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Governing Innovation for Sustainable Development:

– Integration of Environmental and Innovation Policies in Norway

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Report

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FOREWORD

ProSus is a strategic university programme established by the Norwegian Research Council at the Centre for Development and the Environment (SUM), University of Oslo, Norway.

The goal of ProSus is to provide knowledge and information in support of a better realization of national targets for sustainable development. The work in the current financing period is concentrated on three main tasks:

> Conducting systematic evaluations of Norway's implementation of international commitments on sustainable development. Evaluations are based on three types of standards: external criteria – targets and values from international agreements and programmes; internal criteria – national goals and action plans; and comparative criteria – performance by other countries in relevant policy areas. The relationship between the demands of sustainability and existing democratic procedures is a key interpretive theme.
>
> A documentation and evaluation of policy implementation that provides a basis for strategic research on barriers and possibilities. ProSus employs an integrated research model (SusLink) that focuses on the relationship within and between different arenas of governance. Research is focused on the supranational, national, and local levels of governance, as well as households and business and industry.
>
> An information strategy based upon open and interactive means of communication to quickly and effectively disseminate research conclusions to central actors within the field of sustainable development. The goal is to highlight alternative strategies of governance and instruments for more sustainable societies locally, nationally and globally.

In addition to books and articles in scientific journals, ProSus also publishes reports and working papers in order to disseminate the research results in an effective manner to key actors and decision-makers within the field of sustainable development.

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William M. Lafferty
Professor of political science
Director, ProSus

PREFACE

Finally completing this Cand. polit Thesis marks the end of a long and winding journey. During fall 2001 I started writing a thesis on policy instruments promoting environmental disclosure in companies' financial annual reports as a means for achieving sustainable development. One year later I got "an offer I could not refuse": I was asked to take a full time position as research assistant on ProSus' CondEcol project (Exploring the Conditions for Adapting Existing Techno-Industrial Processes to Ecological Premises). The downside was that I had to scrap my half finished thesis on environmental disclosure and study issues related to innovation and sustainable development instead.

The thesis has been written under the research programme ProSus (Programme for Research and Documentation for a Sustainable Society) at Centre for Environment and Development (SUM) and is based on and influenced by work I did as a research assistant for the Norwegian contribution to the OECD-initiated research project "Monitoring and Implementing Horizontal Innovation Policy" (MONIT).

Besides providing me with excellent office facilities, ProSus has offered enthusiastic and supportive colleagues. My supervisor Audun Ruud has shoved remarkable and enduring enthusiasm and patience throughout the process. Together with ProSus' director, William M. Lafferty, he has given constructive feedback and sound scientific advice and inspired me to get going when the going got tough. Quite frankly I doubt that this thesis would have been completed without their support.

Last but not least, my adorable wife Cathrine and my daughter Maria deserve gratitude for their support in the process and for creating and maintaining a home to return to. Thanks also to the rest of my family for life long support, baby-sitting and Sunday dinners.

Oslo, March 2005

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LIST OF ABBREVIATIONS AND ACRONYMS

CEO	Chief executive officer
CFC	Chlorinefluorocarbon
EEA	European Environment Agency
EIA	environmental impact assessment
EPI	environmental policy integration
ENGO	environmental non-governmental organization
EPSB	Environmental Profile of the State Budget
ETAP	Environmental Technologies Action Plan (EU)
GHG	green house gas
GMO	genetically modified organisms
GRIP	the Norwegian Foundation for Sustainable Production and Consumption
GTC	Green Tax Commission
GWP	global warming potential
HEPI	horizontal environmental policy integration
HFC	Hydrofluorocarbon
HIP	Government Plan for a Comprehensive Innovation Policy
IEA	International Energy Agency
ISC	the Industry Structure Commission
LO	the National Council of Trade Unions
MONIT	Monitoring and Implementing Horizontal Innovation Policy
MoA	Ministry of Agriculture
MoE	Ministry of Environment
MoER	Ministry of Education and Research
MoF	Ministry of Finance
MoFA	Ministry of Foreign Affairs
MoFC	Ministry of Fisheries and Coastal Affairs
MoH	Ministry of Health
MoLR	Ministry of Local Government and Regional Development
MoPE	Ministry of Petroleum and Energy
MoSTI	Danish Ministry of Science, Technology and Innovation
MoTC	Ministry of Transport and Communication
MoTI	Ministry of Trade and Industry
NA21	National Action Plan for Sustainable Development
NCSD	National Committee on Sustainable Development
NGO	non-governmental organization
NHO	Confederation of Norwegian Business and Industry
NEMS	National Environmental Monitoring System[1]

[1] National Environmental Monitoring System (NEMS) is a term coined by the author. It is a loose translation of the Norwegian term “resultatoppfølgingssystemet”. No official translation to English has been proposed by the authorities. In the latest White Paper 25 (2002-2003) it is only referred to as “monitoring the results of environmental policy” [in Norwegian: “resultatoppfølging av miljøvernpolitikken”].

NPD	Norwegian Petroleum Directorate
NTC	the Norwegian Trade Council
OG21	Oil and Gas in the 21st Century
Petromaks	Programme for the optimal management of petroleum resources
RCN	Research Council of Norway
RDS	result documentation system
SD	Sustainable Development
SDS	National Sustainable Development Strategy
SEA	strategic environmental assessment
SEPA	Swedish Environmental Protection Agency (Naturvårdsverket)
SEAP	Sectoral Environmental Action Plan
SFT	the Norwegian State Pollution Control Authority
SINTEF	the Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology
SIVA	the Industrial Development Corporation of Norway
SND	the Norwegian Industrial and Regional Development Fund
TWh	terra watt hours (1.000.000.000.000 watt hours)
UNCED	United Nations Conference on Environment and Development (1992 Rio Conference)
VEPI	vertical environmental policy integration
WCED	World Commission on Environment and Development (The Brundtland Commission)
WSSD	World Summit on Sustainable Development (2002 Johannesburg Conference)

1 INTRODUCTION

The role for innovation and public policy in achieving sustainable development (SD) is clearly pronounced in the Brundtland report:

> The role of public policy is to ensure, through incentives and disincentives, that commercial organizations find it worthwhile to take fuller account of environmental factors in the technologies they develop. (WCED 1987: 60)

Given the current "state of the world" and the environmental effects of production and consumption, it is easy to argue that innovation is crucial to achieve SD. To ensure that future economic growth is sustainable, radical changes in the way we produce, distribute and consume goods are required. Innovation is one of today's "buzzwords" in national policies in many sectors, and innovation action plans are published in the EU as well as several other countries. But to what extent does innovation promote sustainable development?

Politically, socially and culturally, a shift towards SD is the most important and challenging task the world has ever taken on. Since the Brundtland report "Our Common Future" (WCED 1987) and the UNCED process commencing in the Rio-Summit in 1992, a central concern in achieving SD has been the concept of *environmental policy integration*. The endorsement of environmental policy issues into other policy sectors was characterized to be the "chief institutional challenge in the 1990s" (WCED 1987: 313). The concept of environmental policy integration has consequently been followed up by, amongst others, the EU and the OECD as a key feature of governance for SD.

OECD has also introduced the notion of *decoupling* as vital to achieve SD. This means that the pressures of the existing economic drivers must be decoupled from life-support systems. For example, further economic growth must be created without a growth in green house gas emissions. Consequently decoupling will impose widespread and radical implications for the developed countries' "business as usual".

If the present standard of living in the developed countries is to be maintained, and the developing world is to meet its basic needs without further ecological degradation, environmentally friendly innovations are needed. Innovation policy can therefore be considered a key arena for environmental policy to achieve SD. Green, or environmentally friendly innovations do not, however, necessarily contribute to SD only because they contribute to decouple environmental degradation from economic growth. If a relationship between economic growth and environmental degradation is decoupled it is only reasonable to expect that it somehow must be re-joined to ensure further economic growth, but *without* environmental degradation. The decoupling of *non*-sustainable development thus necessarily implies a recoupling *for* sustainable development. A key challenge for any government is therefore to *"couple"* innovation- and environment policies, while at the same time making sure that the outcome of such an integrated policy represents a *recoupling* for sustainable development. The thematic baseline of this thesis is "governance for sustainable development" while the main research question is: *How can innovation for sustainable development be conceptualized and governed*?

1.1 Research questions

To answer the main research question I will study the case of green innovation policy in Norway. Based on the short discussion above this thesis will elaborate on the following three research questions:

1. How can innovation for sustainable development be conceptualized?
2. How and to what extent are Norwegian environmental and innovation policies integrated?
3. To what extent do Norwegian innovation policies contribute to sustainable development?

The research questions require further explanation:

How can innovation for sustainable development be conceptualized? In the Norwegian Government's plan for a Comprehensive Innovation Policy (HIP) (MoTI 2003) innovation is defined as:

> A new product, a new service, a new production process, application or organizational structure, which is launched in the marketplace or made use of in production, for the purpose of generating economic value. Innovation is based on new knowledge and new combinations of existing knowledge. New knowledge may be gleaned from practical experience or generated through systematic research and development, and is reflected in gradual modifications and improvements, or in more extensive and radical innovations (MoTI 2003:9).

The HIP is the latest innovation policy document published in Norway and I assume that the definition above expresses how the Norwegian government understands innovation. For the purpose of this thesis the definition serves as an interesting point of departure because it illustrates how almost anything "new", which seems to mean anything that is different from the existing, can be characterized as an innovation. It also illustrates a point of key importance with regard to SD: the definition does not take into account the systemic limitations environmental degradation and irreversible damage on life carrying eco-systems pose on human activities.

To answer the first research question I will first clarify how I will understand innovation in the thesis. Then I will present and discuss the role innovation is assigned in the SD discourse. There are "different shades of green" and all approaches to green innovation do not necessarily lead to a more sustainable development. For example: A new technology halving CO_2 emissions from a power plant based on fossil fuels is an environmentally friendly innovation, but it is not necessarily a sustainable innovation because the emissions will still override the carrying capacity of Earth. Based on a cross tabulation of OECD's notion of decoupling, and the concept of eco-efficiency introduced by the World Business Council for Sustainable Development (WBCSD), I will develop a fourfold typology of green innovation and show that the different shades of green span from traditional end-of pipe approaches to innovation promoting SD. The typology will then be used as a conceptual backdrop throughout the thesis.

After analyzing the concept of green innovation, I will discuss: *How and to what extent are Norwegian environmental and innovation policies integrated?* Drawing on ongoing strategic research and evaluation undertaken by ProSus at the University of Oslo, I will use the concept of Environmental Policy Integration (EPI) and the EPI benchmarks proposed by Lafferty (2004b) as point of departure and analytical framework.

The UN, EU, OECD, the Nordic Council of Ministers as well as the Norwegian government consider environmental policy integration as a key prerequisite in governance

for SD. From a public policy point of view both innovation and environmental policies are easily contextualized and related to other policy areas. Environmental policies have – or should have – wide implications for energy, transport and agricultural policies, while innovation policies have implications for industrial, regional, educational, research-oriented and trade policies. Both policy fields are interesting but complex in a policy integration context.

Increases in the range and scope of pollution problems and higher political awareness of environmental challenges have triggered new formal and informal demands on innovation and technology development. This is evident in a variety of countries comparable to Norway. The Swedish government has established the Swedish Agency for Innovation Systems (VINNOVA)[2] to promote sustainable growth and the Swedish Energy Agency (STEM)[3] to transform "the Swedish energy system into an ecological and economically sustainable system". The Danish Ministry of Science, Technology and Innovation has established a commission on Green Technology Foresight[4] and the EU released an Environmental Technology Action Plan (ETAP)[5] in January 2004. Norway does not have any such agencies or plans. During autumn 2003, however, the Norwegian government released two fairly high profiled reports; a "National Action Plan for Sustainable Development" (NA21) and "From Idea to Value: The Government's Plan for a Comprehensive Innovation Policy" (HIP). But are the reports coordinated in order to promote green innovation? I will analyze NA21, HIP and other policy documents, instruments and initiatives from the Ministry of Trade and Industry (MoTI), the Ministry of Petroleum and Energy (MoPE) and the Ministry of Environment (MoE) to evaluate the extent to which Norwegian environmental and innovation policies are integrated.

I will then discuss the third research question in the thesis: *To what extent do Norwegian innovation policies contribute to sustainable development?* Whereas research question 2 studies the interaction and coordination between environmental policy and innovation policies, the third research question highlights what it takes for innovation policy to actually promote SD. To answer the research question I will apply the "fourfold typology of green innovation" on the empirical findings of the thesis. This will illustrate how demanding green innovation for SD actually is. It will also highlight a point made in the theoretical chapter of the thesis, namely that during the process of integration one will sooner or later have to deal with the issue of trade-offs between environmental and other policy concerns. Thus, if SD is the goal of the integration process, an integration of the (traditionally separated) innovation and environmental policy fields will require a formal or informal value hierarchy "guiding" the policymakers.

Based on the findings related to the three research questions, the main research question – *How can innovation for sustainable development be conceptualized and governed?* – will be approached in the concluding chapter of the thesis. Here I will also use the theoretical approach of the thesis and the insight from the EPI discourse to outline what a green innovation policy for SD might entail. Finally, I will relate some of the implications of my findings to the thematic baseline of the thesis: *governance for sustainable development*.

[2] More information at: www.vinnova.se (Accessed February 23, 2005)
[3] In Swedish: Energimyndigheten. URL: www.stem.se (Accessed February 23, 2005)
[4] In Danish: Grønt teknologisk fremsyn. URL: http://www.teknologiskfremsyn.dk/ (Accessed Feb 23, 2005)
[5] More information at: http://europa.eu.int/comm/environment/etap/ (Accessed Feb 23, 2005)

1.2 Initial definitions and analytical clarifications

The terms 'sustainable development' (SD), 'innovation', 'governance for sustainable development' and 'environmental policy integration' (EPI) are of particular interest for the thesis and in need of an initial clarification.

The concept of SD has since the release of the Brundtland Commissions report *Our Common Future* (WCED 1987) been widely discussed and a number of definitions have been proposed. I will not engage in an open-ended discussion of SD here. Rather, I will point at the most commonly used definition of SD and the implications it has for this thesis. The core definition of SD is stated as follows (WCED 1987: 43):

> Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:
>
> – The concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and
>
> – The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.

One should note that the Brundtland Commission very clearly states that "The satisfaction of human needs and aspirations is the major objective of the development" (WCED 1987:43). Overriding priority should be given to meet the essential need of the world's poor. But every generation can only pursue its interests if it is sustainable. The definition of SD imposes a clear limitation on "the direction" of the development: technology and social organization impose limits on the environment's carrying capacity to meet present and future needs. The environmental pillar of SD is therefore crucial: "At a minimum, sustainable development must not endanger the natural systems that support life on Earth: the atmosphere, the waters, the soils and the living beings" (WCED 1987: 44). This thesis elaborates on possible innovation policy responses to the ecological "pillar" of SD.

"Innovation" is also a term in need of clarification as to how it will be used in this thesis. Common definitions of innovation are wide: anything "new", e.g. a new service or a new organizational structure, is an innovation. I will apply a narrower approach. In the 'conceptualizing innovation for SD' chapter I will understand innovation as a new or significantly improved product, service or process that enhances competitive advantage among firms. 'New' implies that technological characteristics or intended uses differ significantly from those it may replace. 'Significantly improved' implies an enhancement or upgrade that have major competitive effect on the firm. The four-fold typology of green innovation (to be presented in chapter 4) can accommodate a wide understanding of innovation, but when it comes to the empirical evidence of the thesis a narrower, mainly technology oriented approach is appropriate. The reason for this dual approach is that while a theoretical clarification of green innovation for SD is needed, a more narrow definition must be applied when evaluating governance for green innovation in order to operationalize the actual policy initiatives integrating environmental and innovation policies.

The thematic baseline of the thesis – governance for sustainable development – is also in need of a brief clarification as to how it will be applied. Two major topics serve as defining characteristics for the topic in question: "rational democratic governance" as both underlying logic and goal of the SD programme; and the "'differentness' of

sustainable development" as the key premise for identifying and analyzing the specific topics, mechanisms and instruments (Lafferty 2004a). *Rational democratic governance* implies that the purpose of and responsibility of specific governments is to direct and steer change; and that the steering presupposes a sequential logic (ends and means) which is open to external evaluation and adjustment. The *"'differentness' of sustainable development"* implies that SD is a program more demanding and challenging than a "normal" policy program due e.g. to its outside-in characteristic (it was 'made outside' domestic politics and had to be 'brought home' for ratification); its abstractiveness; its normative end point; its trans-border/supranational scope; and its long time range. Thus, implementation of the sustainable development program into the current western model of a market liberal democracy is challenging and demands special grips. EPI (which will be discussed in chapter 3) is such a grip.

Finally, Environmental policy integration (EPI), which constitutes the key theoretical and analytical reference in the thesis, is in need of a short clarification. EPI has, since the release of the Brundtland Report, been a central concern in achieving SD. The concept of 'policy integration' is very relevant for a number of policy fields. It is therefore important to emphasize that this thesis is discussing *Environmental* Policy Integration *for sustainable development* and even more narrow: integration of environmental and innovation policies. EPI implies in short that environmental considerations should be integrated into all stages of policymaking in non-environmental policy sectors. Furthermore, as I will discuss throughout the thesis (but mainly in chapter 3), for EPI to actually promote SD, environmental concerns must – in given circumstances – be assessed as potentially dominant if life-support systems of Earth is threatened.

1.3 Outline of the thesis

Chapter 2 draws up the methodological approach of the thesis. It discusses evaluation as method and considerations related to data collection, validity and reliability. Chapter 3 presents and discusses EPI as the theoretical and analytical approach of the thesis. The chapter gives a short overview of the mandate for EPI, it discusses what EPI is all about and presents benchmarks for the evaluation. It also discusses three main approaches in the EPI discourse on how to resolve trade offs between environmental and other policy objectives. Chapter 4 discusses the first research question: 'How can green innovation be conceptualized?' The chapter elaborates on what innovation is all about and the role of innovation for SD. Finally the chapter discusses a fourfold typology of green innovation. Chapter 5 presents empirical findings related to environment and innovation from the Norwegian MoE, MoTI and MoPE based on the analytical approach elaborated upon in chapter 3. The "National Action Plan for Sustainable Development" (NA21), the "the Government's Comprehensive Innovation Policy Plan" (HIP), White papers, Parliamentary bills, sector specific documents, directorates and cross sectoral plans are studied. In chapter 6, based on the EPI benchmarks, I discuss the second research question: to what extent innovation and environmental policies are integrated within and between the three ministries in question. Chapter 7 discusses the third research question on the extent to which Norwegian innovation policies contribute to SD. This will be done by applying the fourfold typology of green innovation arrived at in chapter 4, and the theoretical framework for the thesis outlined in chapter 3. The concluding chapter 8

recapitulates the main findings and provides a discussion of the main research question of the thesis: 'How can innovation for sustainable development be conceptualized and governed?' It then illustrates how a green innovation policy for SD can be designed, integrating environmental concerns into all relevant policy fields and assigning principled priority to the environment over other policy concerns. Finally the concluding chapter draws some implications of the findings of the thesis for the broader debate on governance for sustainable development.

2 METHOD AND DATA

The research questions of the thesis are related to governance for green innovation and the extent to which environmental and innovation policies are integrated to promote SD. I will perform an evaluation of innovation policies for SD in Norway and have therefore chosen an evaluation approach. Furthermore, I have chosen the case study as research strategy. Which research method is most appropriate for the thesis, which data are relevant and how should the data be treated and applied?

2.1 Public policy and program evaluation

Vedung (1997) terms evaluation "a semantic magnet" and Kjellberg and Reitan states that one steps into a terminological minefield as soon as one mentions the word evaluation (1995: 133). Evaluation is clearly a contested approach. According to Lafferty and Ruud (2004) the use of evaluation as method and approach has little prominence in academic political science. A review of seven major "handbooks" of political science published between 1975 and 1999 revealed no significant reference to the approach as an independent method. The only area where evaluation as method had played a role was in the sub-field of applied "policy analysis" mainly connected to the study of policy implementation (ibid.).

2.1.1 Policy implementation

Policy implementation is a central feature of public administration and can broadly be divided into a top-down and bottom-up approach. According to Wilkinson (1997: 155), strategies for implementing environmental concerns into "non-environmental" sectors can take a variety of forms along what may be termed an "integration continuum" ranging from top-down to bottom-up initiatives. *Top-down* integration typically involves the establishment of binding frameworks which constrain the actions of sectoral departments. Top-down implementation requires plans, goals and targets and effective review and reporting mechanisms to monitor progress in achieving the targets. This implies that a central authority must play a crucial, horizontal, role reviewing and regulating the environmental performance of other ministries. This thesis is concerned with how the Government has integrated environmental and innovation policies, a top-down approach.

