified between studies in the fields of climate change and energy and policy discussions on these issues, including policy strategies and laws. These links include references by politicians to a study; other examples of the further resonance of a study in political circles (e.g. its use in debates and policy papers); use of elements of a study in a policy strategy; a direct reference to a study.

In interviews, German officials working on such studies noted that these are only one of many elements that play a role in the democratic and administrative decision-making processes. Moreover, in the fields of energy and climate, several recent studies have provided similar conclusions, making it difficult to distinguish the influence of any one.

Figure 5 Influence of forward-looking work and studies on environmental strategies



These links are seen in the German Cabinet's new energy 'concept' or strategy that was adopted on 28 September 2010. This policy document explicitly refers to the study 'Energy scenarios for an energy concept of the Federal Government' (Section 2.2.2).

Another direct link to policymaking can be seen in the *German Strategy for Adaptation to Climate Change*, which acknowledges the importance of forward-looking studies, in particular modelling, in its development.

In addition to these direct links, the officials and researchers who were interviewed mentioned several examples of indirect links to policy discussions and strategies. These include the following.

- A UBA official noted that the target of a 40 % reduction of greenhouse gas emissions as proposed by their study (Climate change in Germany: 40 % reduction of CO_2 emissions) was taken up as goal in the so called Meseberger Beschlüsse (Meseberg resolutions) from 2007: these provided the basis for the integrated energy and climate programme that was later adopted. This programme includes 29 measures, many of echo recommendations in this UBA report. Many of these measures were then adopted in laws.
- Officials at SRU and the UBA believe that their studies (100 % renewable energy supply until 2050: climate-friendly, safe, affordable by SRU and 'Energy goal for 2050: 100 % renewable electricity' by the UBA) have contributed to the objective in the energy concept for an 80 % share of renewable energies in energy supply by 2050. These studies draw the conclusion that a 100 % renewable energy supply is technically feasible and SRU showed also that it is economically viable.
- An SRU official said that the Council's focus on certain issues has raised awareness in the BMU and other ministries and that some of their ideas are now reflected in the energy concept. This includes the 2050 time frame in most of recent energy studies and also in the energy concept.
- A representative at the WBGU said that their studies are discussed in political circles at national and international levels and have influenced policy decisions. One example is the two 2 degree guardrail in climate policy, which was developed by WBGU in 1995 and since then has been repeatedly recommended: today this guardrail is recognised by Germany and the EU ([34]).

([34]) See in particular: European Council, Presidency Conclusions — Brussels, 29 and 30 October 2009 (document 15265/09).

- According to a representative from the Research Consortium of the Renewable Energy Research Association (FVEE) ([35]) that conducted the study 'Energy Concept 2050: A vision for a sustainable energy concept on the basis of energy efficiency and 100 % renewable energies', many aspects developed here can be found in the Energy concept of the Federal Government, including its focus on renewable energies, energy efficiency and research and development.

The studies cited here for energy and climate change have had a strong quantitative focus. This may in part be due to the nature of policy issues. At the same time, the officials interviewed noted that more 'visionary' approaches to forward-looking analysis have not had strong support within the German Government.

3.2.2 The Sustainable Development Strategy

The relationship between the SDS and forward-looking analysis is itself complex.

The development of the SDS directly followed a 1998 report by the Enquete Commission of the German Parliament (Section 2.4), and this link is acknowledged in the Strategy. On the other hand, two studies on sustainability were produced by the UBA around this time (*Sustainable Development in Germany — Progress and Prospects*, published in 1997, and the follow-up *Sustainable Development in Germany — Towards an Environmentally Friendly Development* in 2002): a literature review and the interviews, however, did not find any evidence of links between these and the SDS ([36]).

A further link can be seen between the SDS and Germany's renewable energy and climate change policies. The SDS itself includes targets for the reduction of greenhouse gases and the expansion of renewable energies, and thus provides a framework that includes policy initiatives and forward looking studies in these topic areas. For example, the independent study *Energy concept 2050* does not explicitly refer to the SDS but identifies sustainability as a leitmotiv ([37]).

This relationship is explicit for the Strategy for Adaption to Climate Change, which states that it and the SDS are meant to complement each other ([38]). Moreover, the 2008 progress report on the SDS identified climate and energy as one of four priority areas for national sustainability policy, and the Adaptation Strategy specifically supports this.

As noted, the SDS has also led to work on forward-looking analysis. This includes work under research programmes such as Fona. Moreover, studies prepared by the BMU and the UBA, such as the one on sustainable construction on housing, are undertaken within the broad theme of sustainability policy.

([35]) Forschungsverbund Erneuerbare Energien.

([36]) With the release of the first of these UBA studies in 1997, the Minister for Environment at that time, Angela Merkel, declared that 'the results of this study will have some influence on the dialogue with social groups as well as on my announced priority programme for environmental policy'. This is not an indication of a strong impact. Moreover, the Priority programme for Environmental Policy was not pursued following a change in government in 1998. For Merkel's statement, see the BMU press release from 1997(http://www.bmu.de/pressearchiv/13_legislaturperiode/pm/1327.php).

([37]) The term 'sustainability' is defined in the preamble of the study.

([38]) German Strategy for Adaption to Climate Change, p. 7, is available online (http://www.bmu.de/files/pdfs/allgemein/application/pdf/das_gesamt_bf.pdf).

4 Conclusions

Over the past decade at least, the German Federal Government has developed a range of forward-looking analyses in several important policy areas, including sustainable development, renewable energy and scientific research. Some of these studies are used in policymaking, though the links between forward-looking analysis and policy decisions are not always easy to identify.

This section explores some of the key factors for success, as well as barriers in terms of using forward-looking analysis in policymaking.

4.1 Factors for success

One important factor for success is that Germany has a multifaceted landscape of research organisations from the public and private sector that carry out forward-looking analysis. This provides a broad base of expertise, both within and outside of government.

A few government bodies, notably the Federal Ministry of Education and Research, have gathered in-house expertise in managing forward-looking analyses. In the area of environment, both the BMU and the UBA have regularly carried out and commissioned forward-looking studies. Moreover, this type of analysis is well integrated into the research agendas of research institutes and advisory bodies.

In policy areas such as climate and renewable energy in particular, studies have had a strong quantitative component.

Forward-looking analysis in Germany also uses participative approaches, in particular consultation with major stakeholders. This has been seen in particular in the area of Sustainable Development Strategy.

The national Sustainable Development Strategy — and more generally, the goal of sustainability — has been an important driver for forward-looking thinking and its integration into policymaking. The implementation of the SDS has involved the creation of mechanisms to build consensus among ministries and to involve stakeholders, thus to some extent breaking down institutional barriers. This may also have helped to encourage the use of forward-looking analysis. The regular reviews of the achievement of SDS objectives may have also promoted long-term thinking.

More recently, the development of a new energy strategy has been an important topic of political debate and has also spurred the preparation of several forward-looking studies.

4.2 Barriers to success

The first major barrier in Germany is that, as indicated in the interviews with officials, inter-ministerial cooperation is often not strong. This appears to be a barrier in several areas. For example, the links among forward-looking studies undertaken for different government bodies seem to be weak and mostly informal. This appears to have been the case, for example, in the earlier studies on renewable energy: these were managed almost exclusively by the BMU and the UBA, and coordination between the BMU and other ministries on studies and also at early stages of policy process could not be identified.

There are some positive examples of inter-ministerial cooperation: one recent one is the study *Energy scenarios for the energy concept of the federal government* that was carried out for the federal government by the BMU and the Ministry of Economics and Technology. Moreover, the SDS process provides a forum that brings together Federal ministries. Despite these cases, compartmentalisation among ministries appears to continue, linked to the tradition established by the departmental principle.

A further barrier is that forward-looking analysis is not strongly institutionalised. Germany does not have a central office for forward-looking analysis as in the United Kingdom. While a number of ministries and agencies reviewed do have offices

for forward-looking analysis, for the environment at least, these offices do not appear to be strong (as a comparison, the BMBF's work on technology foresight appears to have a stronger administrative base than equivalent work on environmental futures in the BMU, the UBA or other bodies).

A further related issue, is that Germany's government and ministries often rely on external bodies for futures studies. This has a positive element: Germany has a strong network of institutes and other bodies within and outside government that with expertise. Within ministries and agencies that work on environment, however, experience appears not to be as strong.

Another issue is that government bodies appear to have relatively limited experience with more participatory approaches to scenario development or with other non-quantitative methods of forward-looking analysis (e.g. horizon scanning). As noted above under the factors for success, Germany has a strong tradition of quantitative analysis. However, Germany's expertise with quantitative studies is mirrored by an apparent reluctance to use qualitative methods, including approaches that could lead to more visionary studies. Qualitative approaches to scenario development could provide a more robust assessment of future pathways. Some recent studies, such as the UBA's *Sustainable construction and housing*, have combined participatory and quantitative methods. Most of the participatory approaches identified, however, have involved a restricted set of experts and stakeholders.

Moreover, participatory methods may have difficulty being accepted as 'scientific' tools. As in other countries, the use of modelling appears to provide conclusions that can be more easily adopted in the political sphere. At the same time, Perlitz and Seger describe German corporate culture has having a 'high uncertainty avoidance' and, as a result, 'planning plays an important role to keep the future free of surprises'. These authors also point to a 'high respect for technology and production' in Germanic countries in relation to Anglo-Saxon countries ([39]). These cultural factors may be reflected in the preference for quantitative approaches in the policy sphere.

A series of challenges are related to the role of Germany's Sustainable Development Strategy. As noted above, this has a strong inter-ministerial mechanism. The SDS, however, does not appear to have strong links with current policymaking. A further issue is that, according to the Indicator Report 2010, Germany is not on track to meet several environmental objectives of the SDS in the areas of raw material productivity, species diversity, land use and farming. Finally, the SDS currently does not have a long time frame, only to 2020. A more broad-based approach to forward-looking analysis may be useful in addressing environmental issues.