A *bottom-up* approach reflects, according to Wilkinson (1997:156), the application of influence rather than formal power. Integration is not "steered" from above, and the ministries are more or less left free to decide how environmental concerns and considerations should be part of their priorities. Instead of goals, targets and plans, procedures designed to ensure integration and environmental awareness in the ministries are in use. Such procedures could for instance be use of inter-departmental committees or officials responsible for environmental aspects in the "non-environment ministries". A bottom-up approach may thus implicate a process of continuous negotiation between environment and sectoral ministries.

For this thesis it is appropriate to note that a main difference between environmental and innovation policies is that environmental policy traditionally has been considered top-down with extensive use of "command and control" policy instruments. On the other hand innovation policies have been characterized by bottom-up approaches utilizing economic policy instruments like tax relief and support schemes, as well as research programs, open for applications from a number of actors.

2.1.2 Policy evaluation

In his classic text on evaluation theory, Vedung (1997) gives a thorough justification of his definition of evaluation. Vedung defines evaluation as:

> Careful retrospective assessment of the merit, worth, and value of administration, output and outcome of government interventions, which is intended to play a role in future, practical action situations (1997: 3).

My evaluation approach corresponds with what Vedung (1997: 37) terms a "goal-attainment" design. This is the "classical way of approaching the evaluation problem" (ibid). The key question in goal-achievement measurement is whether the results are in accord with the program goals. What then is the goal to be evaluated in the thesis? As we will see, the Norwegian government has stated that "An efficient environmental policy must ensure that *environmental considerations are integrated into the policy frameworks and concerns for all sectors in society*" (White Paper 58 (1996-97): 25). There are, however, no explicit goals of integrating environmental concerns into innovation policies in Norway, but given that there is a clear overarching goal of integrating environmental considerations into the policy frameworks of *all* sectors in society, I interpret this to also be valid for innovation policies.

The two major forms of evaluation are "monitoring" and "impact assessment" (Vedung 1997:137). Monitoring is first and foremost an evaluation of policy implementation, while impact assessment refers to evaluation of actual outcomes. Evaluation without impact assessment is common place (ibid: 137, 166). My option is clearly monitoring, which can be construed as a "five-step activity" (ibid: 138). I will perform the evaluation more or less based on these five steps:

The *first* step is to "reconstruct the intervention theory" which is to find out what the intervention was designed to achieve and how this achievement was to come about. In the thesis the issue will be touched upon several places, especially in chapter 3.1 where the mandate for EPI will be discussed. The first research question on conceptualizing green innovation is also relevant for the first step. The *second* step is to select stages for empirical checks in the intervention theory. This will be done at two stages/places in the thesis. First, I check at the horizontal, cross sectoral, level, and relate it to the central authority's ability to communicate to the sectors a detailed understanding of what it aims to achieve by EPI. The second check is at the vertical, intradepartmental, level and concerns the actual outputs of policies for green innovation, that is at the place where the governance systems actually meets its addressees. I will check for both process and output related initiatives at both levels. The *third* step entails collection and analysis of data. In the thesis this will be carried out in chapter 5. The *fourth* step involves the application of criteria of merit and the standards of performance to the findings. This is related to the second and third research question and I will base my evaluation on Lafferty's definition

and proposed benchmarks for EPI (presented in more detail in chapter 3). The exercise will be carried out in chapter 6 and 7. The *fifth* and last step in Vedung's approach, which he himself claims to be "somewhat unusual" in an evaluation context (ibid: 138), involves an analysis of the evaluand, its intended administration and final delivery from a general governance perspective. In the conclusion of the thesis I will address the fifth step by partly outlining what an innovation policy for SD might entail and partly by drawing some implications of my findings for the broader governance for SD debate.

Given the complexity and difficulty of taking EPI from rhetoric to actual politics, substantial academic and political efforts have so far been devoted to developing EPI as concept and to study EPI as a policy *process* (Collier 1994; Liberatore 1997; Lenschow 2002; Lafferty and Hovden 2003; Lafferty 2004b, Persson 2004; Lafferty, Larsen and Ruud 2004). EPI may also be studied as *output* in terms of policy initiatives, statements, objectives and so forth. It might, however, be difficult to assess whether the actual policy outputs – or lack thereof – are a direct causal effect of EPI or only part of conventional political bargaining. The study of EPI as an *outcome* is a third option which would imply evaluation of actual real-life results of integration of environmental concerns into other policy fields (Persson 2004).

EPI involves a governing process designed to produce policy outputs which aim to achieve discernable SD outcomes. In an article in Journal of Environmental Policy & Planning, Persson and Nilsson (2003) present a fairly comprehensive framework for analyzing EPI. They study "policy making rules and assessment processes" as the main independent variables. Based on a "network perspective", they end up concluding that "learning across frames" is the main difference between EPI and environmental policy (ibid: 353). Thus they somehow, in my opinion, seem to "black box" the actual processes and outputs of EPI. Furthermore they seem to emphasize a bottom-up perspective in which:

> actors and actor coalitions are positioned according to their belief systems/frames, and EPI occurs through learning across frames when actors meet and create new debates and deliberations in the policy network or change actual policy outputs, including policy instruments, objectives and strategies (ibid).

This thesis is concerned with an evaluation of the goal of integrating environmental concerns into innovation policies in a top-down perspective. The exercise is, therefore, both a form of evaluation of Norwegian governing mechanisms for what can be termed "green innovation" – *process* – and actual policy *outputs*, that is programmes, directorates or other efforts to promote green innovation. An evaluation of the actual *outcomes* of the policy processes and outputs is beyond the scope of the thesis. As my evaluation approach is concerned with governmental interventions, I will also make clear that this thesis does not evaluate the processes, outputs and outcomes of green innovation in the private sector.

2.2 Method: case study

The case subject to study and the dependent variable in the thesis is integration of environmental concerns into innovation policies in Norway, what I also frequently mention as "green innovation policy" or "innovation policy for sustainable development". The case of study is thus a policy field, and I have chosen to focus on three Norwegian

ministries' approach to the policy fields; the Ministry of Environment (MoE), the Ministry of Trade and Industry (MoTI) and the Ministry of Petroleum and Energy (MoPE).

Why then choosing the case study as research strategy? The answer is simply that it seems to capture my intention with the thesis: A case study is a small N-study with many variables. According to Yin (1989, cited in Andersen 1990: 122ff), a case study research design is an empirical approach illuminating contemporary real life phenomena; where the borders between the phenomena and the environment it is a part of is not obvious; and it is possible to use several information sources to study the phenomena. A case-study design is ahistorical, non-experimental and it is studying only one phenomena. I will, however, have a partly historical approach to my case, a point that, according to Andersen (1990: 123), also Yin seems to accept.

Why then, will I study integration of environmental concerns into innovation policies in Norway, when e.g. Sweden seems to be a frontrunner? The main reason for this is that parts of the thesis is based on and influenced by previous commissioned work I did as a research assistant at the OECD-sponsored research project Monitoring and Implementing Horizontal Innovation Policy (MONIT). Furthermore, I am not aware of other studies of integration of environmental concerns into innovation policies in Norway. It is therefore, in my view, fruitful to first get an overview of the Norwegian case before expanding the study to also include e.g. Sweden. And why will I study MoE, MoTI and MoPE to shed light on the case? The first two ministries are obvious candidates: the MoE is responsible for environmental policy and has worked extensively on EPI (Lafferty, Larsen and Ruud 2004) while the MoTI is responsible for the innovation policy in Norway. The MoPE is maybe not such an obvious candidate, but considering the sectors' significance for the Norwegian national economy, that it is very technology intensive, of vital concern for e.g. climate policy, and that all Norwegian petroleum resources are situated offshore, I found the MoPE an interesting unit to include. Ministry of Transport and Communication (MoTC) is another interesting candidate due to the simple fact that about 25 per cent of green house gas emissions in Norway stems from the transport sector (MoTC Parliamentary Bill 1 (2004-2005: 42)). Due to lack of time and space, however, it has not been possible to include MoTC in the analysis.

2.3 Sources

Data sources can be divided into two main types: quantitative and qualitative. In this thesis qualitative data are the most important, but quantitative data are also represented, mainly as part of the parliamentary bills on the state budget. The complexity of the case, the fact that I am not aware of any similar studies of green innovation policy in Norway and the need to obtain reliable and valid data, speaks strongly in favor of using multiple sources of evidence. Yin (1994:93) has argued that such data triangulation is crucial in the "development of *converging lines of inquiry*". In this thesis, three kinds of sources are used: official documents, interviews and secondary literature. The official documents and the interviews can be considered primary sources. Each will be discussed.

The most central source of data is *official documents* – white papers, parliamentary bills and various action plans etc – (primarily) from the MoE, MoTI and MoPE and their directorates: The sources are informative and can at the outset be considered reliable, but they must be read critically as they are always written for some specific purpose and for

some specific audience. A challenge by using official documents is that they represent the ministries own evaluations and are not necessarily objective.

Some *secondary literature* like news paper articles, a few independent policy evaluations, articles and information on various websites has also been used. These sources have mainly been used to complete the information from the official documents and to prepare for interviews with relevant actors.

The various written sources have been complemented by *interviews* with representatives from the ministries and directorates. The interviews have mainly been conducted to verify already gathered information from the official documents and secondary literature, but some interviews have been conducted to make sure that I have not ignored any important initiatives. Some respondents were interviewed more than once; some were followed up by subsequent e-mail correspondence. With a few exceptions all interviews conducted have been telephone interviews. Respondents were mainly chosen for the role they play within the ministries and directorates I have studied. In some cases I knew, from the document studies, whom to approach. In other cases I made open inquiries by telephone or e-mail in search for informants with knowledge about the relationship between environmental and innovation policy concerns in the given entity.

With the broad concerns of this thesis, stretching from general environmental and innovation goals and procedures to the nitty-gritty of specific innovation programs and initiatives, it has not been possible to discuss every issue with each respondent. All interviews have followed a semi-structured strategy (Andersen 1990:143). In practice, this means that for each interview, the main topics and questions to be covered were put down in advance while allowing for open-ended answers, follow-ups, as well as interviewee-initiated "spin-offs". Some informants from MoE and MoTI have read and approved summaries of their interviews.

Finally, it must be noted that parts of this thesis have been published in ProSus publications earlier. However, all the parts are written solely by me: I presented parts of chapter 3 of this thesis at the Berlin Conference in December 2004[6]. This was later published as a ProSus Working Paper (Lafferty, Larsen and Ruud 2004). Furthermore I gave substantial input to another paper presented at the conference (Lafferty, Ruud and Larsen 2004). Parts of that paper are presented in chapter 4 of this thesis. Finally, the data on MoE's and MoTI's efforts on green innovation in chapter 5 and parts of chapter 8.2.1 and 8.2.2 is based on work I did as a research assistant for ProSus' contribution to the MONIT-project (see also Ruud and Larsen 2004). The presentation of MoPE's efforts in chapter 5 is, however, collected and written for this thesis only.

2.4 Validity and reliability

Yin operates with three types of validity: "construct validity", "internal validity" and "external validity" (Yin 1994: 34-36). A main point with research related to a theoretical concept, in my case EPI, is to achieve correlation between the theoretical concept and the empirical material. What is studied empirically must be related to the theoretical concept

[6] "The 2004 Berlin Conference on the Human Dimensions of Global Environmental Change: 'Greening of Policies – Interlinkages and Policy Integration'". More information about the conference is, as of February 2005, available at http://www.fu-berlin.de/ffu/akumwelt/bc2004/ .

and its definition. This can be termed *construct validity*. I will in chapter 3 discuss EPI and arrive at Lafferty's (2004b) definition. To operationalize the concept, I will follow Lafferty's approach and apply his proposed benchmarks for the Horizontal (HEPI) and Vertical (VEPI) dimension. It must also be mentioned already here, although I will return to the issue, that in the course of writing the thesis it appeared to me that an evaluation based only on Lafferty's *full* EPI definition was not very fruitful, as it revealed very little integration. In chapter 6 I therefore discuss EPI based on what I have coined a "thin" version of Lafferty's definition, while an evaluation of environmental policy integration into innovation policy based on a "thick", or full, version of Lafferty's definition is conducted in chapter 7.

Internal validity refers to whether the researcher can pinpoint causal relationships and not only spurious relationships. As my thesis does not aim at explaining why or why not there is a certain degree of environmental policy integration in Norway, this is less relevant for me. In the concluding chapter I do, however, touch upon the issue, but more related to Yin's third type of validity: external validity. *External validity* refers to the possibility of generalizing the findings from a study to a universe or a theory. As I am studying integration of environmental concerns into innovation policy in Norway it is not possible to generalize to a universe consisting of comparable policy fields in other countries. It is however possible to make some generalizations to the EPI discourse and governance for SD in general. I must also note that empirical studies of EPI are relatively few, and most of the studies conducted are related to "heavier" policy fields like finance and energy. However, any scientific work needs to be grounded in thorough empirical findings. If my study of policy integration into a "niche policy area" like innovation policy is only a modest contribution to the development of EPI as a principle or conceptual framework my endeavor will be worthwhile.

Reliability is about whether the findings of the research can be reconstructed. The aim is to ensure that if the same analysis was conducted again – using the same empirical material – it would arrive at the same conclusion (Yin 1994: 36). All my written sources are publicly available and I have followed normal social scientific procedures to refer to the sources used in the text. I have also kept the e-mails and the notes from the telephone interviews and the interviewees are in most cases mentioned by name. I can not guarantee that another researcher would arrive at the same conclusions as I have, but it is possible to evaluate my interpretation of all the sources used.

3 THEORETICAL APPROACH[7]

This thesis is about governance for sustainable development and more specifically about the integration of environmental and innovation policies in Norway. I will use Vedung's framework of 'monitoring' (Vedung 1997) to evaluate the implementation of green innovation policies in Norway. According to Sabatier (1999: 3):

> The process of public policymaking includes the manner in which problems get conceptualized and brought to government for solution; governmental institutions formulate alternatives and select policy solutions; and those solutions get implemented, evaluated and revised.

This process can be illustrated by the contested (see e.g. Sabatier 1999) stages approach to the policy process: Initiation, estimation, selection, implementation, evaluation and termination (DeLeon 1999). A similar illustration, the "policy cycle framework", is used in the summary report from the Work Package on "Coherence of Sustainable development and Innovation policies" in the OECD-sponsored research project Monitoring and Implementing Horizontal Innovation Policy (MONIT) (Hjelt et al, 2004). The "policy cycle framework" mentions agenda setting, design, implementation, evaluation and policy learning in a circular illustration of the policy process.

The stages approach and the policy cycle framework are similar and two of many possible illustrations of the process of public policy making. A study of the full policy cycle or all the stages for innovation and environmental policies is beyond the scope of this thesis. I will rather focus on the evaluation part of the public policy process. That is, I will evaluate the extent to which Norwegian innovation and environmental policies are integrated. I will base my evaluation on the growing discourse on EPI and the EPI definition and benchmarks developed by Lafferty (2004).

Environmental policy integration (EPI) constitutes the key theoretical reference in the thesis and implies in short that environmental considerations should be integrated into all policy sectors. During the last five years a substantial academic discourse on EPI has emerged. The concept of Policy Integration is very relevant for a number of policy fields. It is therefore important to emphasize that this thesis is discussing *Environmental* Policy Integration *for sustainable development* and even more narrowly: integration of environmental and innovation policies. I will further emphasize that the thesis is primarily an empirical exercise. It is not my purpose to test or show the "explanatory force" of different theoretical approaches, but rather to use the concept of EPI to explore and evaluate policy responses to innovation for SD in Norway.

This chapter will first give a very brief overview of the mandate for EPI. Then I will make an effort to conceptualize EPI by discussing and defining EPI and present a set of EPI benchmarks. The fourth section contains a discussion of three main approaches in the EPI literature on how to resolve trade offs when integrating environmental and other societal objectives. Finally, I clarify different "types" of integration relevant for the thesis: Am I studying innovation concerns in the environmental policy?; environmental concerns in the innovation policies?; or something in between?

[7] Parts of this chapter (sections 3.1, 3.2 and 3.3) have been published in Lafferty, Larsen and Ruud (2004).

3.1 The mandate for EPI for sustainable development

In the introduction to the thesis I traced the roots of EPI back to the Brundtland Report and Agenda 21. There are more key formulations in the same documents and the concept can be traced even further back (Lafferty and Hovden 2003: 3; Lafferty 2004). It is, however, appropriate to make clear that there is a considerable discussion on what EPI is all about (Collier 1994; Liberatore 1997; Lenschow 2002; Lafferty and Hovden 2003; Nilsson and Persson 2003; Lafferty 2004, Persson 2004). The focus in the discourse so far has mainly been on the integration dynamics between traditional environmental policy and the driving forces of leading economic sectors (energy, industry, transport, agriculture). Although environmental technology programs were common throughout the world in the 1990s, the integration of environmental concerns into the much broader field of innovation policy is relatively new. I am only aware of one academic project systematically addressing this, the OECD-initiated Monitoring and Implementing Horizontal Innovation Policies (MONIT) (Hjelt et al 2004; OECD forthcoming). In the following I will give an overview of the general EPI approaches for SD of the UN, the EU, and, important for this thesis, the approach of the Norwegian Government.

3.1.1 The policy mandate of EPI within the UN

Already at the outset it is important to point out that the Brundtland Report is, in fact, that only document that sets down baseline conditions for "sustainable development". The Rio Declaration, Agenda 21 and the entire follow-up process of the UN Commission on Sustainable Development (UNCSD) anchor their principles and policy instruments in the Brundtland understanding. The Brundtland Report, "Our Common Future", gives a crystal clear mandate for EPI:

> The common theme throughout this strategy for sustainable development is the need to integrate economic and ecological considerations in decision making. They are after all integrated in the workings of the real world. This will require a change in attitudes and objectives and in institutional arrangements at every level. (WCED 1987: 62)

This is further enforced in the section – appropriately titled – "Proposals for Institutional and Legal Change":

> Environmental protection and sustainable development must be an integral part of the mandates of all agencies of governments, of international organizations, and of major private-sector institutions (WCED 1987:312)

> The ability to choose policy paths that are sustainable requires that the ecological dimensions of policy be considered at the same time as the economic, trade, energy, agricultural, and other dimensions – on the same agendas and in the same national and international institution. That is the chief institutional challenge in the 1990s. (WCED 1987: 313)

The ideas proposed by the Brundtland-commission were followed up more specifically as a series of "objectives" in Chapter 8 of Agenda 21 (United Nations 1994), entitled: "Integrating Environment and Development in Decision-Making". The statements chosen are from the two most relevant sub-sections of the chapter: (A) "Integrating environment and development at the policy, planning and management levels", and (D) "Establishing systems for integrated environmental and economic accounting". Though the general ideas here are well known, it is important for further discussion that I reference and highlight some of the key formulations:

> Governments, in cooperation, where appropriate, with international organizations, should adopt a strategy for sustainable development based on, inter alia, the implementation of decisions taken at the [Rio] Conference, particularly in respect of Agenda 21. This strategy should build upon and harmonize the various sectoral economic, social and environmental policies and plans that are operating in the country. (Para. 8.7)
>
> [To adopt] a domestically formulated policy framework that reflects a long-term perspective and cross-sectoral approach as the basis for decisions, taking account of the linkages between and within the various political, economic, social and environmental issues involved in the development process. (Para 8.4.b)
>
> [To ensure] transparency of, and accountability for, the environmental implications of economic and sectoral policies. (Para 8.4.e)

The main objective related to chapter 38 on "International Institutional Arrangements" is also an illustrative reference:

> The overall objective is the integration of environment and development issues at national, subregional, regional and international levels, including in the United Nations system institutional arrangements. (Para 38.7)

There are more key formulations in the Brundtland Report and in Agenda 21 and the concept of EPI can be traced even further back (Lafferty and Hovden 2003: 3). The mandate for EPI is, however, still very much alive. Let us therefore turn to the approach of the EU and the interpreted policy mandate for EPI.

3.1.2 The policy mandate of EPI within the EU

The European Union clearly recognizes the challenge of sectoral integration within the Union. In 1997, in Article 6 of the Treaty of the European Community (the Amsterdam Treaty), it is stated that:

> Environmental protection requirements must be integrated into the definition and implementation of the Community policies and activities referred to in Article 3 [listing the full range of Community activities] in particular with a view to promoting sustainable development

In the so-called "Cardiff Process", initiated by the Luxembourg European Council in December 1997, and elevated to a full-scale EU programme in Cardiff, June 1998, EPI was given institutional impetus and the goal is that "all relevant Council configurations" should work to develop "their own strategies for integrating environment and sustainable development into their respective policy areas". The strong nature of the mandate here is reflected in a policy evaluation from 2001, where the report concludes that:

> In summary … the Cardiff Process can be characterised as binding and committing. Legally, the binding nature is rather weak, but the political commitment is strong. There was a clearly expressed will at the start, which was reinforced at various levels throughout the whole process. Of significant importance are the various self-commitments of the Council configurations to further refine or revise the strategies, and the work packages delegated to the European Commission or specific working groups." (Kraemer 2001: 33)

Further, I can mention the EU "Strategy for Sustainable Development". Authored directly by the office of the President of the EU Commission, and presented to the European Council in Gothenburg in June 2001, the strategy stated that:

> The process of integration of environmental concerns in sectoral policies, launched by the European Council in Cardiff, must continue and provide environmental input to the EU Sustainable Development strategy, similar to that given for the economic and social dimensions by the Broad Economic Policy

> Guidelines and the Employment Guidelines. The sectoral environmental integration strategies should be consistent with the specific objectives of EU Sustainable Development strategy. (CEC 2001: 14).

Finally, in September 2002, the entry into force of the Commission's 6th Environmental Action Programme put renewed emphasis on the importance of EPI (EU Commission 2004b).

3.1.3 The policy mandate of EPI in Norway

For this thesis, focusing on integration of innovation and environmental policies in Norway, national commitments are of particular interest. In White Paper 46 (1988-89) "Environment and Development. Norway's follow up of the World Commission report" (presented by the second Brundtland Government[8]), it is stated in the introduction to chapter 7 on "policy instruments in the environmental policy" that:

> The Government puts decisive emphasis on the inclusion of sustainable development considerations into all societal planning and sectoral policies. (White Paper 46 (1988-89): 71) [Author's translation]

The White Paper then proceeds with a substantial discussion on how the "inclusion" will be organized.

In White Paper 58 (1996-97) "Environmental policy for Sustainable Development", the expressed public commitment to EPI is also strong. With explicit reference to cross-sectoral interaction causing specific environmental impacts, EPI was established as a guiding principle in Norwegian environmental policies. As stated:

> An environmental problem is seldom caused by only a single sector. The sources of negative environmental impacts vary within the sectors and the sectors have varying capacities and cost-benefit structures for reducing environmental impacts. For cross-sectoral environmental problems to be solved at the lowest cost possible, the Government will do everything it can to consider the combined impacts of all relevant sources. *A sector encompassing environmental policy requires a comprehensive cross-sectoral utilization of policy instruments.* An efficient environmental policy must ensure that *environmental considerations are integrated into the policy frameworks and concerns for all sectors in society*. Integration of environmental concerns early in the decision-making process will prevent environmental problems from arising, which in most cases is less costly than having to "repair" them. (White Paper 58 (1996-97): 25) [Original emphasis. Author's translation.]

White Paper 58 (1996-97) also established the principle of sectoral responsibility which is still very influential on Norwegian environmental politics.

It is safe to say that the mandate for EPI is well founded in relevant UN, EU and national policy documents. Nevertheless, EPI is semantically diffuse and it has been a challenge to conceptualize and operationalize the concept. The next section will draw some broad lines and suggest a set of minimum "baseline" requirements for implementing EPI through governmental steering mechanisms.

3.2 Conceptualizing EPI

Environmental Policy Integration means in short that environmental concerns must be integrated into other policy areas. The principle recognizes that environmental policy alone cannot achieve the environmental improvements needed as part of SD. The

[8] Gro Harlem Brundtland, chairman of the World Commission on Environment and Development (WCED) was Norwegian Prime Minister for three periods: Feb 04, 1981 – Oct 14, 1981; May 09, 1986 – Oct 16, 1989; and Nov 03, 1990 – Oct 25, 1996.

changes required to reduce negative environmental impact from policy areas like energy, transport and industry can only be achieved through a process of environmental integration in these sectors (EU Commission 2004b).

What is then "policy integration" all about? In the words of Lafferty and Hovden (2003) "How will we recognize it when we see it?" Ute Collier's work on EPI is a valuable starting point for discussing the concept. She is one of the few who define EPI in a way that distinguishes between features of its application such as strategies and indicators. She offers a three-point definition of the objective of EPI (Collier 1994:36). EPI should aim to:

1. Achieve sustainable development and prevent environmental damage
2. Remove contradictions between policies as well as within policies
3. Realize mutual benefits and the goal of making policies mutually supportive

While Collier's definition places the concept of EPI in the right intellectual context and provides a number of possible indications as to what it might entail, the definition is short of a precise, *applicable* definition of EPI.

The early work of Arild Underdal is more helpful. Even though Underdal deals with policy integration in general, his approach to the problem has the appealing feature of concentrating on the character of the policymaking process. For a policy to be 'integrated', three criteria need to be satisfied: comprehensiveness, aggregation and consistency. Underdal defines an integrated policy as one where:

> all significant consequences of policy decisions are recognized as decision premises, where policy options are evaluated on the basis of the effects on some aggregate measure of utility, and where the different policy elements are in accordance with each other (Underdal 1980: 162).

The definition proposed by Underdal is well developed and precise, but it can in principle be used for any type of policy integration. It is not specifically tied to environmental policy or SD. Consequently, I lack a value hierarchy of "the aggregate measures of utility" to guide the actual integration in question. In accordance with the reasoning embedded in the UNCED process, but inspired by Underdal (1980), Lafferty (2004b: 201) proposes that EPI be defined as:

> the incorporation of environmental objectives into all stages of policymaking in non-environmental policy sectors, with a specific recognition of this goal as a guiding principle for the planning and execution of policy;
>
> accompanied by an attempt to aggregate presumed environmental consequences into an overall evaluation of policy, and a commitment to minimise contradictions between environmental and sectoral policies by giving principled priority to the former over the latter.

The first part of the definition specifies the integration principle in terms of policymaking and is primarily a process-oriented concept. Environmental objectives need to be part of the fundamental premises for policy-making at all stages. This is very much "in line" with the commitments to EPI I have referred to above.

The second part of the definition refers to a crucial and more controversial issue in defining EPI. Many discussions assume that conflicting interests between policy objectives can be resolved to the satisfaction of all affected parties. According to the reasoning of Lafferty, however, the crucial significance of EPI as a principle rests in the issue of "trump": that is, that environmental concerns be accorded "principled priority" within a

"canon of practical judgment" for resolving trade-offs among environmental, economic and social policy goals (Lafferty, Ruud and Larsen 2004). The increasing recognition and acceptance of the fact that the Earth is facing potentially irreversible damage to crucial life-support systems implies that environmental objectives – under stipulated decision-making constraints – should be seen as principal. This does not imply an "extra-democratic" mandate (Lafferty and Hovden 2003). Political priorities must be agreed within overall democratic procedures. As Lafferty has argued elsewhere (Lafferty and Hovden 2003; Lafferty 2004b), however, there is considerable room for strengthening the mandate for environmental SD within the policy realm of existing sectoral interests.

It must be noted already here that Lafferty's definition of EPI must be considered a weberian ideal type. This refers to a construction of certain elements of reality into a logically precise definition of a concept (Lafferty and Hovden 2002: 12). It will thus probably not be possible to identify a perfect example of EPI in "the real world", but the concept has great analytical value. EPI can be considered as one extreme on a scale from no EPI to the ideal EPI. I will leave this as it is here and return to the discussion of resolving trade-offs in section 3.4 below. Next I will introduce a set of the EPI benchmarks proposed by Lafferty (2004b). The benchmarks will later on be used in my evaluation.

3.3 EPI benchmarks

According to Lafferty and Hovden (2003) and Lafferty (2004b) EPI has horizontal and vertical dimensions (Figure 1). The horizontal dimension refers to the governmental responsibility for SD and the overall challenge of inter-ministerial policy coordination. The vertical dimension refers to the particular sectoral responsibility and policy fields of the individual ministry. EPI, then, refers to the policy challenge of comprehensive coordination within and between the two dimensions. I will use this framework for organizing and presenting the data collected. Further, Lafferty (2004) have developed a comprehensive set of benchmarks to evaluate the extent to which governmental provisions and institutions for EPI are in place. I will use the benchmarks to assess and discuss the extent to which environmental and innovation policies are integrated.

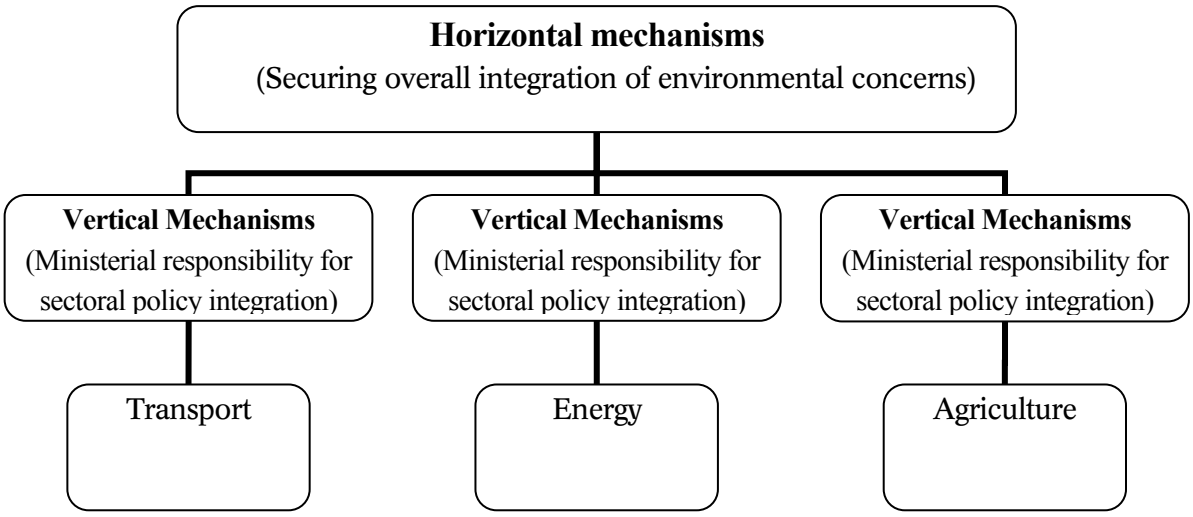

Figure 1: Environmental policy integration. Horizontal and vertical dimensions (Lafferty and Hovden 2003: 14)

Horizontal Environmental Policy Integration (HEPI) refers to whether a central authority has developed a comprehensive *cross-sectoral* strategy for EPI. The central authority could be the government itself, or a particular body or commission entrusted with an overarching responsibility for SD. As emphasized by Lafferty and Hovden (2003:14)

> If 'who gets what, where, when and how?' is the essence of a political system, the relevant understanding of HEPI is to substitute 'environmental interest' for 'who', and to insist on at least equal treatment for the environment as for other competing interests.

HEPI also includes the central authority's ability to communicate to the sectors a detailed understanding of what the central authority aims to achieve by EPI.

Lafferty (2004b) proposes the following benchmarks for horizontal environmental policy integration (HEPI):

1. a "constitutive" mandate providing provisions for the special status of environmental/ sustainable development rights and goals;

2. an *over-arching strategy* for the sectoral domain, with clearly enunciated goals and operational principles, and a political mandate with direct backing from the chief executive authority;

3. a *national action plan* with both over-arching and sectoral targets, indicators and time tables;

4. a *responsible executive body* with designated responsibility (and powers) for the overall coordination, implementation and supervision of the integration process;

5. a *communications plan* stipulating sectoral responsibility for achieving overarching goals, and outlining how intra-sectoral communications are to be structured and made transparent;

6. an *independent auditor* with responsibility for monitoring and assessing implementation at both governmental and sectoral levels, and for proposing revisions in subsequent generations of strategies and action plans;

7. a *board of petition and redress* for resolving conflicts of interest between environmental and other societal objectives, interests and actors.

The benchmarks for HEPI should be considered as minimum "baseline" requirements for the horizontal aspect of implementing EPI through governmental steering mechanisms. For EPI in general, that is integration of environmental concerns into all other policy fields, the "constitutive" mandate is of course important. In Norway for example strong environmental prescriptions (and implied 'rights') are included in Article 110b of the Constitution. It is further clearly stated in the tone setting White paper 8 (1999-2000) that the intent of the report to Parliament is: "to emphasize the ecological perspective as a foundation for policy formulation in all areas of society" (Lafferty, Larsen and Ruud 2004:35). Secondly, besides a Strategy and an Action Plan to provide the long term stability and targets, a responsible executive body for the overall coordination and enforcement of the process is important. Without clear responsibility, horizontal cross-sectoral plans are endangered species easily overridden and neglected by strong sectoral interests and more "urgent and pressing" political matters.

Vertical Environmental Policy Integration (VEPI) indicates the extent to which a particular governmental sector has taken on board and implemented environmental objectives as central in the portfolio of objectives that the sector continuously pursues (Lafferty and Hovden 2003: 12). In other words, VEPI refers to a "greening" of sectoral policies. It is important to stress that the term "vertical" is used in a functional sense, and not in the sense of vertical constitutional division of powers. VEPI, the vertical axis of EPI as illustrated in Figure 1, signifies administrative responsibility *up and down* within the arena of the specific ministerial sector.

Indicators for VEPI must refer to efforts on how a given governmental ministry aims to integrate environmental concerns into its activities. Lafferty (2004b) propose the following benchmarks:

1. a *scoping report* providing an initial mapping and specification of sectoral activity, which identifies major environmental/ecological impacts associated with key actors and processes – including the government unit itself;

2. a *forum* for structured dialogue and consultation with designated principal stakeholders and citizens;

3. a *sectoral strategy* for change, putting forth the basic principles and goals for the sector;

4. an *action plan* to implement the strategy, with stipulated priorities, targets, timetables, policy instruments and designated responsible actors;

5. a *green budget* for the integration and funding of the action plan;

6. a *monitoring programme* for overseeing the implementation process, its impacts and target results, including specified cycles for monitoring reports and revisions of the sectoral strategy and action plan.

These mechanisms can be viewed as baseline institutional reforms for vertical policy integration. The key initiative is the combination of sectoral strategy and action plan. However, both these elements will be of limited importance if the overall effort fails to properly assess and identify the key environmental challenges for the sector; or if it fails to stipulate realistic targets, benchmarks and measures for objective assessment of implementation results. It is of course possible to pursue sectoral change without the formal structure of strategic plan, but such ad-hoc approaches are often 'fragile' in the daily workings of sectoral departments – where they must compete on an on-going basis

with the dominant interests of more traditional sectoral policymaking (Lafferty, Ruud and Larsen 2004).

3.4 Trade offs between environmental and "other" concerns in the EPI debate

Policy integration can be addressed from a variety of angles. The approach of this thesis is to discuss the political-administrative implications of environmental policy integration. There is for example broad agreement that policy integration facilitates more rational policy making. When bringing together different policy actors, the pool of knowledge grows and chances for identifying win-win solutions, or at least avoiding obvious policy contradictions, increase. This also applies to EPI. EPI, however, can also be advocated from a normative viewpoint, in that the environment needs better protection and that addressing and integrating environmental concerns in sector policy must be promoted[9].

It is generally acknowledged that SD is the "mother concept" of EPI. It is also generally acknowledged that EPI will somehow, somewhere lead to trade offs between policy concerns. It is therefore surprising that the discourse on EPI is relatively sparse on the issue. I have identified three approaches to resolving trade offs between environmental and "other" policy concerns which seems to capture the main positions in the debate: Pareto optimality (Collier 1994), a set of criteria for EPI trade offs (Collier 1994; Lenschow 2002b; SEPA 1999, 2003, cited in Persson 2004) and assigning the environment principled priority if life carrying systems are in danger (Lafferty and Hovden 2003; Lafferty 2004b).

Collier's (1994) book on energy and the environment in the EU is one of the first substantial discussions of EPI. Collier distinguishes EPI from normal policy making by interpreting EPI as "an approach which requires the inclusion of the environment amongst the set of values being considered" (ibid: 35). Collier further states that "Integration obviously requires compromises and trade offs" (ibid: 36). Her solution to solve the problem is ideally to be the achievement of a state equivalent to the economic concept of Pareto optimality. In policy terms this would, according to Collier, "be the point where it was impossible to pursue energy policy without causing further environmental damage" (ibid). She notes, however, that "this state can only be achieved with a full reflection of environmental costs which, as already mentioned is far from simple". In her concluding chapter she sets out a framework for integration where environmental, energy centred and economic concerns are presented as three sides of a triangle. Policy integration is placed in the middle of the triangle, where the three objectives are viewed as balanced (Collier 1994: 254). Lafferty (2004b) notes, based on his definition of EPI, that *"the issue in question here is the extent to which such a presentation describes EPI since the imagery does not convey a sense in which environmental policy objectives are given priority in the process"*. In the end the general problems with trade-offs and ambiguity in policy-making leads Collier to conclude that, as a second-best option (after the concept of Pareto optimality), a set of criteria would be useful for the analysis of EPI (Persson 2004:13).

[9] I will not engage in a debate on ecocentrism vs anthropocentrism here. The point to be made is simply that there might be other reasons than mere rationality for promoting EPI.

Regarding the concept of Pareto optimality, Collier is the first to admit that "practical difficulties such as insufficient knowledge make such a criterion hard to apply in the near future" (Persson 2004). I would argue however, that a second factor is even more crucial: An outcome of a game is Pareto optimal if there is no other outcome that makes every player at least as well off and at least one player strictly better off. That is, a Pareto Optimal outcome cannot be improved upon without hurting at least one player. Although beautiful in logic when all players are reasonably well off at the outset of the game, the principle also justifies maintenance of unequal distribution. The outcome of the game is totally dependent on the outset of the game. If the principle of Pareto optimality for resolving trade-offs is applied to Collier's example of energy and environment it would allow a non-sustainable energy production to be continued if energy production was non-sustainable at the outset of the game. Another point to be made is that individual rationality is not sufficient to guarantee a Pareto optimal outcome, making actual utilization of the principle difficult at the sectoral level. In the famous prisoner's dilemma game for instance, the non-cooperative strategy is dominant for both players, but the outcome of the dominant strategy is not Pareto optimal.

In her book on "Environmental Policy Integration", Lenschow (2002a) explicitly couples EPI to sustainable development:

> Sustainable development' represents an idea able to facilitate political consensus; it offers a story that is attractive to many actors because it provides a conceptual foundation for the pursuit of widely accepted ethical values (intergenerational equity, alleviation of poverty, environmental protection) at seemingly low financial and political costs

and further that: *"EPI represents a first-order operational principle to implement and institutionalize the idea of sustainable development"* (ibid: 6). Lenschow thus leaves a first impression of SD and EPI as one long story of win-win solutions. This is soon to rectified, however, when she states that the EPI principle is likely to gain acceptance on the top level among conceptually working persons, but is likely to face resistance where immediate trade-offs are felt (ibid: 7). Lenschow (2002a) emphasizes the need to consider trade-offs as a critical aspect of the EPI concept, but she does not really discuss how the critical aspect can be solved or addressed, and she keeps arguing that SD is a positive-sum game and that there most often will be win-win solutions to trade offs (ibid: 226-227).

In an article in "Global Environmental Change" she does however get a little closer to the issue (Lenschow 2002b). She states that there are "two ways out" of the dilemma of implementing "the win-win logic" of SD in practice (ibid: 242). The first is that:

> public authorities and individual producers need information and guidance to discover win-win opportunities, i.e. using environmental benchmarks, environmental impact assessments and indicators.

The second "way out" should apply if

> no amount of innovation will outweigh the cost of adaptation for individual producers, consumers or a particular economic sector. In such cases a beneficial situation needs to be constructed, e.g. by correcting economic incentives (eco-taxes etc.).

Of course discussions and negotiations discovering win-win opportunities is a "way out" given that there really is a win-win solution. But Lenschow does not really touch the main issue of the discussion, namely criteria for resolving trade offs between policy concerns when there are *no* win-win solutions. Further, her second "way out" is not really a way out, but a compensation for the loosing party. The description of the compensation,

however, could be interpreted to imply that the environment will "win", but Lenschow does not elaborate further on the issue.