The interviewees also indicated that the barriers to a better integration of forward-looking studies in the decision-making process include budget restrictions in the current economic crisis and the continuing focus on short-term goals and results at the political level.

([39]) Perlitz, M. and Seger, F., 'European cultures and management styles', *International Journal of Asian Management*, 2004, p. 16.

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Renewable Energy Research Association (http//www.fvee.de).

Appendix 1
Approaches to futures studies

Country: Germany		
Title of futures programme(s):		**Perspectives for Germany — Our Strategy for Sustainable Development** **Sustainable Development in Germany — Progress and Prospects** **Sustainable Construction and Housing**
1. Overall governance culture of country	***Description***	Article 20(1) of the German Basic Law *(GG) defines the Federal Republic of Germany as a democratic and social federal State. Germany is further marked by its strong federalism which has been subject to various changes due to the federalism reform in 2006.* In environmental matters, the competence to legislate is mainly vested in the federal State. Even though the federal chancellor is responsible for setting the general policy guidelines, the predominately executive power in environmental matters falls in the remit of the Federal Ministry for the Environment, Nature Protection and Nuclear Safety. The overall governance culture of Germany can be described as partly participative and cooperative and partly as hierarchical and marked by a silo mentality. Both poles are anchored in the German legal system. The department principle lays down that each minister leads his ministry independently and under his own responsibility (Article 65, sentence 2 GG). This forms the breeding ground for a non-cooperative policy style on the ministerial sphere. By contrast, the ministries are obliged to work together in areas where the portfolio of more than one ministry is touched (paragraph 19 of the Joint Rules of Procedure of the Federal Ministries (GGO)). This principle encompasses consensus building procedures and cooperation between the ministries. In consistency with these legal settings, the political life in Germany is rich in contrast. Where some authorities cultivate a strong silo mentality within their ministry and are built on a strong hierarchical structure, others pursue a consensual and cooperative policy style. The style of governance in Germany reflects the Germanic cultural tradition as described in Perlitz and Segener *(2004).*
	Nature of futures organisation(s)	In Germany there is no public institution that carries the label 'foresight' that is exclusively dedicated to the conduct of forward-looking studies in contrast to, for example, the United Kingdom, where foresight is conducted via the UK Government's Foresight programme. However, forward-looking approaches are integrated in the work of various public institutions and the federal State provides for a number of research platforms, where forward-looking studies can be conducted. 1. The federal government initiated the strategy Perspectives for Germany — Our Strategy for Sustainable Development in April 2002 which envisages the time span until 2020 and contains normative and quantitative objectives. 2. With the goal to support and enhance research on sustainability, the BMBF initiated the research project Fona (research for sustainable development) in 2001. Fona provides a platform for research on sustainability. Moreover, in 2009 the Institute for Advanced Studies on Sustainability was founded (IASS). It offers up to 50 fellows (guest researchers) the opportunity to research on freely chosen subjects.

Country: Germany		
		3. Futures thinking is integrated in the BMU and is part of its agenda mainly with regard to renewable energy and climate change (cf. the 'Guidance study 2008' update of the 'Strategy of developing renewable energy resources' taking into account Germany's and Europe's actual climate protection targets ([40]) and the German Strategy for Adaptation to Climate Change ([41]) (adopted by the federal government)). However, the approaches applied are predominately quantitative and normative. If qualitative approaches are considered this is down to the initiative of an individual official. Financial means, e.g. allocated by the Environmental Research Plan, are sporadically used by the BMU to fund such forward-looking projects. 4. The Federal Environment Agency (UBA) is the central authority for environmental protection in Germany and, in the interplay with other authorities it provides the scientific basis for the national environmental policy. It is subject to the technical supervision of the BMU. Its research work is partly commissioned by the BMU and partly initiated by an own agenda setting. The agenda of the the UBA comprises conceptual and applied forward-looking work. The UBA partly itself undertakes studies and partly commissions research institutes by using financial means from the Environmental Research Plan. 5. Since 1991, the Federal Ministry for Education and Research (BMBF) has used foresight approaches to support the identification of new research fields and its in-house agenda setting. The BMBF initiated a new BMBF-Foresight-Process in 2007 with the aim to explore cross-cutting research fields relevant for the future. Some explored research fields are related to the environment and to sustainable development and have been taken up by the Fona project. 6. Germany consists of various private and half-private research institutes, such as the Institute for Technology Assessment and System Analysis (ITAS); Institute for Futures Studies and Technology Assessment (IZT), the Institute for Applied Ecology (Öko-Institut e.V.), the Fraunhofer-Gesellschaft and the Max-Planck-Gesellschaft and its aligned institutes etc. that predominately or as part of their research agenda conduct forward-looking studies.
	Date programme(s) introduced	The German SDS was introduced in April 2002.
	Responsibility	The German SDS was initiated by the federal government. The main responsibility, however, is attributed to the Federal Chancellery. The UBA is responsible for supplying the BMU and the federal government with a scientific background.
	Resources	Within the Federal Chancellery, the federal government and the Bundestag no extra jobs have been created and no additional financial resources have been allocated for the implementation of the German SDS. However, the budget for the RNE is EUR 1.9 million for the next three years and approximately EUR 800 000 million were set aside for the Fona research project as of 2001. The BMU has no staff or money exclusively allocated to forward-looking work. This can be explained by the fact that futures thinking is not institutionalised in the BMU. However, sporadically initiated projects which last one or two years normally have a budget of EUR 50 000–200 000. The federal budget allocates financial means to the UBA. Within the UBA, it is not possible to directly allocate money or staff to forward-looking studies or forward-looking projects because forward-looking studies and projects are not in the portfolio of a certain department, but are applied and used by each department.