Criteria or evaluative benchmarks for resolving goal conflicts can thus be identified as a second option in the EPI literature for resolving trade offs between environmental and "other" policy concerns. The Swedish Environmental Protection Agency (SEPA) (1999) differentiates between internal and external goal conflicts. Internal goal conflicts are related to conflicts internal to environmental policy goals, while external goal conflicts are related to conflicts between environmental goals and other goals. The SEPA report states that ethics are tested when external goal conflicts occur. Somehow one has to consider which comes first: the welfare of the citizens or the health of nature. SEPA's reasoning is in many ways similar to Collier's and Lenschow's: goal conflicts often occur "in practice" and prioritizing is needed. Criteria for handling and resolving goal conflicts are called for, but they are not specified.

Establishing a set of criteria for handling goal conflicts is a viable option. The approach could very well result in better integration of environmental concerns in non-environmental policy sectors. However, the actual design of the criteria is crucial for the outcome and I am not aware of any attempts by Collier, Lenschow or SEPA to indicate how such criteria could be specified.

Lafferty's (2004b) contribution to the EPI discourse is most clear with regard to sector and environmental objectives. His definition of EPI stand out in the debate on what EPI is really all about. The first part of the definition on what EPI implies: "The incorporation of environmental objectives into all stages of policy making in non-environmental policy sectors, with a specific recognition of this goal as guiding principle for the planning and execution of policy" is similar to the overall understanding of EPI. It focuses on policy coordination, coherence and a good policymaking strategy for environmental policy goals, but, according to Lafferty (ibid), it does not point towards a *distinct* purpose for EPI.

The second part of Lafferty's EPI definition marks the *distinctness* of EPI and states that the coordination part of the definition should be "accompanied by an attempt to aggregate presumed environmental consequences into an overall evaluation of policy, and a commitment to minimize contradictions between environmental and sectoral policies by giving principled priority to the former over the latter". Thus the definition addresses the question of priorities. Lafferty elaborates on the point in two respects. He first refers to the observation that the fundamental premise of all the most influential policy documents from the Brundtland report to more recent "national strategies for sustainable development" is that environmental policy must be moved from the periphery to the centre in regional, national and local decision-making. His other point is that the increasing recognition and acceptance of the fact that Earth faces the prospect of irreversible damage to life support systems requires that at least some environmental concerns demand more than just a balancing or coordination with other policy concerns.

Lafferty illustrates the point by referring to the current priority principle in most Western democracies – the ultimate policy "trump" – economic concerns. Economic concerns play a vital role in all sectors on all levels and in all stages of policy making and implementation. According to Lafferty economic concerns illustrate how the objectives of a given policy sector, in this case represented by the Ministry of Finance, can influence and dominate policymaking in sectors that have no explicit responsibility for the "external" objective.

With regard to environmental concerns a parallel can be drawn to the policy objective of curbing CO_2 emissions: Introducing an environmental principal would imply that every non-environmental sector would have to comply with the overriding norm. There would be clear stipulation of emission targets, monitoring to ensure that all sectors comply with the targets, evaluation procedures to compare actual emissions with the target and external auditing to ensure that the reported numbers were correct. Clearly a situation like this is far away, but according to Lafferty (2004) the "basic notion of EPI is to bring policy making closer to such an ideal typical situation; and it is this expectation that is given specific expression in the second part of the definition".

Lafferty is, however, quick to add that "the 'priority' dimension of the definition should not be seen as some kind of an 'edict' " (2004b: 204). The policy principles must be decided democratically and "the priority aspect of integration should not be taken to mean that environmental objectives must in every case override other societal or economic objectives". And further that this does not imply an "extra-democratic" mandate (Lafferty and Hovden 2003). Political priorities must be agreed upon within overall democratic procedures, but there is considerable room for strengthening the mandate for environmental SD within the policy realm of existing sectoral interests (Lafferty and Hovden 2003; Lafferty 2004b).

Lafferty's position does not exclude a set of guidelines to aid the policymaker and it can, in my opinion, rather be considered as an overarching principle for a set of such guidelines. His position can therefore be regarded as similar to Collier's and Lenschow's, although it is clear that neither Collier nor Lenschow consider environmental concerns as potentially dominant. The introduction of environment as a potential policy "trump" is Lafferty's main value added to the EPI discourse. In conclusion I will argue that if sustainable development is the goal of EPI, the concept of an environmental principal is crucial. Without a principal, EPI is no more than "normal" policy coordination – necessary, but not sufficient for sustainable development.

3.5 Integrating what into what? – A clarification

This thesis is studying the integration of environmental and innovation policies. A crucial and maybe diffuse issue is then: what is being integrated into what? Taking two of the latest EU strategies as example, how can integration of environmental and innovation concerns be depicted? Is the goal to integrate environmental concerns into the ten-year Lisbon strategy[10] to make the EU the world's most dynamic and competitive economy? A kind of integration one could term "environment as opportunity". Or is the goal to integrate innovation concerns into the EU Sustainable Development Strategy[11]? Integration one could term "innovation as eco-efficiency". Or, as a third alternative, is the idea left vague to "accommodate the 'happy' (and often highly illusive) medium of 'win-win': innovation that simultaneously promotes economic competitiveness and sustainable development?" (Lafferty and Ruud 2004).

The actual goal of the integration of environmental and innovation policies can be illustrated in three ways:

[10] Set out by the European Council in Lisbon in March 2000
[11] Adopted at the 2001 Gothenburg European Council

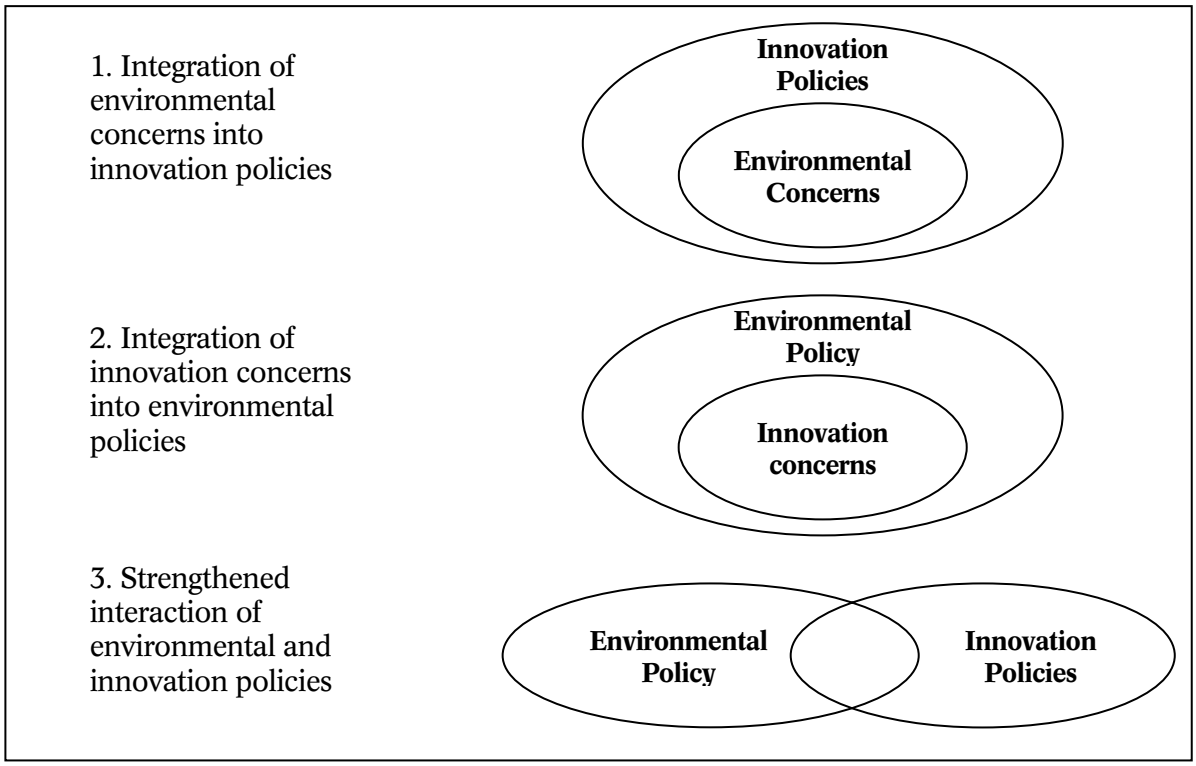

Figure 2: Integration of environmental and innovation policies: Three options

The second research question of this thesis (How and to what extent are Norwegian environmental and innovation policies integrated?), aims at evaluating the third option: strengthened interaction of environmental and innovation policies. It thus studies the degree to which environmental and innovation concerns are integrated and coordinated. This corresponds with Vedung's fourth step of monitoring (1997: 151-152) and will be carried out in chapter 6. To do that I will apply the HEPI/VEPI benchmarks referred to above, but not evaluate the extent to which environmental concerns are considered dominant. I will thus use what can be coined a "thin" version of Lafferty's EPI definition.

The third research question (To what extent do Norwegian innovation policies contribute to sustainable development?), which also corresponds with Vedung's fourth step, is concerned with first option in the figure, namely to determine the degree of integration of environmental concerns *into* innovation policies by applying Lafferty's full, or "thick", definition of EPI. This will be carried out in chapter 7. When discussing the third research question of the thesis I will therefore also consider the extent to which environmental concerns are considered potentially dominant, and the implications such an approach will have for the design of innovation policies.

As announced in the introduction I will now turn to a conceptualization of innovation for SD. After I have presented and discussed the fourfold typology of green innovation I will return to EPI, HEPI and VEPI and green innovation initiatives in Norway.

4 CONCEPTUALIZING INNOVATION FOR SUSTAINABLE DEVELOPMENT

Green technology, environmental technology, clean technology, cleaner technology, sustainable innovation and radical innovations are all terms used to characterize technologies contributing to a more environmentally sound development. Nevertheless, both innovation and SD are still considered as semantically diffuse concepts. This chapter aims at classifying green innovation with respect to the extent SD is promoted. In short, the chapter aims at answering the first research question of the thesis – How can innovation for sustainable development be conceptualized? – by posing the following three interrelated questions: What is an innovation?; What does it take to characterize it as green? and; Are there different shades of green?

4.1 Innovation

Agriculture, the wheel, the alphabet, the ability to navigate the oceans by the stars and sail head on the winds, the printing process, the light bulb and the atomic bomb are just a few of many important innovations in human development. New technology and new ways of organizing society has had and will continue to have decisive impact on our way of living for good and for bad. The innovations mentioned above marks discontinuity in technological trajectories. Still, many smaller happenings, incidents and products have also contributed significantly to the way we lead our lives, but in a more incremental way. What then is an "innovation" and what is a good approach for analyzing innovation in a political science context?

Schumpeter (1939) provides an early and much cited definition of innovation:

> Innovation is the implementation of a technical or organizational novelty ['Neuerung', in German, which is best translated into English by 'innovation'], not just its invention or development. A creative entrepreneur is an entrepreneur who speeds along the process of creative destruction in his search of new fields of activity. There are technical, organisatorial, institutional and social innovations

This definition is very wide and resembles in many ways the quote from the Norwegian Plan for a Comprehensive Innovation Policy referred to in the introduction to this thesis. How then can we get from an "anything new" approach to a more tangible focus?

Innovation can of course occur in any sector of society, also in kindergartens and governments. Within the OECD, innovation has, however, long been treated under a variety of names and as an important feature of economic growth. The second version of the so-called Oslo Manual[12] states that:

> The complexity of the innovation process and the variation in the way it occurs in different types of firms and industries means that clear-cut definitions are not always possible and conventions have to be adopted" (OECD 1996: 31).

[12] The Oslo Manual is published by OECD in cooperation with the European Commission and Eurostat and contains "proposed guidelines for collecting and interpreting technological innovation data". It was first produced in 1992, revised in 1996, and is now in the process of a third revision, to be completed by 2005.

The Manual moves on to give this (not very parsimonious) definition of Technological product and process (TPP) innovations:

> Technological product and process (TPP) innovations comprise implemented technologically new products and processes and significant technological improvements in products and processes. A TPP innovation has been implemented if it has been introduced on the market (product innovation) or used within a production process (process innovation). TPP innovations involve a series of scientific, technological, organisational, financial and commercial activities. (OECD 1996: 31)

The manual further states that the TPP innovations can be broken down between product and process and by the degree of novelty of the change introduced in each case. The manual then moves on to provide good and illustrative explanations and examples of TPP innovations.

Despite the OECD's efforts of conceptual clarification of innovation it is safe to say that there currently exist considerable confusion and disagreement as to what "innovation" is all about. Given that this thesis will not measure or evaluate *outcome*, I will leave the definition from the Oslo Manual as it is and present two definitions that are more easily accessible. Charles Edquist (1997: 1) defines innovations as:

> new creations of economic significance. They may be brand new but are more often new combinations of existing elements. Innovations may be of various kinds (e.g. technological and organizational).

In Lafferty and Ruud (2004: 20) the notion of innovation

> refers primarily to change that enhances competitive advantage within and among European firms. Such advantage can be measured in terms of increased market shares, gross earnings, profit margins, number of patents, etc.

Thus, both Edquist and Lafferty and Ruud clearly relate innovation to economic matters, but they do not give an indication as to "how new" it has to be to be termed an innovation.

Based on the above contributions I will for the purpose of this thesis understand innovation as a new or significantly improved product, service or process that enhances competitive advantage among firms. 'New' implies that technological characteristics or intended uses differ significantly from those it may replace. 'Significantly improved' implies an enhancement or upgrade that has major competitive effect on the firms involved.

The emergent discourse on innovation has clearly led to an understanding that innovation has to do with economic improvement and that the core purpose of innovation, at least in the EU-OECD context, has to do with enhancement of economic growth in general and "economic competitiveness in particular". It seems, to quote Lafferty and Ruud (2004: 20), that "the idea of innovation itself has gradually become a free-floating 'good'; with anything that appears to hinder innovation being seen as a free-floating 'bad'." The discourse on innovation is to a large extent based on the model of economic growth and the notions of "progress" and "development" without (or with very little) concern about the impacts on the carrying capacity of Earth. Economic growth is for sure a very important part of SD, but to be sustainable the "direction" of the growth is crucial.

4.2 Sustainable development and the role of science and technology

In the introduction to the thesis I limited the scope of the study to the possible innovation policy responses to the environmental pillar of SD. In this section I will elaborate further on the second "key concept" of the core definition of SD namely "The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs" (WCED 1987: 43) *and* give an introduction to the role science and technology is assigned in the Brundtland report.

SD implies a trade off between a social, economic and ecological dimension. The main purpose of SD is (1) the social dimension: that the "essential needs" of the poor are satisfied for both present and future generations. But SD also implies (2) that policies are designed to achieve stable economic performance to make sure that the essential needs of the poor are satisfied, i.e. economic growth. (3) This must, however, not be pursued by damaging the long term functionality of life-supporting systems, i.e. the environmental ecological dimension. The principles and criteria of (3) thus constitute a limit for achieving (1) and (2) and also constitute a "proviso" for making judicious decisions on (1) and (2) (WCED 1987; Lafferty and Langhelle 1999). It is in this context I will try to conceptualize green innovation.

The idea of a limitation imposed by the state of technology and social organization does inherently imply that technology and social organization might also contribute to SD, if it is "better", in a normative sense, than the existing. At least two citations clarify the "second key concept" – economic growth – in the definition of SD I mentioned above:

> The concept of sustainable development does imply limits – not absolute limits but limits imposed by the present state of technology and social organization on environmental resources and by the ability of the biosphere to absorb the effects of human activities. But technology and social organization can be managed to make way for a new era of economic growth. (WCED 1987: 8)

> Growth has set no limits in terms of population or resource use beyond which lies ecological disaster. Different limits hold for the use of energy, material, water, and land. Many of these will manifest themselves in the form of rising costs and diminishing returns, rather than in the form of any sudden loss of a resource base. The accumulation of knowledge and the development of technology can enhance the carrying capacity of the resource base. But ultimate limits there are, and sustainability requires that long before these are reached, the world must ensure equitable access to the constrained resource and reorient technological efforts to relieve the pressure. (WCED 1987: 45)

The term "innovation" is not found many places in the Brundtland report, not very surprising as the term was not in widespread use in the 1980s. In the two quotes above, however, the role science and technology is assigned is very similar to the role innovation is assigned today. I therefore presuppose that innovation is covered by the role science and technology is given in the Brundtland report.

4.3 Decoupling – an OECD approach

The interaction between economic growth and the environment that supports it lies at the heart of SD. Economic growth contributes to higher levels of human well-being and is crucial to support the needs of the increasing global population. Economic growth also provides resources to address environmental challenges. Nevertheless, economic growth of today leads to degradation of the environment and damages on life-supporting systems. Maintaining functioning ecosystems that can support economic and social development is crucial for development to last. Consumption patterns in OECD countries are imposing a

large burden on the global environment. The OECD has introduced the term *decoupling* to refer to breaking the link between "environmental bads" and "economic goods". Decoupling is identified as a "key challenge" of SD and also signifies that necessary environmental protective measures should be pursued regardless of economic growth patterns and business cycles (OECD 2001).

Decoupling must necessarily be expressed in terms of changes over time. Decoupling occurs when the growth of a relevant environmental variable is less than of its economic driving force, e.g. GDP, over a given period. An important distinction between absolute and relative decupling is also made: If GDP displays positive growth, *absolute decoupling* occurs when the growth of the relevant environmental variable is neutral or negative. That means that the pressure on the relevant environmental variable is either stable or falling. *Relative decoupling* occurs when the growth of the environmental variable is positive, but grows at a slower rate than GDP (OECD 2002a).

Decoupling, then, is very much related to *protection* of the natural resources and maintaining *status quo*. To highlight the challenge of integrating both SD and innovation, Lafferty (2004c) and Lafferty and Ruud (2004) have referred to the notion of "recoupling". They take as point of departure that recoupling is a logical instrumental necessity for decoupling. If a relationship between economic growth and environmental degradation is decoupled it is only reasonable to expect that it somehow must be re-joined to ensure further economic growth, but without environmental degradation. The decoupling of *non*-sustainable development thus necessarily implies a recoupling *for* sustainable development (ibid). Environmental protective measures must be promoted in a way that triggers modified and even new value added-activities and economic growth patterns. This can be achieved through incremental changes of existing patterns of consumption and production, but can also involve a need for more radical discontinuous change[13]. Moving from a decoupling orientation towards recoupling for SD requires highly creative architectural innovations in both technical and non-technical governance systems (Lafferty, Ruud and Larsen 2004).

The content of economic growth in production and consumption must be altered in such a way that it is recoupled with environmental concerns and imperatives. This implies (for example) technical efforts in the field of dematerialization and decarbonization. Services can increasingly be substituted for the production of certain material goods, and renewable energy sources can be a substitute for fossil fuels. Such efforts must, however, be actively pursued and supported by appropriate governing structures, and it is within this "policy space" that the relationship between innovation and SD concerns becomes crucial. Within the normative-functional framework of SD, innovation must be green – and greening must be innovative (Lafferty, Ruud and Larsen 2004).

[13] The distinction between incremental and radical innovations is usually attributed to Freeman and Perez (1988) and the following definitions: *Incremental innovations* appear continuously, to varying degrees in different industries, and originate either in the production process itself or as response to initiative from users. A single incremental innovation has no dramatic effects, even though the combined effect of incremental innovations may be very important, for instance regarding growth in productivity. *Radical innovations* appear discontinuously, mainly as the result of research and development (R&D), and create a higher degree of change, for instance in the growth of new markets or waves of new investments. Radical innovations often involve a combination of innovations in product, process and organization.

4.4 Eco-efficiency – the WBCSD approach

Business clearly has a responsibility for sustainable development. World Business Council for Sustainable Development (WBCSD) is one of the most central business interest organizations working for a more sustainable production and consumption. It was established in 1991 (prior to the Rio Summit) and consists of CEOs from 175 of the world's biggest companies. In addition, 45 regional councils comprise thousands of companies in most corners of the world.

The WBCSD took the concept of eco-efficiency as point of departure when they started their work on SD in 1991. The concept is framed within the same reasoning as the decoupling debate and was launched worldwide in the book "Changing Course" by Stephan Schmideiny (1992). Eco-efficiency has since a WBCSD workshop in Basel in 1993 been defined as:

> being achieved by the delivery of completely comprised goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle, to a level at least in line with the Earth's estimated carrying capacity.

In short it can be summed up to "creating more goods and services with ever less use of resources, waste and pollution" (WBCSD 2000a).

The concept has been widely adopted by the business community and is to a large extent business' operationalization of the economic and ecological pillar of SD.

According to WBCSD (2000a) Eco-efficiency says that becoming more efficient makes good business sense. The notion of "eco" has a twofold meaning: it addresses both economic and ecological aspects of business and applies to the full life cycle of a product. Eco-efficiency is concerned with three broad objectives. *First*, it calls for reducing the consumption of resources, which implies minimizing use of energy, materials, water and land and also enhance recyclability and durability and closing of material loops. *Second*, it includes reducing the impact on nature. This implies minimizing emissions to air and water, waste and the dispersion of toxic substances and fostering sustainable use of renewable resources. The *third* objective is related to "increasing product or service value". A bit harder to grasp than the two first objectives, this is about "providing more benefits to the customers through product functionability, flexibility and modularity, providing additional services and focusing on selling the functional needs that customers actually want". Thus it has something to do with re-designing existing products or designing new products that will satisfy the same needs, but with fewer materials, less resources and less negative impact on the environment.

Incorporating environmental concerns into the ongoing activities of business surely make a difference and eco-efficiency has certainly contributed to environmental improvements in many products and processes. Critics argue, however, that eco-efficiency is necessary but not sufficient to achieve SD and highlights the need for Eco-effectiveness (Ruud 2004). Eco-effectiveness is understood as the

> cumulated total environmental impacts generated by the firms aiming to promote eco-efficiency. Consequently eco-effectiveness refers to the functional absolute impacts of relative eco-efficiency gains, reflecting the total sum of corporate environmental and economic efforts, and taking into account ecological thresholds and the carrying capacity of the Earth (ibid: 222).

Thus, where eco-efficiency stresses relative environmental improvement, eco-effectiveness stresses absolute environmental improvement in the whole value chain. Further, Ruud argues that rebound effects[14] and ecological thresholds must also be taken into account.

4.5 How can innovation for sustainable development be conzeptualized?

Although WBCSD considers eco-efficiency as the business response to SD and further argues that incorporation of eco-efficiency in all stages of the product life cycle may lead to innovation, the organization states that it also believes that the promoters of eco-effectiveness are right to focus on going beyond improving existing processes (WBCSD 2000b). Based on the above discussion I will take as point of departure that eco-efficiency mainly promote relative improvements in existing products and production and at best incremental innovation on a micro, that is, product or process (technical) level. Eco-effectiveness on the contrary, is oriented towards accumulated environmental impacts and stresses more radical innovation. It thus focuses on the macro (functional) level and avoiding rebound effects, which is related to systems change and change in consumer preferences. The distinction between the two is not an either-or approach, but it is useful for distinguishing efforts for relative environmental improvements in products and processes from more absolute improvements in a quest for innovation for SD.

A crucial premise for the logic of this thesis is that innovation is needed to realize SD. Given the variety of approaches to what I with a collective term call "green innovation", I will suggest a four-field typology based on a cross-tabulation of the decoupling/recoupling and eco-efficiency/eco-effectiveness distinctions elaborated upon above. The major difference between decoupling and recoupling is that the former is related to environmental protection while the latter is related to *sustainable* growth. The major difference between eco-efficiency and eco-effectiveness is that the former is characterized by isolated and relative ecological improvement and the latter is related to aggregated, overall ecological improvement. Several alternative cross-tabulations could of course have been made. I feel, however, that a cross tabulation of the WBCSD and OECD approaches offers a fairly simple and easy accessible typology that is sufficient for the task in question: to answer the first research question and talk more systematically about what green innovation for SD really implies.

Table 1: Fourfold typology of green innovation.

	Technical Micro **Eco-efficiency**	Functional Macro **Eco-effectiveness**
Decoupling (Protection)	(1) Environmental innovation	(2) Ecological communalism
Recoupling (Sustainable growth)	(3) Ecological modernization	(4) Innovation for sustainable development

[14] Rebound effects are defined by Grepperud and Rasmussen (2004) as *"economic forces (demand side effects) that over time weaken the potential (technical) savings associated with efficiency improvements"*.

The four types of green innovation that emerge from the table will in the following be presented and given more detailed descriptions.

4.5.1 Environmental innovation

The upper left corner of the table encompasses what has traditionally been termed environmental technology and end-of-pipe solutions. The outcome characterizes innovations that are eco-efficient. They aim at reducing resource use and/or environmental impact and so forth from a product or process. They also contribute to decoupling by breaking the link between environmental pressure and economic growth, but they are not aiming at recoupling these pressures by finding new more sustainable ways of production and consumption, thereby contributing to sustainable growth. This is the "traditional" and the most common way of perceiving green innovation. It is also the "easiest" mode to achieve given that it does not pose high qualitative demands on the innovation: as long as it is more environmentally sound than the existing alternative it can normally be fitted into this mode.

The EU Environmental Technologies Action Plan (ETAP) definition of environmental technology is a relevant example for innovations in this corner of Table 1. In the introduction to the ETAP it is stated that

> Environmental technologies – taken in this Action Plan to include all technologies whose use is less environmentally harmful than relevant alternatives – are key to this [create synergies between environmental protection and economic growth]. They encompass technologies and processes to manage pollution (e.g. air pollution control, waste management), less polluting and less resource intensive products and services and ways to manage resources more efficiently (e.g. water supply, energy-saving technologies) (EU Commission 2004a: 2).

This very broad definition of environmental technology is fruitful in that it does not discriminate technologies and turns every choice of technology into a choice of more or less environmentally friendly technology. The definition is thus applicable to all sectors. However, the definition is not very ambitious and it seems to assume that achieving eco-efficiency is equivalent to achieving eco-effectiveness.

The same approach to green innovation is also evident in the Green Technology Foresight, one of eight technology foresights carried out by the Danish Ministry of Science, Technology and Innovation (MoSTI):

> … 'green technology' or 'environmental technology' … is a wide concept that covers cleansing technologies, cleaner technologies and eco-efficient technological systems. In practice it is difficult to make distinctions between environmental technology and new technology, because new technology often implies improved eco-efficiency (MoSTI 2003: 12 [Author's translation]).

The last part of the citation illustrates another characteristic by this mode of green innovation, namely that many innovations are motivated by product/process improvements rather than ecological improvement, but they can still have significant eco-efficient attributes.

4.5.2 Ecological communalism

Innovations in this mode are mainly non-growth focused. Nevertheless, whereas the environmental innovation (upper left corner) has a relatively narrow reference, innovators in the Ecological communalism mode also focus on the aggregate effects of the innovation

on production and consumption. They focus and reflect on actual impacts within a broader framework of eco-systems, the carrying capacity of Earth and potential rebound effects. This mode is frequently advocated by parts of the environmentalist movement, posing that economic growth is not environmentally friendly, and the degrowth-movement[15], posing that growth and development will lead to increase the divide between north and south and to a further degradation of the environment. Thus, the proponents of ecological communalism have an idea of self-sustained communities, lower growth and lower level of consumption. The endpoint for the "eco-communalists" is not capitalism as we know it today, but a society based on an economy "as if people mattered" (Schumacher 1973). Innovation (the way I have defined it) in this mode is therefore counter intuitive to a liberal market economy logic focusing on maximizing profit and growth. It is hard to find actual examples of innovations in the mode, but they could e.g. be related to locally produced energy or ecological and "short circuit" food (the argument being that transport of foodstuffs is energy intensive and causes negative environmental effects). A point to be made for later reference is that the proponents of ecological communalism consider self sustained communities and low or non-growth as the right way to achieve a sustainable society.

4.5.3 Ecological modernization

Innovation in the lower left corner of Table 1 is easier to conceptualize in an innovation context. It can be characterized as compatible with the modern environmental policy paradigm of Ecological modernization. Ecological modernization theory provides us with some understanding of how the ecological question transforms the modernization process. According to Mol (1996) modern science and technology are central institutions for ecological reform in ecological modernization theory. Importance is given to economic market dynamics in ecological reform, and to the role of innovators, entrepreneurs and other economic agents as social carriers of ecological restructuring (in addition to state agencies and new social movements). Mol states that "Economic development and ecological quality are interdependent but not antipodal or incompatible in a simple monocausal way, as we asserted in the 1970s" (Mol 1996: 313-314). The well known "green and competitive hypothesis" of Porter and van der Linde (1995) is one example of this view at a company level. Win-win solutions and green growth is promoted, but the innovations are "only" eco-efficient: They do not necessarily take aggregate environmental impacts or potential re-bound effects into consideration.

4.5.4 Innovation for sustainable development

Innovations in the bottom right corner of Table 1 are characterized by a major emphasis on achieving overall eco-effectiveness in a global context. Following the line of reasoning from ecological modernisation, the main difference is that environmental concerns are assigned "principled priority" if life carrying systems are threatened. Potential re-bound effects are taken into account – and avoided – and extended producer responsibility may be applied. It is indeed demanding, but reflects the challenge of promoting SD. Examples of sustainable innovation can e.g. be found in the renewable energy sector. Most relevant

[15] See for example Serge Latouche in Le Monde Diplomatique November 2004.

and viable at the moment are wind and solar energy. For example, the so-called "energy pay back time" of conventional solar panels based on multicrystalline wafers is estimated to be 2 years in (the most sunny) parts of the world. Energy pay back time is an expression of how much time it takes for the solar panel to generate the energy required to produce it. When that amount of energy is generated, or "paid back", the substantial surplus amount of energy will be sustainable for the rest of the life time of the panel, probably about 30-40 years. A society fully based on new renewable energy would be capable of accommodating economic growth energy-wise without compromising the carrying capacity of Earth. It thus corresponds with both the sustainable growth (recoupling) and the Eco-effectiveness (functional) axis in Table 1.

4.6 Concluding remarks

The four-fold typology of green innovation is based on a cross tabulation of decoupling/recoupling on an overall systems level and eco-efficiency/eco-effectiveness on the product or process (outcome) level. The logic of the cross-tabulation allows for a more nuanced view of the different shades of green innovation. It captures two significant aspects of innovation in a governance for SD context. First, the vertical axis signifies that there exists an implied, but not adequately expressed, presumption that decoupling involves recoupling. It is important to explain the implications of not only disconnecting drivers from pressures on natural resources and eco-systems, but also of finding ways (or not) of surplus-generating development. The importance of such a distinction is particularly clear with respect to the EU Environmental Technologies Action Plan (ETAP), where it is often assumed that end-of-pipe initiatives require no compensatory sustainable growth-maintaining initiatives.

The horizontal axis, differentiating between eco-efficiency and eco-effectiveness, is equally important in illuminating the different eco-performance of actual innovations. Are they merely environmentally sound on a (technical) micro level, or do they actually contribute to an overall (functional) improvement of the state of the environment? The differentiation is important for the innovators, but also for the designers of innovation policy instruments and e.g. for criteria determining who should be eligible for grants from different national innovation schemes.

Instead of viewing any kind of innovation as potentially positive for value-creating competition, the typology points out that innovation can serve other ends than increased economic growth through increased market/profit shares. Innovations in the mode of "environmental innovation" referred to in Table 1 (p. 44), can contribute significantly to decoupling, without being commercially competitive. Innovation can also contribute to apparent "ecological modernization", without contributing to SD (due to reduced eco-effectiveness and "rebound effects"); and innovation can contribute to "ecological communalism" by developing life-styles, learning mechanisms and organizational forms that seem to point backwards rather than forwards in terms of economic growth and development.

Ecological communalism and ecological modernization are perceived by various stakeholders as the most "progressive" solutions in the promotion of SD. Apparently there are different approaches and perspectives in how to integrate environmental concerns and innovation. Some are primarily emphasizing the actual goal of integration as related to

recoupling economic patterns in more eco-efficient ways, while other are more concerned with substantive norms and limitation of growth patterns. The variety of perspectives is important for assessing the overall costs and benefits of innovation in a much broader normative context.

5 INTEGRATION OF ENVIRONMENTAL AND INNOVATION POLICIES IN NORWAY – EMPIRICAL BACKGROUND[16]

This chapter aims at providing the empirical background for the second research question of the thesis, namely 'How and to what extent are Norwegian environmental and innovation policies integrated?' To do this I will use the benchmarks proposed by Lafferty (2004b) on the horizontal and vertical dimension of EPI when discussing the question. The chapter thus corresponds to Vedung's third step of monitoring. It is appropriate to stress that the approach taken here is related to governance for SD. The data is not a presentation of all green innovation initiatives in Norway or of actual outcomes of policy, but an overview of policy efforts – process and output – in the interface between innovation and the environment. The ministries studied are the Ministry of Trade and Industry (MoTI), the Ministry of Petroleum and Energy (MoPE) and the Ministry of Environment (MoE). As illustrated in Figure 3, the horizontal and vertical dimensions of EPI are used to organize the data collected.

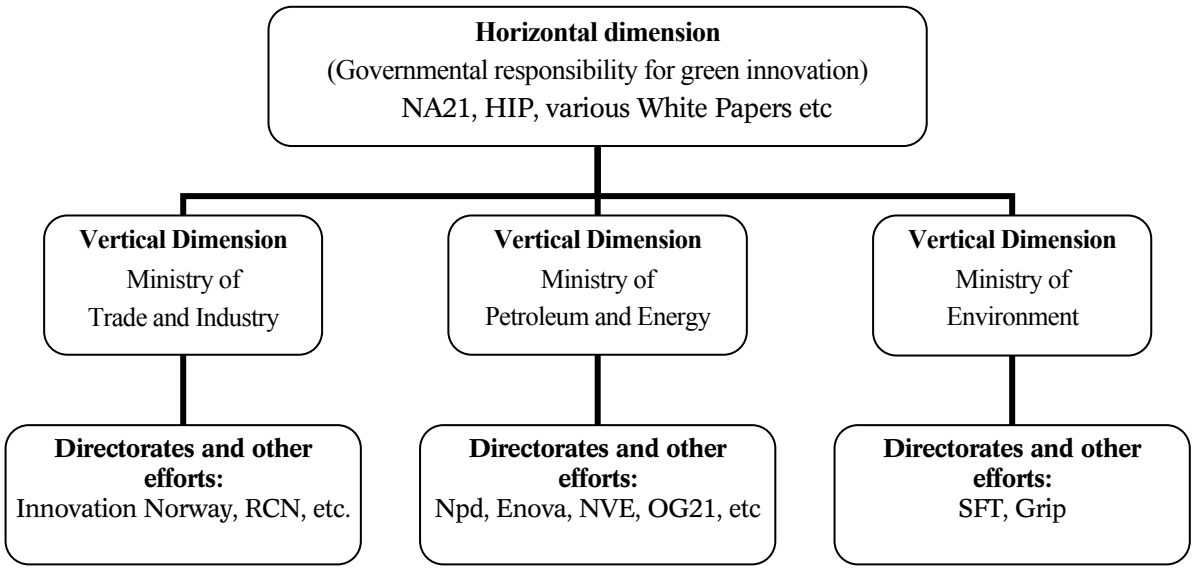

Figure 3: Organization of the data in accordance with the HEPI/VEPI framework (see Figure 1, p. 31).

The outline of the chapter is as follows: First I will give a brief introduction to Norwegian environmental politics. This is necessary to understand environmental policy formulation and implementation in Norway. The second section of the chapter will then elaborate on the overall governmental responsibility for green innovation, referred to as horizontal environmental policy integration (HEPI) in chapter 3. I will study White Papers in which

[16] Much of the data in this chapter is based on work I did as a research assistant for ProSus' contribution to the MONIT-project. A more thorough presentation of MoE's and MoTI's efforts on green innovation is given in Ruud and Larsen (2004). The data on MoPE's efforts, however, is collected and written for this thesis only.

references to green innovation could be found. First I review the National Strategy and the Action Plan for sustainable development, then I review innovation policy documents, especially the comprehensive innovation policy plan (HIP), third I review innovation related documents from the MoPE and finally relevant documents from the MoE. In the third section of the chapter I will turn to the vertical dimension and study the efforts of MoTI, MoPE and MoE to promote green innovation within their respective sectors, referred to as vertical environmental policy integration (VEPI) in chapter 3. Explicit references are made to the ministries Sectoral Environmental Action Plans, their environmental profiles in the State Budget, their respective directorates and other sectoral activities. I will again stress that only initiatives that are relevant in a green innovation context are included. Some of the initiatives have innovation as their primary concern, but most don't. Furthermore, as my evaluation is concerned with governmental interventions the collection of data does not include the private sector.

5.1 A brief introduction to Norwegian environmental politics

In White Paper 46 (1988-89) the Government proposed to the Parliament efforts to follow up the requests made by the WCED in the Brundtland report. The government identified three strategies to make industry more environmentally friendly: (1) changing product technologies; (2) changing production technologies; and (3) strengthening pollution control. The White Paper refers to strengthening pollution control as the most common strategy to combat hazardous industrial discharges into the air and water, but points out that a focus on end-of-pipe solutions does not eliminate the sources of pollution. Consequently, the White Paper concludes that changes in product and production technologies which alter consumption and production structures will also be necessary if industry is to contribute to SD (ibid:102).

Eight years later, in White Paper 58 (1996-97), the government proposed a revised "Environmental Politics for a Sustainable Development". With White Paper 58 Norwegian environmental politics took a new direction that may be described as "ecological modernization" (Reitan 2001). This can be illustrated in three ways:

First, Norwegian environmental politics took a new direction in terms of *policy principles*. While previous policies focused on specific environmental problems and on conservation or protection of specific natural resources, the new focus was more systemic with respect to ecosystems and broader solutions. In White Paper 58, two important principles were introduced as premises for Norwegian environmental policy making: the idea of nature's carrying capacity and the precautionary principle. The idea of *nature's carrying capacity* – of *thresholds* or *critical levels* in relation to ecosystems – is directly related to sustainability. Given the complex and interrelated nature of ecosystems, the *precautionary principle* is introduced to address situations of scientific uncertainty in the policy-making process. The precautionary principle implies that, faced with a risk of serious or irreversible environmental damage, lack of scientific certainty neither justifies environmental destruction nor allows postponement of policies to protect nature (Lafferty and Langhelle 1999).

Second, with White Paper 58 the traditional focus on nature conservation through administrative/judicial instruments was firmly expanded and *new policy instruments* were introduced, in particular economic instruments. *Cost efficiency* became a guiding principle

in environmental politics. The attempt to introduce a green tax system is a key example of Norwegian experiments with economic instruments in environmental policy (Ruud 2002).

Third, White Paper 58 signaled a shift to a *sector-encompassing* approach. SD issues were to be integrated in all aspects of societal planning and sectoral policy (Langhelle 2000; Hovden and Torjussen 2002).

However, already with White Paper 46 (1988-89) the principle of *sector responsibility* was introduced. The principle implies that most of the political responsibility for following up general programmes is left to the ministries and directorates of each sector. The principle was further elaborated and formally acknowledged in White Paper 58 (1996-97) and it has been followed up in the three bi-annual white papers on "The Government's Environmental Policy and the State of the Environment" (White Paper 8 (1998-99); White Paper 24 (2000-2001); and White Paper 25 (2002-2003)).

Norwegian environmental policy is, as of 2005, based on the sector-encompassing approach in combination with the principle of sectoral responsibility. This does in many ways mirror the methodological approach taken in this thesis: the sector-encompassing approach resembles HEPI and the principle of sectoral responsibility resembles VEPI. The stage is thus set for exploring the horizontal and vertical axis of environmental policy integration and innovation policies.

5.2 Environmental and innovation policy integration: the horizontal dimension

In Lafferty's EPI framework Horizontal Environmental Policy Integration (HEPI) refers to whether a central authority has developed a comprehensive *cross-sectoral* strategy for EPI. As this thesis is concerned with green innovation policy efforts I will study if there are cross-sectoral strategies for green innovation in place. The central authority could be the government itself, or a particular body or commission entrusted with an overarching responsibility for green innovation.

With horizontal initiatives I understand policy documents or efforts especially aimed at coordinating policies across the sectoral domains. With regard to SD and environmental issues there are for instance issued both a national strategy and an action plan for SD. With regard to innovation policies a "Comprehensive Innovation Policy Plan" is developed. MoPE frequently issue white papers on both the petroleum and energy policy. These can, however, not necessarily be regarded as cross-sectoral, but to follow the logic applied to MoE and MoTI and given that, as we will see, the petroleum and energy sector is extremely important for the national economy, I have decided to include them in this chapter on horizontal initiatives.