([40]) http://www.erneuerbare-energien.de/inhalt/42383/5466/
([41]) http://www.bmu.de/files/english/pdf/application/pdf/das_zusammenfassung_en.pdf

Country: Germany		
	Tradition	Long-term environmental programmes have a long but disrupted tradition in Germany. The German SDS was adopted in April 2002 and from this time has been continuously updated and improved without being subject to any major changes. The organisation of the RNE contains long-term elements and (intended) elements of reorganisation. The RNE was established in 2001. The Council is always appointed for three years. Every three years, a new Council is appointed by the federal government. Every three years some members are reappointed and others are replaced. Since 2010, the Council has consisted of 15 members (previously, there were 14). The head office consists of one secretary-general and staff: a secretary, a media consultant and six scientific consultants. The secretary-general has presided over the head office since it was established in 2001. Foresight programmes within the framework of BMBF have a long tradition (back to the 1990s). However, they have been subject to many reorganisations.
	Parliament	No bodies are directly responsible for forward-looking studies. The Parliamentary Advisory Council on Sustainable Development was established early in 2004. Its task is to accompany the implementation of the national and European SDS on a parliamentary level. This advisory council also examines new laws under the aspect of sustainability at the beginning of the legislative procedure as of 24.3.2010. Separately, the parliament has established the Office of Technology Assessment at the German Federal Parliament. As an independent scientific institution, it serves to advise the German Bundestag and its committees on matters relating to research and technology.
	Advisory councils	No bodies are directly responsible for forward-looking studies. The Council for sustainable development advises the federal government in relation to sustainability. Within the framework of the German SDS, the federal government has installed specific forums for public dialogue with citizens. Within the process of drafting the German SDS and writing progress reports, citizens can contribute their ideas and proposals (the next consultations begin in autumn 2012 for the progress report for 2012). The federal government and the BMU are furthermore advised by the independent German Advisory Council on the Environment (SRU) and the German Advisory Council on Global Change (WBGU).
	Legal framework	A formal requirement to provide long-term analysis does not exist. However, since 1994, the principle of sustainability has been implicitly integrated in the German Basic Law. In accordance with Article 20a GG, the Federal State must protect the 'natural basis for life' and also show 'responsibility for future generations'. The need for a German SDS was emphasised by a parliamentary motion for a resolution in 1998 and goes back to the United Nations Conference on Environment and Development in Rio in 1992. Forward-looking studies and long-term analysis are on the research agenda of the UBA, but are not formally requested by law.
	Political framework	Compare Germany's SDS (Appendix 2, Example 1)

Country: Germany		
	Role of environmental research/ foresight programmes in providing futures thinking	The German SDS and its institutions (especially the RNE) play an important role in providing for a sustainable thinking and a consideration of a long-term perspective until 2020. Also the UBA studies 'Sustainable Germany' in 1997 and 'Sustainable development in Germany' in 2002 and the high number of topic-related studies play an important role in the provision of futures thinking. In addition, the BMBF with its tradition of foresight programmes contributes to futures thinking. However, there are also a number of research institutions with agendas including future-related studies and research. Hence, it can be said that environmental research is only one mode of several where future-related studies are conducted.
	Actors	**German SDS:** 1. Main actors The federal government adopted the German SDS in 2002 and updated it in 2004 and 2008 simultaneously with the publishing of progress and monitoring reports. The Federal Chancellery bears the main political responsibility for the implementation of the German SDS. The Federal Chancellery drafts and updates the German SDS in cooperation with the Federal Committee of State Secretaries for Sustainable Development which has been installed in the Federal Chancellery. This committee is additionally responsible for coordinating and monitoring the process, for setting guidelines and for intervening — if necessary. The UAL-AG (permanent working group that consists of officials from each ministry) coordinates conflicting interests of the ministries and prepares the meetings of the Committee of State Secretaries. The Council for Sustainable Development (RNE) advises the federal government in relation to sustainable development, makes proposals for a further development of the German SDS and communicates the theme of sustainability to the public. The Parliamentary Advisory Council on Sustainable Development is attributed to accompany the German and European SDS, to make recommendations and to scrutinise legislative initiatives, and determine whether they correspond with the outlines of the German SDS as of 2010. 2. Broad dialogue and consultation • Elaboration and update of the German SDS Two rounds of a public dialogue have been conducted within the process of elaborating the strategy. Before and after the presentation of the draft version of the German SDS, citizens and social groups were asked to contribute their ideas and proposals via the Internet or in written form. Both rounds were accompanied by direct rounds of consultations with municipalities, trade and industry and trade unions, environmental groups and development organisations, agricultural and consumer groups, science and churches. As part of the updating and further development process of the strategy, which takes place every four years (2004, 2008, 2012, etc.), these dialogues and consultations are continuously developed and applied. • Council for sustainable development As one of its fundamental functions, the Council for sustainable development advises the federal government in relation to sustainability. Intentionally, it consists of members that represent different interests in society (e.g. the economy, environment, churches, trade unions), specific social groups so as to guarantee that a broad range of views is considered, when the German SDS is developed and updated.