5.2.1 The National Strategy and Action Plan for Sustainable Development

The existence of a long term national strategy for sustainable development is the second benchmark on the proposed checklist for horizontal environmental policy integration (HEPI) by Lafferty (2004b). In 2002 Norway adopted a "National Strategy for Sustainable Development". The strategy was hastily prepared by the Ministry of Foreign Affairs (MoFA) for the World Summit on Sustainable Development (WSSD) in Johannesburg.

The strategy mentions innovation a couple of times but never systematically. However, a relevant example for this thesis is the following quote:

> The national authorities will have to take account of sustainability considerations in all sectors that they administer directly, and set framework conditions that will motivate others to take account of the same factors, for instance in the form of economic instruments (taxes, market-based emissions trading systems, removal of subsidies that are environmentally harmful, incentives for technological innovation) and administrative instruments ("green public administration", strategic environmental impact assessment, ecolabelling, conditions for and agreements with the industrial sector, legislation, information and research). The central government authorities will coordinate national policy and issue clear, coherent signals to ensure that the aggregate effect of the individual measures serves to promote sustainable development. (MoFA 2002: 43)

The Government thus commits itself to take account of sustainability considerations in all sectors – policy integration – and provide incentives for technological innovation. The incentives are not specified, but increased research seems to be part of the solution. In section 4.2 on Policy instruments for Long-term action under the heading "new knowledge" it is stated that "Innovation must be stimulated through a greater research and development effort and more testing of new technologies", and further that:

> Norway will play an active role in developing environmentally friendlier technology through research. This may apply to the production of goods and also to the improved provision of services. Areas of particular interest include the environmentally sound use of natural gas, gas-fired power plants with CO_2-reduction technology, and more efficient energy technology for buildings, the marine sector, medicine, etc (MoFA 2002: 35).

Considering the signals in the strategy one would expect that its follow up, an action plan, would specify the commitments to development of environmentally friendlier technology and specify some incentives for technological innovation.

The third HEPI benchmark is an action plan for sustainable development. The Norwegian government issued a National Action Plan for Sustainable Development (NA21) in autumn 2003, but its influence on green innovation is uncertain. NA21 has been criticized for being even less concrete than already published policy documents (ProSus 2003). NA21 is written by the Ministry of Finance, not by the Ministry of Environment, Ministry of Foreign Affairs (also responsible for International Development) or the Prime Ministers Office. The Prime Ministers Office is relatively small and thus many "sector-encompassing" tasks in Norway, like a strategy for SD, are assigned to the Ministry of Finance, the ministry "on top of the sectoral pyramid".

Development of environmental technologies is mentioned several times in NA21. However, it makes mention of only one specific instrument: to strengthen the basic research through the fund for research and innovation (White Paper 1 (2003-2004): 195). The fund has contributed to research on environmental issues, but to be eligible for grants, research projects do not *necessarily* have to deal with either the environment or innovation. It cannot be perceived as an instrument for achieving innovation or environmental policy goals per se.

Two more references to innovation are made in NA21. One is related to policy instruments for SD (White Paper 1 (2003-2004): Ch 6.4.2). Under the section concerning Research and Development, increased use of "environmentally sound technology" is mentioned as decisive to reducing the negative environmental impact(s) of economic development. Economic instruments (unspecified) are highlighted as having the potential to give strong incentives to the development and commercialization of green technology. The other reference to innovation in NA21 is in section 6.6.1 and regards the role of

business and industry in sustainable production. NA21 states that the capacity of business and industry to innovate towards more sustainable production processes, and their willingness to assume social responsibility are decisive for achieving political goals. Business and industry is urged to increase the use of environmental management systems and to strengthen the focus on developing environmentally sound technology, eco-design, environmentally friendly products and industrial ecology. Thus the somewhat reactive and passive position that the government has taken towards business and industry since the release of White Paper 58 in 1996, has not been challenged with the release of NA21.

NA21 also refer to the "Government's Plan for a Comprehensive Innovation Policy" (HIP). It is stated that the HIP (presented by MoTI a few weeks after Ministry of Finance presented NA21) will be consistent with the NA21 (White Paper 1 (2003-2004): Ch 6.5.6). Was this actually followed up? I now turn to documents related to innovation policy which have been published by MoTI, "the Ministry of Innovation".

5.2.2 MoTI: Innovation policy and environment

The separate notion of innovation policies is relatively new in Norway. It is the Ministry of Trade and Industry (MoTI) which is responsible for the innovation policy. So far MoTI has only published two policy documents especially dedicated to innovation policy. In this section I will describe references to green innovation in the two documents: First Parliamentary Bill 51 (2002-2003) on the establishing of a new state innovation agency; "Innovation Norway"; second "the Government's Plan for a Comprehensive Innovation Policy" (HIP) (MoTI 2003).

Parliamentary Bill 51 (2002-2003) "Policy instruments for an innovative and creative business and industry"

In the introduction to Parliamentary Bill 51 (2002-2003), SD is referred to as one of four main goals in the government's economic policy. The other three goals are full employment, development of the welfare state and fair income distribution (Parliamentary Bill 51 (2002-2003): 5). The principal proposal in the bill is the establishment of "Innovation Norway"[17], a new public entity aimed at promoting increased innovation in firms all over the country. I will give a detailed presentation of Innovation Norway in section 5.3.1.

According to the Bill the main goal of the innovation policy is *to contribute to increased innovation in business and industry in all parts of the country*. This implies that regional policy also will focus on innovation. With the exception of the introduction, SD is not mentioned in the parliamentary bill and there are few references to environmental matters, except for brief case studies of "success" companies presented in text boxes. Three of the five "success" companies have a major environmental component in their business activities[18] (ibid: 20, 36 and 43). Such a component is not, however, highlighted or called for by MoTI in the parliamentary bill. It is interesting to note that a parliamentary bill on the establishment of a new big state "directorate" for innovation hardly mention

[17] Innovation Norway is a merger of four previously independent public entities: The Norwegian Tourist Board, The Norwegian Trade Council, The Norwegian Industrial and Development Fund (SND) and the Government Consultative Office for Inventors (SVO).
[18] Repant AS, ScanWafer AS and Energos ASA.

environmental issues and totally leaves out green innovation. Is this an indication that environmental issues are not considered important in innovation policies?

From Idea to Value – the Government's Plan for a Comprehensive Innovation Policy
The official status of the "Government's Plan for a Comprehensive Innovation Policy (HIP), launched in October 2003, is "plan", a type of document without administrative status. It will therefore not be given further political democratic treatment, nor will it necessarily be followed up or assessed. The government's ambitious vision for its innovation policy is that "Norway is to be one of the most innovative countries in the world". The Government has with the plan "embarked on the development of a comprehensive innovation policy", a "long term and wide-ranging task" and "the first steps of a long journey" (MoTI 2003: 5). The plan "will contribute to a more coordinated and targeted effort, across various policy and administrative areas" (ibid: 5).

The plan is signed by the Ministers of Local Government and Regional Development, Education and Research, Agriculture, Petroleum and Energy and Trade and Industry. The Minister of Environment, however, has not signed the plan. According to a MoTI representative[19], the MoE has been aware of the process from its start when it was discussed in the government and the government's Research Committee. However, it was not "considered necessary" that MoE participated. Further, it has not been a goal in itself to highlight certain issues or sectors in the plan. MoE has, however, had representatives on some of the interdepartmental committees working on the plan and has therefore had an opportunity to influence the process and the document.

Environmental matters have clearly not been important and are only mentioned a few places. The following is one example: "there are numerous examples of stricter international environmental requirements promoting innovation within businesses that have to adapt to a changed regulatory framework" (MoTI 2003: 10). Besides this rather reactive reference, environment is mentioned briefly in relation to the EU Lisbon Strategy and the development of an "efficient, safe and environmentally friendly transport system" in Norway. In conclusion, environment is mentioned very briefly a few places, green innovations are not discussed and SD is not mentioned at all. The HIP leaves us with the impression that the carrying capacity of Earth is unlimited and that there are no limits to growth.

5.2.3 MoPE: Petroleum and energy policy and the role of green innovation

Norway is the world's third largest exporter of oil (after Saudi Arabia and Russia) it is the leading energy supplier to Europe (EIA 2002: 188) and accounts for about 9 per cent of Europe's total natural gas supply. The petroleum sector is extremely important for Norwegian national economy. In 2003 crude oil and natural gas accounted for 45,9 per cent of Norwegian total exports and 18,8 per cent of GDP (MoPE 2004a). Domestically, Norway has historically almost exclusively relied on hydroelectric power for its electricity needs, with the result that total electrical generation has been more than sufficient to meet its needs most of the time; however, power must be imported in drier years. Total

[19] Telephone interview March 16, 2004.

electricity consumption has been steadily increasing over the past decade, and Norway now has one of the highest per-capita consumptions of electricity in the world.

The Petroleum and Energy sector is, in addition to the economic importance, of great environmental and technological importance due to the substantial greenhouse gas emissions and the fact that all petroleum activities are situated offshore in some of the richest fisheries in Europe. Hence, MoPE is also important in a green innovation perspective because innovation is at the core of the offshore activities and the environmental demands on the technology are strong.

White Paper 38 (2003-2004): "On the Petroleum Activity"

Every two years MoPE publishes a white paper on the petroleum activities in Norway. White Paper 38 (2003-2004) is the latest in the series. The white paper gives a brief overview of the status for Norwegian petroleum activities before it, over more than 50 pages, elaborates on "Challenges and strategies to realize a long term scenario[20]", the main goal of Norwegian petroleum policy since White Paper 38 (2001-2002). This implies that "all profitable petroleum resources on the continental shelf will be exploited". After more than 30 years of petroleum production on the Norwegian continental shelf, it is estimated that 29 per cent of the resources have been produced. A realization of the long term scenario will, according to the white paper, lead to oil production for more than 50 years and natural gas production even longer, but the estimates are uncertain. Nevertheless, this will require improved technology because the remaining resources are technically and commercially more demanding to produce than the ones already recovered. They are smaller, deeper and in more environmentally vulnerable areas than the older ones.

The offshore situation of the Norwegian petroleum production implies that costs are very high compared to onshore oilfields in other countries due to need for advanced technology, safety measures and the simple fact that Norway is a high cost country. A main goal is therefore to cut cost considerably. Second, it is stated that "Norway's role as a major energy producer must be reconciled with our ambition to be a pioneer in the environmental area" (White Paper 38 (2003-2004):53). This dual goal has interesting implications for this thesis because it implies that the development of new technology is important both to reduce costs and avoid environmental degradation. According to MoPE, there are strict environmental regulations on the shelf and a goal of zero discharges to sea from all installations within 2005, 30 per cent reduction of emissions to air and other environmental goals were formalized with MoE's third "State of the Environment Report" in 2003 (which I will return to in section 5.2.4 below).

According to the white paper the goals will be fulfilled as cost-efficient as possible. It is further emphasized that to achieve the environmental goals the government has used and introduced a variety of instruments spanning the spectrum from traditional administrative, mainly legal instruments, to taxes and voluntary agreements. Research and development is also an important part of the petroleum policy. Several initiatives are in place and in the context of this thesis it is very interesting to note OG21 (Oil and Gas in the 21st Century), a technology strategy unit established on MoPE's initiative. The secretariat for OG21 is cooperating closely with RCN and the industry, and has developed an interesting strategy

[20] Norwegian term: "Den langsiktige utviklingsbanen"

plan with environmental concerns identified as some of the most important. I will return to the strategy in section 5.3.2 below.

Environmental impact assessments (EIA) are also an integrated part of the governmental regulation of the activities on the continental shelf. A summary of a governmental report (attached to White Paper 38 (2003-2004)), assesses expansion of petroleum activities to Lofoten and the Barents Sea. Environmental concerns are high on the agenda in the report. 10 out of 23 background reports for the scenarios of such activities are directly related to environmental issues. That said, expansion into the areas is disputed due to the vulnerability of the fisheries and arctic flora and fauna. Environmental concerns and technology development to meet the fairly strict environmental regulations are therefore enforced. A relevant question, posed by the environmental NGO's is if the regulations are too mild. An answer to that question is, however, beyond the scope of this thesis. The point I want to make is that the EIAs might also be a driving force for green innovation.

White Paper 29 (1998-99) "On the energy policy"

Although more recent white papers also treat the Norwegian energy policy (e.g. White Paper 18 (2003-2004)), White Paper 29 (1998-99) "On the energy policy" is, as of February 2005, still the main reference document for the policy field. The document treats a wide range of relevant issues. For the purpose of this thesis the chapter on restructuring of energy use and consumption is of main interest.

First, however, it is important to note that a defining feature of the energy policy is the fact that 99 per cent of all electricity production in Norway is based on hydropower, a renewable energy source. Most hydropower resources have, however, been exploited and increase in energy production will therefore be carried out by other means. Electricity consumption is steadily increasing and the authorities want to reduce energy consumption and develop new renewable energy sources. Chapter 4 in White Paper 29 is devoted to this issue.

Three main goals of the restructuring of energy production and consumption within 2010 are outlined: 1) to reduce energy consumption significantly, 2) to use 4 TWh water based central heating, and 3) to establish wind energy plants producing 3 TWh. To realize these goals the government allocates up to NOK 5 billion over a ten year period combined with an increase in the electricity levy. This is a substantial effort in Norwegian terms. The responsibility for the realization of these goals was later transferred to Enova, which I will return to in section 5.3.2 below.

It is clearly stated in the introduction to chapter 4 that "The government will promote an energy policy which is supporting an ambitious environmental policy" (White Paper 29 (1998-99): chapter 4.1). It is further stated that:

> The new renewable energy sources are the energy sources of the future. The government bases its politics on technological development that will produce solutions that in long term will contribute significantly to the energy supply in the world. Norway is well positioned for increased use of new renewable energy sources like wind power, bio-energy, heat pumps and solar energy (ibid: chapter 4.8.2).

Although the government seems to be open for any new renewable energy source, the most pointed focus is on wind energy.

No concrete strategy for increased use of new renewable energy sources is presented, however, but especially wind energy is mentioned a number of times and it is emphasized that the Government will provide financial support for establishment of wind power plants. Furthermore, the government will provide a national overview of the sites most attractive for wind energy based on already available technology. It is also stated that investment support will be provided until wind energy can compete in the open energy market. White Paper 29 also declares that

> it is important that research and development is coordinated with the energy policy by following up new opportunities from an early stage till new technology is established as a competitive alternative in the market. This implies that the research policy must be long term and strive for stable framework conditions (ibid: chapter 4.8.2).

Research and development is declared as an important instrument for innovation. The Research programme Renergi (a Norwegian short for clean energy – Cleanergy) is the main research effort related to renewable energy in Norway. I will return to the Renergi programme in section 5.2.5 on the Research Council of Norway. It must also be noted, however, that the national energy saving goals includes a substantial allocation of funds dedicated to increased production of wind energy.

5.2.4 MoE: Environmental policy and innovation

The Ministry of Environment is responsible for the overall formulation of environmental policy in Norway. MoE is, however, not a "super-ministry" and is considered a sectoral ministry which does not have particular administrative power to impose its strategies on the other Ministries. Nevertheless, White Papers 46 (1988-89) and 58 (1996-97) are, together with the three bi annual "State of the Environment" reports, the most important and influential *environmental* policy documents. They include a wide variety of issues, but given the approach of the thesis, I will in this chapter mainly pay attention to how they treat innovation.

White Paper 46 (1988-89) "Environment and Development. Norway's follow up of the World Commission's Report"

According to White Paper 46 (1988-89), the development of environmental technology was to be stimulated by state development contracts. It further emphasized that to monitor the development of environmental technology it was necessary to coordinate instruments already being utilized *and* to develop new policy instruments for that purpose. Chapter 10.5.1 emphasizes that *"strengthening of policy coordination in this field will be considered"* to monitor research on environmental technology and coordinate use of existing and new policy instruments for industrializing and utilizing new technologies. Finally, the White Paper states that government procurement policies should favor environmentally sound products.

As proposed in Whiter Paper 46 (1988-89), the government launched a national campaign promoting cleaner production. The development of environmental technology was given high priority and special programmes were supported by both MoE and MoTI. At the same time two comprehensive R&D programmes were organized and funded by RCN. The objective of the programmes was to strengthen the competitiveness of Norwegian companies by increasing productivity, reducing environmental impacts,

developing environmental technology and improving management. According to an evaluation by Aasen and Onsager (1995), the campaign was successful, but it was, despite the promising results, discontinued.

The focus on environmental technology and greening of industry in White Paper 46 (1988-89) was significant. It was therefore expected that White Paper 58 (1996-97), aimed at establishing an SD policy in Norway, would follow up the policy initiatives on green innovations.

White Paper 58 (1996-97): "Environmental Policy for Sustainable Development"

White Paper 58 was originally announced as a paper on Sustainable Development (SD) policy, but turned out to be limited to an environmental policy for SD. While the focus on environmental technologies and the promotion of green innovations was quite explicit in White Paper 46, these issues were hardly mentioned in White Paper 58. Instead, White Paper 58 focused on fiscal measures and voluntary agreements as policy instruments. Industry was *asked* to be more pro-active, and *encouraged* to extend the life time of their products and focus on the products lifecycle. However, no concrete measures were proposed by the government.

In general, White Paper 46 is more pro-active than White Paper 58 regarding how public actors should be involved in promoting trade, industry and environmental responsibility (Ruud 2002). The two White Papers illustrate the shift from "administrative rationalism" to "ecological modernization" in Norwegian environmental policy, a shift characterized by new policy instruments, in particular economic instruments, and a sector encompassing approach, stressing integration of environmental concerns into other policy sectors (Reitan 2001).

However, in Chapter 7.3 of White Paper 58, which deals with national climate policy, development of environmental technology is briefly mentioned. Reference is made to the five-year research programme Klimatek initiated in 1997 by the RCN. Klimatek was co-financed by the MoE, MoPE, and MoTI. Its objective was to test technologies which could reduce emissions of CO_2 and other Green House Gases (GHG). Further, development of environmental technologies is mentioned in relation to policy instruments for renewable energy production (Ch 7.3.2.3). The most concrete step is a NOK 50 million grant from the state budget of 1997 to develop bio-energy technology. Solar energy, heat pumps and wind energy are also briefly mentioned but not with reference to green innovative efforts. Emphasis was placed on facilitating use of renewable energy, but very few concrete efforts were presented. The most concrete efforts concerned energy-saving schemes.

White Paper 58 announced the establishment of an environmental fund ("Statens Miljøfond") to stimulate development of environmental technologies, but after the initial funding of NOK 250 million was spent, it also was discontinued. This was also the fate of targeted technology funds under the FUNN programme of the RCN, but they were never related to *green* innovation.

In contrast to White Paper 46 (1988-89) no specific green innovation efforts are called for in White Paper 58 (1996-97). Consequently, except for prospects for tax deductions, the Government assumes that green innovations and cleaner production are to be promoted by industries themselves. Rather than motivating industry through special policy schemes to promote cleaner production, vague requests are chosen as the public policy

option. Under policies recommended in White Paper 58, the greening of industry is to a large extent left to market forces; the associated risks are to be borne by the firms themselves.

The bi-annual 'State of the Environment' reports

Green innovation is hardly mentioned in the bi-annual White Papers on "The Governments Environmental Policy and the State of the Environment".[21] The reports systematically report on actual national emissions and their impact on the environment. In addition, they provide an overview of existing policies, describes central targets in the environmental policy, and gives valuable historical insight into the main priorities of the MoE and the government's environmental policies at the time of the report's release.

Regarding the thematic of this thesis it is therefore interesting to note that none of the three "State of the Environment" reports published so far mention innovation or related topics in a systematic manner. Further, none of them lists innovation or technology development in the overviews of main priorities. In the first two "State of the Environment" reports – White Paper 8 (1999-2000) and White Paper 24 (2000-2001) – innovation and technology development are only mentioned in relation to the RCN Klimatek research program and the SND "Environmental fund" to reduce GHG emissions. Klimatek and the "Environmental Fund" are presented in somewhat more detail below in section 5.2.5 on the Research Council of Norway and section 5.3.1 on Innovation Norway.

When MoE published the most recent "State of the Environment" report (White Paper 25 (2002-2003)) – in April 2003 – both the Klimatek program and the "Environmental fund" had been terminated. The only remaining references made to development of environmental technology are vague and related to increasing spending on research and development on "technology that reduces GHG emissions" and "environmentally friendly energy technology" (White Paper 25 (2002-2003): 101-103). Although not specifically mentioned in the document, the above probably concerns the "Renergi" research programme at the Research Council of Norway which will also be treated in some more detail below.

5.2.5 Cross-sectoral initiatives

I have identified several approaches to promote green innovation. Some important innovation efforts are, however, not MoE's, MoTI's or MoPE's sole responsibility. They can therefore hardly be presented as vertical initiatives. This section will give a very brief presentation of environmental taxes, especially the *CO2 tax,* and the fiscal incentives for R&D proposed by *SkatteFUNN* as well as some of the most relevant research programmes by the *RCN.* Finally, I will present *Green National Government in Norway*[22] – and the potential for the state to be a green supplier and consumer, creating new domestic markets and triggering green innovation in the private sector.

[21] The "State of the Environment" reports are, the main publication and in many ways the cornerstone of the so-called National Environmental Monitoring System (NEMS). More info on NEMS in Ruud and Larsen (2004) and Lafferty, Larsen and Ruud (2004).

[22] Norwegian term: "Grønn Stat".

Application of environmental taxes and levies

Since the early 1990s tax instruments have played an important role in providing incentives for cleaner production and consumption patterns, even though regulation has remained the main policy instrument to abate environmental damage. Green taxes have been introduced to reduce environmentally harmful emissions to air and water, and to reduce the amount of waste generated. In addition there are levies on electricity and vehicles (Table 2). According to the Ministry of Finance (MoF), properly designed taxes will provide incentives to carry through emission reductions where they are cheapest (MoF Parliamentary Bill 1 2004-2005: 18). The total revenue from green taxes is budgeted to reach close to NOK 47 billion[23] in 2005. Approximately 4.8 per cent of central government tax revenue is due to environmental and energy taxes, equivalent to 1.9 per cent of GDP (estimates based on the 2005 budget)[24].

The CO_2 tax is of special interest for this thesis, as it is mainly directed towards the petroleum sector. The CO_2-tax is levied on mineral oil, petrol and production of oil and natural gas on the continental shelf and covers approximately 65 per cent of all CO2-emissions (MoE 2003: 23). Most evidence indicates that the CO_2 tax really has an effect (Andersen et al 2000). Some reports also indicate that the CO_2 tax has *innovation* effects:

A report from the Norwegian Petroleum Directorate on flaring on the installations on the shelf (NPD 2003) states that immediately after the introduction of the CO_2-tax, a number of fairly cheap actions were taken to reduce flaring. Later on more demanding technical actions have been made and there has been a technological breakthrough with regard to the flaring system. As a result the flaring on the Norwegian continental shelf is about half of the flaring in Denmark and the UK from each produced unit, clear evidence that the CO_2-tax has made it economically viable to the petroleum industry to develop new technologies. In an OECD-report on CO_2 capture and storage it is mentioned that *"Norway's carbon tax has been instrumental in fostering the Sleipner project – covering the cost of CO_2 pressurization and storage"* OECD (2004: 198). An earlier source is the Official Report on "Instruments in the Environmental Policy" (NOU 4 1995). Published only four years after the CO_2 tax was introduced the report states that the tax probably has effect because the emissions from the petroleum sector has been reduced partly due to introduction of more energy efficient solutions. And furthermore "Although the decisions to develop and implement new technology mainly

Table 2: The main green taxes in Norway

Tax	Estimated revenue 2005. Mill. NOK
CO_2-tax	7 647
SO_2-tax	91
Petrol tax	9 341
Autodiesel tax	4 990
Waste tax	720
Tax on HFCs and PFCs	141
Env tax on beverage containers	175
Basic tax on non-refillable beverage containers	474
Tax on electricity consumption	6 550
Heating oil tax	682
Registration tax on vehicles	15 610

[23] Approximately EUR 5,73 billion. (Exchange rate 8,2)

[24] Most of the information in this first paragraph, including the table, is gathered from the Ministry of Finance's webpage on green taxes: http://odin.dep.no/fin/engelsk/p4500279/p4500285/bn.html (Accessed Feb 21, 2005)

were made before the tax was introduced, the tax is considered to be an important factor" (ibid: 303). I am also aware of a series of annual reports on the effect of the CO_2 tax written by the NPD. The reports are based on information from the companies on the shelf. Unfortunately the reports are not public.

SkatteFUNN[25]

SkatteFUNN is currently one of the most important instruments in Norwegian innovation policy. Its main goal is to increase and improve R&D activities in business and industry through more systematic and integrated commercial efforts. The program was established in 2001 and implemented in 2002 as a follow up to the FUNN-program. It is administered by RCN's Division of Innovation, and Innovation Norway. Big enterprises can have up to 18 per cent and small and medium sized enterprises (SMB)[26] can have up to 20 per cent of their R&D expenditures reimbursed through tax-reductions. If a company acts alone, the maximum size of the R&D project eligible for support is NOK 4 million. If a company cooperates with an approved research institution the maximum is NOK 8 million.

SkatteFUNN is one of the government's main means for reaching by 2005 the OECD-mandated level of R&D[27]. In 2002 more than 3100 applications for reimbursement of R&D expenditures were submitted, and 2670 were approved. The approved projects had R&D expenditures totaling NOK 4,5 billion, which as a result of the programme resulted in approximately NOK 760 million in tax reductions (MoTI Parliamentary Bill 1 2003-2004: 119). In contrast to the FUNN programme (SkatteFunn's predecessor) that had limits on its total allocations, SkatteFUNN allows any business to be eligible for tax reductions as long as its projects are approved by RCN or Innovation Norway. For the purpose of this thesis, however, one must note that there are no specific criteria related to environmental issues in the SkatteFUNN program. The program does not necessarily contribute to an integration of environmental and innovation policies.

Research Council of Norway

The Research Council of Norway (RCN) is the main public financier of basic and applied research in all areas of science, technology, medicine and the humanities. It has an annual budget of more than NOK 4 billion[28] and plays a central role in Norwegian research. Important goals include raising the general level of the understanding of research in society as a whole and supporting innovation in all sectors and branches of industry.

RCN is a strategic body which identifies areas of special effort, allocates research funds and evaluates the resulting research. The Council is the principal research policy adviser to the government, and it acts as a meeting-place and network-builder for Norwegian research. RCN comprises three research divisions: 1) Division of Science, 2) Division of Strategic Priorities, and 3) Division of Innovation. The Division of Innovation is declared to be a strategic and operative actor in realizing the HIP. The SkatteFunn scheme is an important part of the division's portfolio. The two green-innovation programs most often

[25] Information in this section on SkatteFUNN is gathered from http://www.skattefunn.no (Accessed Feb 23, 2005)
[26] Less than 250 employees, less than EUR 40 million in annual turnover, and less than 25-percent-owned by a big enterprise.
[27] This would mean an increase from today's level of 1,62 per cent of GDP to 2,3 per cent of GDP.
[28] Approximately EUR 488 million (exchange rate 8,2)

referred to by the MoE, MoTI and MoPE, Petromaks and Renergi are, however, part of the Division of Strategic Priorities, *not* the Division of Innovation.

Until now the government has relied very much on the R&D performed by the oil companies and the service and supply industry. With the introduction of Petromaks (Programme for the optimal management of petroleum resources) the government signals that a stronger governmental engagement in petroleum R&D is necessary. Petromaks was established in 2004 and has its main funding from MoPE. The overarching goal is to contribute to the realization of the long term scenario referred to in the MoPE section above. The programme will have an annual budget of NOK 500-600 million and will aim at implementing the strategies, goals and plans formulated in the OG21 "national technology strategy for the oil and gas industry", which I will return to in section 5.3.2.

The Renergi programme has a budget of NOK 150 million[29] for 2004 and NOK 175 million[30] for 2005. Its main goal is "to develop knowledge and solutions as the basis for environment-friendly, efficient and effective management of the country's energy resources, security of supply and internationally competitive economic development related to the energy sector"[31]. The Renergi programme is indeed a major research program by Norwegian standards, and it might lead to green innovation. A number of ministries are contributing financially, including the MoE and MoTI. The main contribution[32], however, comes from the MoPE. EMBa[33] (Energy, Environment and Construction), now merged into Renergi, is highlighted in MoTI's EPSB. MoTI has allocated NOK 113,7 million[34] to RCN for environmental research in 2004, of which NOK 27 million[35] has been earmarked for the EMBa programme. Another much cited research program is Klimatek. The five year program was initiated in 1997 as a follow-up to White Paper 41 (1994-95) "Norwegian policy directed against climatic changes and emissions of nitro group gases (NOx)". MoE, MoPE and MoTI decided to initiate a programme aimed at testing out relevant technologies which could reduce emissions of all the six greenhouse gases contained in the Kyoto-agreement (CO_2, CH_4, N_2O, HFCs, PFCs and SF6). Klimatek had a total budget of NOK 612 million. It was terminated in 2001 and the activities were transferred to EMBa, which is now a part of Renergi.

Green Government

"Green Government" is a state environmental management scheme based on the principles formulated in ISO-14000 and EMAS[36]. Its goal is to implement environment into the government management systems. Green Government started out as a pilot project in 1998-2001 covering 10 institutions. The project was considered successful and showed that the potential for realizing environmental gains in governmental institutions was significant. Four focus areas were selected: procurement, waste management, energy and transport. Initially the ministries lead the way, starting implementation in 2002. By

[29] Approximately EUR 18,3 million (exchange rate 8,2)
[30] Approximately EUR 21,3 million (exchange rate 8,2)
[31] More information at: www.renergi.com (Accessed Feb 23, 2005).
[32] To the author's knowledge at least 80 %
[33] "Energi, miljø, bygg og anlegg", http://www.program.forskningsradet.no/emba/ (Accessed Feb 23, 2005).
[34] Approximately 13,85 million EUR (Exchange rate: 8,2)
[35] Approximately EUR 3,3 million (Exchange rate: 8,2)
[36] More information on Green Government at: www.gronnstat.no. An English pamphlet presenting the scheme is available at http://www.odin.dep.no/filarkiv/179934/Info-brosjyre-engelsk.pdf (Both accessed Feb 23, 2005.)

the end of 2005, however, all national government institutions are to implement Green Government. The national authorities are also, through § 6 in the Law on public procurement, instructed to take environmental considerations in their purchases.

Green Government has a particular focus on public procurement policy and on the extent to which environmental considerations can be included in the decision-making process. The Environmental Action Plan of MoTI refers to a purchasing manual that the ministry has been responsible for developing[37]. The manual will help public servants to formulate strategic and specific environmental prerequisites to suppliers. MoTI refers to the Green Government project, but underlines that this must be followed up with a general strengthening in the market demand for innovative solutions creating positive environmental benefits. As formulated: "When the government is increasing its demand for 'green solutions', it is probable that business also must increase its activity and particular suppliers of such solutions" (MoTI 2001: 28). Green Government, however, is mentioned in most of the sectoral Environmental Action Plans, but it is never related to green innovation policy.

5.2.6 Concluding remarks on horizontal policy integration for green innovation

Innovation is hardly mentioned in the most important *environmental* policy documents since White Paper 46 of 1988-89. But, environmental issues are hardly mentioned in the most important and recent *innovation* policy documents either. The Plan for a Comprehensive Innovation Policy (HIP) does not consider environmental issues at all. This is interesting, especially when recalling that the NA21 stated that the HIP will be consistent with the NA21. The two documents were written and published at the same time and by the same government. Despite this, they have nothing in common at the policy level. I interpret this as an evidence of only minor horizontal integration between environmental and innovation policies. It is reasonable to conclude after studying these documents that integration of innovation and environmental policy is not a priority of the government.

The finding stands in contrast to the findings from petroleum and energy policies in which environmental concerns seems to be integrated to a quite large extent. The focus on environmental concerns has impact on green innovation in the sector – especially in the petroleum sector. I will return to this and elaborate further on the horizontal coordination in chapter 6 of the thesis. First, I will document if there are policy instruments in use *within* the sectoral responsibilities of MoTI, MoPE or MoE aiming at promoting green innovation.

5.3 Environmental and innovation policy integration: the vertical dimension

While the previous section presented the horizontal dimension illustrated in Figure 3 (p. 49), this section presents the vertically oriented initiatives and instruments of the MoE, MoTI and MoPE. Taking each ministry's Sectoral Environmental Action Plan (SEAP) and their respective Environmental Profiles in the State Budget (EPSB) as points of departure,

[37] The manual is now published and available (unfortunately in Norwegian only) at http://odin.dep.no/archive/nhdvedlegg/01/10/ferdi044.pdf (Accessed Feb 23, 2005)

the most relevant instruments, initiatives and institutions for green innovation will be presented.

The ministries' SEAPs are an important part of the so-called National Environmental Monitoring System (NEMS). Summaries of the ministries SEAPs have been presented in the bi-annual White papers on the "State of the Environment". The EPSB is an annual account in each Ministry's Annual Parliamentary Bill on the State budget commenting on the sector's financial efforts on environmentally related issues. Both the EPSB and the NEMS are the main parts of the government's efforts to strengthen EPI in general[38]. The SEAPs and EPSBs are however not especially dedicated to green innovation efforts. The efforts presented in this section are selected from each ministry's presentation of relevant institutions in the SEAP and EPSB. Assuming that the ministries would not downplay their initiatives on environmental issues, this selection is considered to be fully representative. Furthermore, several telephone interviews have been conducted to assure that relevant efforts are not missed out. Still, I remain focused on the interface between environment and innovation – the sector-specific efforts of promoting green innovation.

5.3.1 Ministry of Trade and Industry (MoTI)

The Environmental Action Plan presented by MoTI

MoTI's SEAP was introduced in 2001 by the former minister of Trade and Industry, Grete Knudsen, of the Labour Party. In the SEAP MoTI presents its perception of the major features of Norwegian environmental policy priorities. It seems like MoTI's environmental focus has shifted from end-of-pipe solutions and clean-ups to pollution prevention and changes in product and processing technologies. MoTI emphasizes that promising opportunities are created by voluntary agreements and self-regulatory efforts by individual firms and/or branch organizations.

The action plan further emphasizes the need to develop regulatory measures that are both governing- and cost-effective. Governing-efficiency means that actual achievements of environmental policy objectives are made with a high degree of certainty while cost-efficiency means that the expenses must be directed to areas with the highest degree of environmental gains. Also policy instruments outside the sectoral responsibility of MoTI such as GRIP, the Eco-Lighthouse Program, Environmental Labeling, ISO and EMAS are mentioned. Despite the fact that this is an Environmental Action Plan from the "ministry of innovation", no efforts on green innovation are proposed or referred to.

The Environmental Profile of the State Budget 2004

In MoTI's EPSB for 2004 it is stated that one of three central aims of the Ministry's environmental policy is to *"To contribute to the development and use of environmentally friendly technology, products and services"* (MoTI Parliamentary Bill nr 1 (2003-2004)). However, except for research initiatives financed by the RCN no specific initiatives for realizing this aim are presented. The EPSB further states that research and development on these issues is a high priority of the RCN.

Results from previous allocations of resources are also presented in the EPSB. According to the Ministry, all projects financed by SND/Innovation Norway have been

[38] More on NEMS and EPSB in Lafferty, Larsen and Ruud (2004) and Ruud and Larsen (2004).

assessed with regard to environmental issues. It is further stated that in 2002, NOK 312 million[39] was allocated to projects that contribute to increased eco-efficiency. This relatively high amount of money stems from the fact that when evaluating the projects financed by the SND, the SND executive officers tick a number of boxes that characterize the projects. If the environment box for some reason is ticked, it "counts" as an environmental project and is filed in the list of projects subject to reporting in the Environmental Profile, even though environmental issues were not necessarily a central concern of the project (Ruud and Larsen 2004: 67).

A first interpretation of the contents of the EPSB suggests that the development of environmental technologies seems to be a central priority of MoTI. Nevertheless, I note that very few specific measures on green innovations are described. In summary, MoTI's Environmental Profile of the State Budget 2004 goes no further than MoE's White Paper 58 (1996-97): *urging* business and industry to innovate in an environmentally sounder way.

I will now leave the sectoral documents and turn to actual policy outputs in MoTI's domain which may have green innovation on their agenda.

Innovation Norway

Innovation Norway is fully owned by MoTI and was established January 1, 2004, as proposed in Parliamentary Bill 51 (2002-2003) mentioned above. With 700 employees and a NOK 1 billion budget[40], Innovation Norway spearheads the government's innovation strategy. Innovation Norway was formed by merging into one organization The Norwegian Tourist Board, The Norwegian Trade Council, The Norwegian Industrial and Development Fund (SND) and the Government Consultative Office for Inventors (SVO). The merger seeks to achieve synergy and coordination of the innovation policy instruments of the former organizations.

Innovation Norway provides advisory services and financing to develop the regions, increase innovation in businesses and promote Norway as a tourist destination. According to Mr. Bjørn Nordby[41] there is currently only one specific program offering financial support to projects directly related to green innovation in Innovation Norway's portfolio: a project on *bio-energy in the agricultural sector* with a 2005 budget of NOK 18 million[42] subsidizing small combustion plants and machinery to make chips for bio-combustion plants. According to Mr. Nordby, Innovation Norway has also supported companies like ScanWafer[43] and ScanWind[44] promoting new renewable energy technology[45]. Innovation Norway also encourages and partly finances environmental certification of companies[46].

With regard to advisory services, Innovation Norway provides general environmental advises to businesses, and aids companies applying for funding from EU's many research

[39] Approximately 38 million EUR (Exchange rate: 8,20)
[40] NOK 973,25 million in 2004 and NOK 997,2 million in 2005 (MoTI Parliamentary Bill 1 (2004-2005): 150).
[41] Telephone Interview Dec 21, 2004.
[42] EUR 2,2 million (exchange rate 8,20)
[43] More information about the company at http://www.scanwafer.com/ (Accessed Feb 23, 2005)
[44] Innovation Norway supported the work on the first turbine, the 3000 DL model. More information about the company at http://www.scanwind.com/ (Accessed Feb 23, 2005)
[45] Enova, has also supported ScanWafer and ScanWind. I will briefly return to that in the section on MoPE below.
[46] Stated in the introduction of SND's "Executives Manual" referencing EMAS, ISO 14000 and the "Eco-Light house program".

programs. There are also general references to environmental issues in SND's "Executives Manual" (which is still in use in Innovation Norway) addressing environmental issues in relation to external risks and possibilities[47] and a section on environmental concerns[48]. Nevertheless, it is hard to characterize Innovation Norway's activities as very pointed towards green innovation.

Innovation Norway's activities related to green innovation are currently limited, but that has not always been the case. Much in line with the policies regarding environmental technology reflected in White Paper 46 (1988-89), the then SND was responsible for fairly big programs like: 1) the *"The Environmental Fund"* with a NOK 250 million annual budget providing low-cost loans to green technology development in industry[49]; 2) a *project on environmental warranties*[50], initiated and financed by MoE, but administered by SND with an annual budget of NOK 75 million the first two years and NOK 100 million annually the remaining four years; and 3) an *inter-institutional committee* consisting of executive officers from SND, SFT, RCN, NTC and some ministries. The committee managed and coordinated the applications for funding for environmental technology projects related to SFT's program for environmental technologies, the research programs managed by the RCN and the initiatives managed by SND.

In summary Innovation Norway has currently only one program for environmental technology, but that is not really directed towards innovation. Considering the general Norwegian lack of political initiatives for green innovation this is not surprising. A preliminary strategic plan for Innovation Norway (2004) makes it clear that special measures for green innovation is not a priority for Innovation Norway. In the Plan environment is hardly mentioned. There is, however, a vague reference to sustainability (not sustainable development) in the section describing the main purpose of Innovation Norway and renewable energy technology is mentioned as a possible strategic focus area for the future.

Other initiatives by MoTI

Argentum Fondsinvesteringer AS

Argentum Fondsinvesteringer AS is a government-owned investment company, and "the only pure fund-of-fund investor in the private equity sector in Norway"[51]. After the Norwegian Parliament passed White Paper 38 (2000-2001) on "Organizing of Investment Companies", Argentum was established in 2001 with total assets of NOK 2,45 billion[52]. Seven investment areas were chosen[53], amongst them the environment.

Due to its mandate as a fund-of-fund investor, however, Argentum is dependent on the portfolios of other Norwegian funds to make their investments. According to Argentum's

[47] From "Krav til innstilling, requirement 4, 'eksterne forhold'", in SND's Executives Manual.
[48] From "Krav til innstilling, requirement 10.3 'Miljøvurderinger'", in SND's Executives Manual.
[49] More information on the Environmental Fund in Harmark Consulting (2003) and Ruud and Larsen (2004).
[50] Information regarding the project on environmental warranties and the executive officers committee was provided by Mr. Emil Jessen of Innovation Norway in a telephone interview May 25, 2004. See also Hagen et al (1996).
[51] Citation from Argentum's web pages (http://www.argentum.no/index.php?lang=eng . (Accessed Feb 23, 2005)
[52] EUR 299 million (Exchange rate 8,20).
[53] Technology/ICT, Marine, Bio technology, Energy, Environment, Maritime and Health/medicine (Parliamentary Bill 51 (2002-2003): Ch 6.8).