Country: Germany		
		• the Committee of State Secretaries on Sustainable Development This Committee consists of state secretaries from the Foreign Office and departments for Finance, Economics, Consumer Protection and Agriculture, Labour, Interior, Transport, Environment, Education and Research, Health, Economic Cooperation, and Family, Senior Citizens, Women and Youth. The integration of these departments in the Committee which crucially contributes to the implementation of the German SDS intends to ensure the coordination of the different departments within the implementation of the German SDS and again to create a dialogue between representatives of the various interests of society on a political level and find common solutions. **The UBA:** If forward-looking studies are conducted by the UBA, there are no fixed rules for consultations. However, the UBA aims to apply a participative approach, including stakeholder dialogue, internal and external scientific exchange, technical dialogues, round tables and status seminars. The UBA partly prepares its studies itself and partly commissions research institutes with the drafting of a study.
	Perceived institutional need	The need for an independent public forward-looking programme or institute is not perceived. This might stem from the fact that forward-looking studies are seen more as a tool for dealing with actual and sector-related topics than as a means to provide an over-sectorial strategy. The BMU only occasionally commissions forward-looking studies to topic-related questions. This ministry assesses the need for forward-looking studies as low. Within the UBA, forward-looking studies are on the research agenda. This environmental research authority deems forward-looking studies an important tool to cope with environmental problems. The BMBF has a long tradition of forward-looking studies and it uses them progressively and extensively to identify new and cross-sectional research areas.
2. Institutional structure for environmental policymaking	***Relevant government departments, ministers, agencies, etc.***	1. Relevant government bodies Due to Germany's Basic Law, the Federal Chancellor shall determine and be responsible for the general guidelines of policy. For that reason, it is of particular importance that the main responsibility for the implementation of the German SDS is vested in the Chancellery. The Federal Chancellor also has the power to set general policy guidelines for environmental policy. However, within this framework, environmental policymaking falls mainly in the remit of the Federal Ministry for the Environment, always being aware that the Bundestag must make all essential decisions and restrictions due to federalism. Within the portfolio of this ministry, three higher independent authorities have been established directly subordinated to the Ministry, i.e. the Federal Environment Agency (UBA), the Nature Conservation Agency (BfN) and the Federal Office for Radiation Protection (BfS). Together, they provide the scientific background for Germany's environment policy. The UBA is the most important of these three agencies. Its main tasks are to scientifically support the federal government, to implement environmental legislation and to inform the public. The UBA is, on the one hand, commissioned by the federal government, especially by the BMU, to conduct research and, on the other hand, has its own research agenda and project setting. Its internal agenda also includes forward-looking studies. The federal government and the BMU are furthermore advised by the independent German Advisory Council on the Environment (SRU) and the German Advisory Council on Global Change (WBGU).

Country: Germany		
		2. Links and integration of the German SDS and forward-looking studies to policymaking There is a clear link between the German SDS and environmental policymaking. First of all, the Chancellery is mainly responsible for the implementation of this strategy. Secondly, the strategy determines 21 long-term objectives/indicators which have to be implemented by 2020. Eight of these indicators directly or indirectly refer to the environment: conservation of resources, climate protection, renewable energies, land use, biodiversity, nutrition, air quality and health. The implementation of the German SDS and the accomplishment of these objectives are continuously scrutinised. The influence of the German SDS on policymaking can also be derived from the coalition agreement of our current government. In this agreement, Christian Democrats and Liberals have determined sustainability as one of the leitmotifs of their policy. This is eventually underpinned by the statement of Angela Merkel, the acting Federal Chancellor of Germany, that the country has already achieved important progress on the path to a sustainable Germany ([42]). Forward-looking studies are not high on the research or political agenda of the BMU. Nonetheless, there are sporadic exercises. From that perspective, there is no tangible influence on policymaking. However, since forward-looking studies are on the research agenda of the UBA which directly provides the BMU with scientific studies and results, there might be an influence but that is, however, not measurable. Nevertheless, it must be taken into account that the work of the UBA as subordinated authority of the BMU is generally well acknowledged by the competent officials of the BMU and is considered in the decision-making processes. Despite the fact that, considering these circumstances, it is difficult to find evidence for the integration of a forward-looking study (except for the German SDS and) in the environmental policymaking, at least one declaration of intent of Germany's former minister for environment, Angela Merkel, can be found. Referring to the UBA's study 'Sustainable Germany', she is quoted in a press release from 1997 with the words: 'The results of this study will have some influence on the dialogue with social groups as well as in my announced priority programme for environmental policy'.
3. Foresight/ scenario culture traditions	***Approach to futures thinking***	According to the information of the interviewed representatives of German institutions, the majority of forward-looking studies are normative and quantitative which implies a corresponding approach to futures thinking. This especially applies to the sectors of renewable energies and climate change. However, the last decade has shown an upward trend toward more exploratory studies and thinking. This trend is reflected in the UBA studies 'Sustainable Germany' in 1997 and 'Sustainable development in Germany' in 2002 and a huge number of more sector-specific studies, i.e. the UBA study 'Sustainable construction and housing' (cf. Appendix 2, Example 3). Comparing the contrasting poles of qualitative and quantitative studies, there is a strong dominance of quantitative with no clear trend for the future. The BMBF foresight process and its long-term tradition in foresight projects must be exempted from this general impression. Since 1991, this institution has applied exploratory and qualitative methods in their foresight work.

([42]) Progress report 2008 in relation to the national strategy for sustainable development, p. 10.

Country: Germany		
	Thematic or issue	The German SDS and the UBA studies of 'Sustainable Germany' in 1997 and 'Sustainable development in Germany' in 2002 pursue more general approaches. However, the high number of forward-looking studies produced by or in commission of the UBA is sector-specific and topic-related. The BMBF futures process is restricted to the identification of research areas, but is not restricted to a specific research topic.
4. Summary of programme(s) as a whole, including within agencies	Cf. Appendix 2, Example 1	

Appendix 2
Examples of future studies (1–3)

Country: Germany		
Institution responsible for the Sustainable Development Strategy: Federal Chancellery		
1. Description/ characteristics of the German SDS	***Examples of specific studies***	Perspectives for Germany — Our Strategy for Sustainable Development
	Exploratory/ normative?	The strategy follows a normative approach. It determines overall concepts and concrete visions for sustainable development and policymaking, taking into account economic, environmental and social issues.
	Qualitative/ quantitative?	The strategy is predominately quantitative in nature. It introduces a system of quantitative long-term objectives and indicators in 21 priority areas to be achieved by 2020. However, it also describes in a qualitative way the envisaged more sustainable future.
	Thematic focus?	The strategy focuses on socio-economic and environmental aspects.
	Specific issue focus?	Structurally, the German SDS contains four main thematic sections. The first section defines a model of sustainability (Section B of the German SDS); the second section lays down 21 quantitative indicators and long-term objectives that aim to implement the model of sustainability (Section D of the German SDS); the third section identifies the key focus points of a strategy for sustainable development (Section E of the German SDS); and the last section deals with Germany's responsibility on a global scale (Section F of the German SDS). The model of sustainability defined in the first section consists of four key issues: inter-generational equity (strong link to the environment), quality of life (strong link to the environment), social cohesion and international responsibility. Section 2 provides long-term objectives and indicators for 21 thematic fields, which are directly linked to the key issues identified under Section 1 The key issue 'Inter-generational equity' comprises the environment-related thematic fields of the conservation of resources, climate protection, renewable energies, land use and biodiversity. The key issue 'quality of life' consists of the environment-related thematic fields of nutrition, air quality and health. The third section identifies key focus points for the German SDS and, among others, comprises the issues of efficient energy use, environmentally sound mobility, health, food and the reduction of land use. The last section sheds light on the responsibility of Germany in the context of global sustainable development.
	Spatial/ temporal scale	The temporal scale of German SDS is 2020.
	Ad hoc/ongoing established futures process?	The German SDS is an ongoing process that includes a periodical development and review of the strategy.
	Sector/cross-sector-based?	The German SDS focuses on economic, environmental and social aspects and draws a broad picture of German society.

Country: Germany		
	Science-based/ multiple stakeholders?	*When elaborating the German SDS, the federal government (Committee of State Secretaries on Sustainable Development) resorted to extensive preliminary work and accompanying research.* Simultaneously, a broad public dialogue was initiated and stakeholder consultations were conducted. Before and after the presentation of the draft version of the German SDS, citizens and social groups were asked to contribute their ideas and proposals via the Internet or in written form. Both rounds were accompanied by direct rounds of consultations with municipalities, trade and industry and trade unions, environmental groups and development organisations, agricultural and consumer groups, science and churches. As part of the updating and further development process of the strategy, which takes place every four years (2004, 2008, 2012, etc.), these dialogues and consultations are continuously developed and applied. By means of integrating the inter-ministry Committee of State Secretaries on Sustainable Development and the multi-stakeholder RNE in the process of writing the German SDS, additional input could be provided.
2. Original purpose and application	***For what purpose?***	The German SDS aims at implementing the idea of sustainable development as defined by the World Commission on Environment and Development in 1987: 'Sustainable Development is a form of development which meets the needs of the generation of today without jeopardising the chance for future generations to meet their own needs.'
	Requested by a specific entity?	At the United Nations Conference on Environment and Development in Rio de Janeiro in 1992, the international community announced a global programme of action for the 21st Century under Agenda 21, which invited the signatory states to set up a strategy for a sustainable development that brings into balance economical, social and environmental aspects. Additionally, the need for a German SDS was emphasised by a parliamentary motion for a resolution in 1998.
	How used?	The German SDS is understood as the baseline for national sustainable policymaking. The federal government has used this strategy to set verifiable long-term goals for its policy and to draw a desirable picture of tomorrow's society.
	By whom?	The federal government, other political institutions and stakeholders.
3. Outcomes (immediate and long term)	***Where and how used in policy (if at all)?***	See above
4. Evaluation	***Any formal evaluation of effectiveness or updates***	The German SDS is updated every four years (2004, 2008, 2012, etc.). For this purpose, the federal government conducts progress reports ([43]). These reports shed light on the status quo of the German-SDS and adapt the strategy to the relevant political and social developments. The implementation of the German SDS and the achievement of its objectives are continuously scrutinised. As part of the progress reports, the federal government conducts a general review of this strategy every four years and the Federal Statistical Office of Germany specifically monitors the compliance with the 35 long-term objectives/indicators every two years ([44]). In addition to this, the Council for Sustainable Development has published the so-called traffic-light report that in a transparent way gives an overview of the stage of implementation of the 35 long-term objectives/indicators in 2008 on the basis of data from the Indicator Report 2006 ([45]). Mandated by the federal government, the RNE has also organised a peer review of the German SDS 2007–2009. Experts from other countries were invited to scrutinise and evaluate the German SDS. The results of this report were published under the title Sustainability 'Made in Germany' — We Know You Can Do It at the end of 2009 ([46]).

([43]) http://www.bundesregierung.de/Content/DE/__Anlagen/2008/05/2008-05-08-fortschrittsbericht-2008,property=publicationFile.pdf
([44]) http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Publikationen/Fachveroeffentlichungen/UmweltoekonomischeGesamtrechnungen/Indikatorenbericht2008,property=file.pdf
([45]) http://www.nachhaltigkeitsrat.de/uploads/media/Broschuere_Ampel_texte_Nr_22_April_2008_01.pdf
([46]) http://www.nachhaltigkeitsrat.de/uploads/media/RNE_Peer_Review_Report_November_2009.pdf

Country: Germany		
	Success factors/drivers	1. The first success factor is that the political responsibility for the German SDS is assigned to the Federal Chancellery, which is one of the most powerful institutions in the national political landscape. 2. Establishing and updating of the German SDS involves a broad dialogue with citizens, social groups and stakeholders. 3. The German SDS was mainly developed and is updated by the Committee of State Secretaries on Sustainable Development as representative body of the federal government. This prompts an inter-ministry approach. 4. It must also be positively mentioned that the German SDS contains quantitative verifiable indicators, the achievement of which can be easily scrutinised. 5. The German SDS provides for a continuous update of the strategy and a periodical review mechanism by two different institutions. 6. The RNE includes representatives of various stakeholders of the society. This encompasses a balance of various views and interests. 7. By means of the indicator reports, the traffic light report and the peer review the German SDS has been reviewed and assessed by independent bodies.
	Barriers to success	1. The SDS does not appear to have strong links with current policymaking. 2. The envisaged temporal scale (until 2020) is too short. At least in some areas, the strategy should embrace a temporal scale until 2050. 3. According to the Indicator Report 2010, of the Federal Statistical Office Germany is only on track with 19 of the 35 objectives/indicators of the German SDS. Germany struggles to achieve the environmental objectives of the SDS in the areas of raw material productivity, species diversity, land use and farming.
5. References	http://www.bundesregierung.de/nsc_true/Content/DE/__Anlagen/2006-2007/perspektives-for-germany-langfassung,property=publicationFile.pdf/perspektives-for-germany-langfassung	

Country: Germany		
Futures studies institution: The UBA		
1. Description/ characteristics of future study	***Examples of specific studies***	The study 'Sustainable development in Germany — Progress and prospects', and the follow-up study 'Sustainable development in Germany — Towards an environmentally friendly development'
	Exploratory/ normative?	Both studies combine exploratory and normative elements. Reflecting the exploratory approach, assumptions are made for three different scenarios: the 'business as usual' scenario, the 'efficiency' scenario and the 'structural transformation and awareness-raising' scenario. However, normatively, a clear preference is given to the 'structural transformation and awareness-raising' scenario and measures are proposed how to foster this development.
	Qualitative/ quantitative?	The approach is mainly quantitative. The scenarios are based on quantitative assumptions and figures which are then projected on to the year 2010. In addition, the studies provide for mainly quantitative indicators to facilitate the verifiability of progress. However, they also qualitatively describe the path to a more sustainable future.
	Thematic focus?	The thematic focus is sustainable development, described as the interdependency of ecological, economic, social and cultural development and the prioritisation of the precautionary principle, and the larger-scale environmental objectives and strategies.
	Specific issue focus?	The study in 1999 focused on the fields of energy use, mobility, food production, material flow management and consumption patterns. The follow up study in 2002 revisits these topics and expands its considerations on tourism, industrial production and resource conservation.
	Spatial/ temporal scale	The temporal scale is 2010.
	Ad hoc/ongoing established futures process?	Apart from these two studies, the UBA has published various studies on sustainability addressing sectoral problems, i.e. sustainable construction and housing (Appendix 2, Example 3).
	Sector/cross-sector-based?	The studies are cross-sectoral embracing economic, environmental and social aspects.
	Science-based/ multiple stakeholders?	The scenarios are based on mainly quantitative assumptions and figures. Whether stakeholders were involved in the scenario building process was not identified.
2. Original purpose and application	***For what purpose?***	The studies aim to contribute to the discussion on sustainability and to raise awareness about a variety of measures that could pave the way to a more sustainable future.
	Requested by a specific entity?	The studies were initiated by the UBA.
	How used?	Not identified
	By whom?	Not identified
3. Outcomes (immediate and long term)	***Where and how used in policy (if at all)***	A concrete link to policymaking could not be identified. This is surprising as the studies show a very close temporal and thematic connection to the German SDS which was adopted in April 2002 and as they propose similar measures.
4. Evaluation	***Any formal evaluation of effectiveness or updates?***	The follow-up study in 2002 assessed the progress made since the first study was published.
	Success factors/drivers	Not identified
	Barriers to success	Not identified
5. References	http://www.umweltbundesamt.de (the studies have ceased to be published)	

Country: Germany		
Futures studies institution: The UBA		
1. Description/ characteristics of future study	***Examples of specific studies***	Sustainable construction and housing — a needs-based approach for the future
	Exploratory/ normative?	The approach chosen is mixed. The reference scenario explores the development of need in the 'construction and housing area' under the scenario assumption of no significant changes to the status quo and the sustainable scenario assumes that the proposed solutions for a sustainable 'construction and housing area' of need are implemented.
	Qualitative/ quantitative?	The study contains qualitative and quantitative elements. The study uses a qualitative approach by elaborating an ideal sustainable scenario and comparing it with the baseline scenario. Simultaneously, quantitative information was used to identify the feasibility of the different approaches.
	Thematic focus?	The thematic focus of the study is sustainable housing and construction by using a need based approach.
	Specific issue focus?	Within this thematic focus, the study concentrates especially on climate protection, land use and raw materials consumption.
	Spatial/ temporal scale?	The study covers a temporal scale until 2025.
	Ad hoc/ongoing established futures process?	In 2004, the UBA published a study 'Sustainable construction and housing in Germany: Materials flow-oriented modules for a national concept of sustainable development', linking the construction and housing sector with the complementary public infrastructure sector ([47]). This study was commissioned by the UBA and prepared by three institutes (one of them aligned to a university).
	Sector/cross-sector-based?	Sector-based
	Science-based/ multiple stakeholders?	The scenarios were drawn up during a workshop that included scientists, representatives of German federal and state ministries, trade unions and environmental associations, credit system experts, housing industry and urban land-use planners. At a later stage, the software 'BASiS-2.0' was used to project the environmental impact on the 'construction and housing' area of need.
2. Original purpose and application	***For what purpose?***	The study assumes that a sustainable approach to 'construction and housing' areas of need is essential for the protection of our environment. The scenarios intend to illustrate the development of different paths in the future and, thereby, show stakeholders where and how they can intervene and what the consequences of their actions or non-actions would be.
	Requested by a specific entity?	The study was initiated and carried out by the UBA.
	How used?	No uses could be identified — the study was only recently published (May 2010). However, the study itself proposes implementation measures and provides examples.
	By whom?	
3. Outcomes (immediate and long term)	***Where and how used in policy (if at all)?***	Not identified
4. Evaluation	***Any formal evaluation of effectiveness or updates***	Not identified
	Success factors/drivers	Not identified
	Barriers to success	Not identified
5. References	http://www.umweltbundesamt.de (the study is not yet available online)	

([47]) The research report of this study in German is available online (http://www.umweltdaten.de/publikationen/fpdf-k/k2600.pdf).

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Annex 4 — Germany country case study
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European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark

Tel.: +45 33 36 71 00
Fax: +45 33 36 71 99

Web: eea.europa.eu
Enquiries: eea.europa.eu/enquiries

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