CTO Nils Vogt[54] there are no funds in Norway having a purely environmental profile, but of the 25 funds registered at The Norwegian Venture Capital Association[55] there are 7 which have environment-related investments. As of January 2004, Argentum was involved in five funds investing in energy, ICT and life sciences. In Argentum's own case, it has no investments related to green innovations, except for investments in the company Pure Process Solutions (part of the EnergiVekst Fund[56]), a company involved in cleansing technology for water and oil within the petroleum sector. Vogt emphasizes[57] that Argentum is a purely commercial actor, which does not have a mandate favoring certain sectors or technologies.

The Industrial Development Corporation of Norway – SIVA SF

SIVA was founded in 1968 as a national actor to develop innovation networks throughout the country and has the role of catalyst and investor to foster innovation and business development. In 2003 it was transferred from the Ministry of Local Government and Regional Development to be fully owned MoTI. "Since 1994, SIVA has been gradually changing from being a state-owned company managing industrial property to being a modern innovation and investment company"[58]. SIVA's basic strategy is to develop strong local and regional business and industry clusters in Norway[59].

According to SIVA's Terje Sæterli[60] the main innovation activities of SIVA involve programmes for business gardens and incubators. SIVA has, however, no specific environmental requirements for providing funding and support. SIVA's decisions on funding are based mainly on the economic merits of each project. In addition, some regional political considerations are taken into account. Thus, environmental concerns are not integrated into the daily workings of SIVA. An illustrative point is the White paper on "SIVA's future activities" (White Paper 46 (2003-2004)) in which neither environmental concerns nor SD is mentioned at all.

The Norwegian Board of Technology

The Norwegian Board of Technology[61] is an "independent consultative office for technology assessment. The Norwegian Board of Technology will work in the interface of technology and society, and contribute to further a human- and environmentally friendly technological development." (White Paper 10 (2001-2002)). It was established in 1999 and is since 2000 fully financed by MoTI. The board consists of 15 members and is backed by a secretariat preparing reports, background information to the board and briefings for the Ministry and the Parliament. In spite of the Board's mandate, very little work has so far been devoted green innovation. A seminar on sustainable technology development was held in February 2004, but as of February 2005 a proposed report is not

[54] Telephone interview Jan 23, 2004 and E-mail to the author May 28, 2004.
[55] Norwegian term: "Norsk Venture Kapitalforening". More information at: http://www.nvca.no/ (Accessed Feb 23, 2005)
[56] More information at: http://www.energivekst.no/ (Accessed Feb 23, 2005)
[57] Telephone interview Jan 23, 2004.
[58] Author's translation. Source SIVA's webpage: http://www.nhnett.net/C125654E0043B247/8486CEFD06DD6D7041256802004F331F/D9E6B2C0FDD72883412568B4005E62C8?OpenDocument (Accessed Feb 23, 2005)
[59] Information collected from SIVA's web-page: http://www.siva.no/ (Accessed Feb 23, 2005).
[60] Telephone interview March 9, 2004.
[61] Norwegian term: Teknologirådet

yet ready. To my knowledge green innovation will not have a significant position in the future work of the board either[62].

5.3.2 Ministry of Petroleum and Energy (MoPE)

The Environmental Action Plan presented by MoPE

MoPE's Sectoral Environmental Action Plan (SEAP) (MoPE 1999) was issued already in 1999 as one of the first SEAPs in the NEMS framework. The 75 pages plan is systematic and thorough and leaves an impression of a sector that is well acquainted with environmental challenges. It is clearly stated that especially the petroleum sector is a significant contributor to environmental degradation. Emissions to air and sea are considered the most important. For the onshore "energy-related" activities, infrastructure like dams, roads and the national electricity grid etc. which interfere with bio-diversity and recreational areas are considered most important.

MoPE's SEAP is, however, like most of the SEAPs, very descriptive on actual emissions and vague on concrete goals, timetables and policy instruments for reducing the impact on the environment. New technology is mentioned several times in the report, but not in a very systematic manner. According to the chapter "on the petroleum and energy policy in Norway", growth, environmental concerns and internationalization are key issues in the petroleum policy. The SEAP states that it will support green technology development, but like the documents from MoTI mentioned above, business and industry is given the responsibility.

The Environmental Profile of the State Budget 2004

MoPE's EPSB for 2004 (MoPE Parliamentary Bill 1 (2003-2004)) provides a more up to date presentation of the Ministry's environmental initiatives than the SEAP. It is however consistent with the SEAP when depicting emissions to sea and air as well as construction of infrastructure for onshore activities as the main environmental challenges.

A description of the development on these areas is provided. Further the government's environmental policy for the sector is given a vague and brief presentation. The reporting on the activities in 2002 is more concrete. The Norwegian Petroleum Directorate (NPD), Enova and RCN as well as a Carbon Sequestration Leadership Forum (CSLF)[63] seem to be the main initiatives worthy of a presentation in MoPE's EPSB. I will return to them below. Finally, the section on short and long term efforts mentions legislative instruments like the Petroleum Act, the Pollution Act and environmental assessments amended by the Planning and Building Act. There are however, very few specific references to technology development and innovation, but it is clearly an underlying theme when the EPSB discuss both discharges to sea and emissions to air.

[62] In a Board meeting report dated Sept 27, 2004 environmental technology or green innovation does not have a prominent position in future activities (Available at http://www.teknologiradet.no/files/referat_september_04_copy1.pdf . Accessed Feb 23, 2005)

[63] More info at http://www.cslforum.org/ (Accessed Feb 23, 2005)

Environment 2004. MoPE's Environmental reports

The publication Environment 2004 (MoPE 2004b) is part of a series of annual environmental reports for the petroleum sector. The reports have been published the last three years and consist of a factual section presenting the status of emissions and discharges, and a special topic section. The topic section for 2004 has a particular reference to new technology for produced water, while the 2003 report's topic section was devoted to usage and storage of CO_2 at the continental shelf.

The factual section of the environmental reports seems to focus on emissions to air (CO_2, NOx and nmVOC) and sea (chemicals, produced water etc). A very interesting feature of the reports is that they have a special focus on technology. Each chapter consists of a section that specifies technological solutions to emissions and discharges and development of new technologies is frequently mentioned. The reports seem to be more operative and more technology oriented than the EPSB and the SEAP and they are surely more easily available.

Like in the previous section, I will now leave the relevant documents and turn to a study of MoPE's actual policy outputs relevant for green innovation.

Norwegian Petroleum Directorate (NPD)

The Norwegian Petroleum Directorate (NPD) was established by the Storting in 1972 to manage the petroleum resources on the Norwegian Continental Shelf (NCS). In 2004 the directorate was divided into two entities.

The new Petroleum Safety Authority (PSA) has the regulatory responsibility for safety, emergency preparedness and the working environment in the petroleum activities. PSA is now transferred from NPD to the Ministry of Labour and Government Administration (MoLA). NPD has kept the responsibility for petroleum resource management and still reports to MoPE (White Paper 17 (2002-2003)). NPD is thus of main interest for this thesis. However, according to an NPD representative[64], the directorate does not have instruments especially dedicated to innovation except for the CO_2 tax.

The Norwegian Water Resources and Energy Directorate (NVE)

The Norwegian Water Resources and Energy Directorate (NVE) was established in 1921 and is responsible for the management of Norway's water and energy resources. The directorate is thus responsible for the "other half" of MoPE's sector. NVE has the responsibility "to ensure an integrated and environmentally sound management of Norway's water resources, promote an efficient energy market and cost-effective energy systems and take initiatives to promote efficient energy use" (NVE 2004). There are no activities related to innovation in NVE. Regarding new renewable energy, there is a clear division of labor between NVE and Enova. NVE is only responsible for considering licenses for new plants while Enova is responsible for actual support schemes and other activities related to new renewable energy.

[64] Telephone interview 25 Feb, 2004.

Enova

Enova SF, established in 2001, is a state enterprise fully owned by the MoPE (Ot Prp 35 (2000-2001)). According to Enova's web site[65] its "main mission is to contribute to environmentally sound and rational use and production of energy, relying on financial instruments and incentives to stimulate market actors and mechanisms to achieve national energy policy goals". Enova's major goal is to save 12 TWh by 2010[66] through stimulating cost-effective and environmentally sound investments in households and business and industry. Out of the overall goal, at least 3 TWh is to be generated from wind energy and 4 TWh must be achieved by increased use of water-based central heating based on new renewable energy sources, heat pumps and waste heat.

To achieve Enova's objectives, the Norwegian Parliament has set up an Energy Fund and indicated grants within a framework of up to NOK 5 billion[67] over a ten-year period. The funding is substantial in Norwegian terms and will come from a levy on electricity distribution tariffs and from ordinary grants in the State Budget. Enova is one of the government's most important instruments in the areas of energy conservation and utilization of more environmentally friendly energy sources.

There are, however, few initiatives aimed at innovation in Enova. The only policy instrument at Enova's disposal is investment support (Enova 2003: 10) and the state enterprise has supported the wave energy company Fobox AS and wind energy plants within a frame of maximum 25 per cent of the investment costs, totaling approximately NOK 200-250 million annually in 2003 and 2004. Enova has also supported the development of the ScanWind 3000 GL[68] turbine and a test site for wind energy outside the city of Tromsø. Except for the goal of 3 TWh there are, however, no official strategies or action plans for development of wind energy. But, the wind industry in Norway is relatively small and there seems to be "informal coordination" between NVE, Enova and the industry.

With regard to the goal of 4 TWh from increased annual use of water-based central heating based on new renewable energy sources, heat pumps and waste heat, Enova has composed a report prioritizing the most relevant areas for achieving the goal[69]. Three main programs are initiated: One related to heat production based on bio-fuels in plants bigger that 2 GWh. This is coordinated with Innovation Norway which has a few initiatives for plants smaller than 2 GWh. A second initiative is related to water based central heating[70] and a third related to subsidizing small combustion plants and machinery to make chips for bio-combustion plants. The third initiative is partly overlapping with Innovation Norway's equivalent initiative, but a major difference is that Enova's criteria for granting support is based on energy-efficiency, while Innovation Norway's criteria are based on net "cash return" of the support. According to Viggo Iversen in Enova[71] some of the actors related to these activities regard them as "innovation" because they are introduced to new

[65] Most information in this section is collected from ENOVA's website http://www.enova.no/?itemid=425 (Accessed Feb 23, 2005)
[66] The initial goal was to save 10 TWh within 2010. In 2004, however, the goal was increased to 12 TWh (MoPE 2004c).
[67] Approximately EUR 610 million (Exchange rate 8,2)
[68] More information about the turbine at http://www.scanwind.com (Accessed Feb 23, 2005)
[69] According to Viggo Iversen in Enova. Telephone interview January 25, 2005. I have, however, not been able to locate the report on Enova's webpages.
[70] In 2002 MoPE issued a Strategy for development of water based central heating (MoPE 2002). The strategy is, however, not related to innovation at all and is not further commented in the thesis.
[71] Telephone interview January 25, 2005.

sources of activity and many actors have established pilot-plants (although with well known technology). That statement is, however, based on a wider definition of innovation than the one applied in this thesis.

Gassnova

With White Paper 9 (2002-2003) on domestic use of natural gas, the government discussed its policy for a natural gas power plant with CO_2 handling. With White Paper 47 (2003-2004) the MoPE took the initiative to set up an innovation body in Porsgrunn in Telemark County. The Norwegian gas technology entity Gassnova was formally established Jan 1, 2005 with an annual budget of approximately NOK 100 million drawn from the annual return of a NOK 2 billion fund. The mandate is to promote an environmentally sound natural-gas electricity generating plant with CO_2 handling.

Gassnova has been flagged as the main green innovation initiative by the government. In publications referring to green innovation and the importance of green technology, Gassnova is the only concrete public initiative (See e.g. MoFA 2002 and MoE 2003). A prerequisite for the establishment is that RCN continue to support technology research in a new research program – Climit[72], while Gassnova is tasked with testing and demonstration of environmentally friendly natural gas power plant technologies. A national natural gas technology program will be established and the government wants a coordinated use of policy instruments in all phases of the innovation process. The first phase of the program will be directed at research, development and testing of technology for natural gas power plants with CO_2 handling. The Program will be administered by RCN and Gassnova, and NOK 10 million is allocated for the first year of operation, a sum that will be dramatically increased when Gassnova is in full operation.

OG21 (Oil and Gas in the 21st Century)

In 2001 the OG21 Task Force (Oil and Gas in the 21st Century) was established on request by MoPE "to bring the oil and gas industry together under a common, permanent, national technology strategy" (OG21 2002a:3). OG21 deserves special attention. The objective is to develop a more co-ordinated and focused approach to research and technology development throughout the oil and gas industry and thereby promoting more efficient and timely results. As stated in the 2002 Strategy (ibid: 5) OG21's main objectives are "To generate new technology and knowledge to ensure profitable, environment-friendly development of the resources on the Norwegian Continental Shelf" and "To enhance the industry's international competitiveness by producing attractive new technology products and system solutions".

The Minister of Petroleum and Energy has the overall responsibility for OG21. It is run by an "independent" secretariat and the board is appointed by MoPE. The board meets frequently and consists of high ranking representatives from the MoPE (observer status only), all the main operators on the shelf, representatives from the RCN, representatives for the research institutions and from the oil and gas business federations. To assure coordination between OG21, RCN and two of the main research programs related to

[72] See http://www.gassnova.no/sw161.asp for more information (Accessed Feb 23, 2005).

OG21, Petromaks and Demo 2000, members of the OG21 board are also represented in the Petromaks and Demo 2000 boards.

The first thing the OG21 did was to identify five "high priority target areas": 1) The environment, 2) Increased Recovery, 3) Deep Water, 4) Small Fields and 5) Gas Chain. Environment is put first on the list and Minutes from a board meeting in summer 2002 stresses that "There are two main environmental challenges: first increased emissions and discharges from existing activities and second 'license to operate' for development in new, more vulnerable areas" (OG21 2002b). However, the other four target areas on the list are also heavy weight research areas for new technology.

So-called Lead Parties have contributed to a division of the five 'target areas' into nine 'technology targets' of which the two first: "Zero harmful discharges to sea" and "A 30 per cent reduction in emissions to air" are covering the environmental 'target area' (OG21 2002a: 19ff). The background for the zero harmful discharges to sea target is future governmental requirements for new and existing facilities from 2005. The background for reduction of emissions to air target is more diffuse, but is stated to be "in compliance with the Kyoto protocol", which probably means within 2012. Although not formulated as a separate technology target, CO_2-injection is considered as one option in the increased recovery 'target area'. All technology targets have designated responsible actors from the gas and oil industry and all the main operators on the shelf are at least responsible for one technology target. It is expected that a revised strategy to be published in October 2005 will be even more concrete and updated.

OG21 has an annual budget of approximately NOK 5 million to coordinate the work with the strategy. In addition, 10 expert groups consisting of representatives from the industry are working on the technology targets formulated. In a board meeting in October 2004 the MoPE representative gave the ministry's view on the budget proposal and stated that Petromaks and Demo 2000 are the main building blocks to realize the OG21 strategy (OG21 2004). This is also emphasized in White Paper 38 (2003-2004: 64). *Petromaks* is one of the biggest research programs in RCN. With regard to financing, however, both the general manager of OG21, Per Gerhard Grini[73], and the MoPE representative, Jostein Dahl Karlsen[74], emphasize that the most important financial and in kind contribution to the realization of OG21 comes from the companies involved. OG21, Petromaks and Demo 2000 spurs a wide range of *concerted* research efforts for new technology in the petroleum industry.

The *Demo 2000* program is an initiative supported by the Ministry of Petroleum and Energy (MPE) in order to ensure long term competitiveness in the oil and gas business and to develop innovative Norwegian industrial products, systems and processes for the global offshore market. The steering group for the program consists of representatives from oil companies, service industry and research institutes of whom many are – or have been – members of the OG21 board. In the State Budget for 2005 the allocation to Demo 2000 was increased from NOK 30 million in 2004 to NOK 50 million for 2005. Since its start up in autumn 1999, a total of 280 million NOK have been allocated through five application rounds within key technology areas (a) reservoir description and interpretation, (b) drilling and well technology, (c) seabed/down hole processing and

[73] Telephone interview January 24, 2005.
[74] Telephone interview January 7, 2005.

multi-phase transport, (d) deepwater technology and (e) gas utilisation. There does not, however, seem to be any special environmental focus in Demo 2000 so far.

5.3.3 Ministry of Environment (MoE)

The Environmental Action Plan presented by MoE

MoE's own Sectoral Environmental Action Plan (SEAP) was issued in 2003, after the plans of all the other ministries had been issued. Innovation or development of environmental technology is not mentioned in relation to the national targets, prioritized policy instruments or responsibilities of the MoE. In the section on climate change, however, it is stated that the most important policy instrument of the MoE is the CO_2-tax, which covers about 65 per cent of all CO_2-emissions. It is further stated that the MoPE has the overall responsibility for budget allocations and development of energy technologies, including new renewable energies and natural gas power plants with CO_2 handling (MoE 2003: 23).

Most of the policy initiatives mentioned in MoE's Environmental Action Plan are related to financial instruments, prohibitions and regulations. It is of course possible that taxes and emission control stimulates the development of more environmentally sound technologies, but the Action Plan does not seem to anticipate such consequences.

The Environmental Profile of the State Budget 2004

Not surprisingly, MoE's Parliamentary Bill on the State Budget mostly concerns environmental issues. The 174-page document extensively covers all financial allocations of the Ministry, their purpose and to some degree their expected outcome. It gives a good, up-to-date account of the amounts allocated and their destination. This said, the quantified measure "financial allocations" will never be sufficient to assess the actual effect of the allocations, but the EPSB can be read as a correction and "verification" to policy statements made.

The impression of a lack of commitment to green innovation in MoE's SEAP is not altered when reading the EPSB. Apart from some funding for the development of water cleansing technology, a grant of 900,000 NOK[75] to the environmental NGO Bellona, to "…contribute to increased knowledge about more environmentally friendly energy technology and environmental technology" (MoE Parliamentary Bill 1 (2003-2004): 113) is the most specific allocation related to green innovation. Next I will consider two other actors that could be seen to have innovation policy functions – GRIP and SFT. Both receive most of their funding from the MoE.

GRIP

GRIP – the Norwegian Foundation for Sustainable Production and Consumption[76] – was founded as an independent foundation in 1995 by Torbjørn Berntsen, Minister of the Environment in the Brundtland Government[77]. GRIP is only briefly mentioned in MoE's Environmental Action Plan and the Environmental Profile, but with 20 employees and an

[75] Approximately EUR 110,000 (Exchange rate: 8,20).
[76] For further details see: http://www.grip.no/ (Accessed Feb 23, 2005)
[77] According to GRIP's Annual Report of 2001.

annual budget of NOK 33 million in 2002, it is an important initiative promoting a greening of trade and industry in Norway. GRIP works primarily with companies that do not pollute in a legal sense, but still have an impact on the environment through their means of transport, energy use, waste disposal and so forth. MoE is GRIP's main financial contributor. Although MoTI frequently mentions GRIP as an example when sustainable or environmental production and consumption are discussed, MoTI has *not* contributed funds to GRIP and GRIP is not part of MoTI's portfolio.

According to Sigve Aasebø of GRIP,[78] innovation is an underlying theme of GRIP's activities given the references to innovation in Agenda 21 Chapter 4, but GRIP does not currently have many specific activities directly aimed at innovation and the environment. Mr. Aasebø stresses, however, that in their view all the businesses they are working with are involved in product development and therefore, depending on how one defines innovation, are also indirectly involved in green innovation.

Noteworthy current and previous efforts by GRIP with regard to green innovation are: 1) the *Glassbjørnen (Glass Bear) Award*, a relatively high-profile media event with five subcategories: innovation, eco-design, recycling, company of the year and price of honor. The event does not contribute directly to more green innovation, but gives much needed media attention to the issue; 2) *The EcoBuild programme*, initiated by the building sector in 1998 and terminated in 2002, a heavyweight initiative with a NOK 170 million budget administered by GRIP. The programme's goal was to increase eco-efficiency in the building and real estate sector; 3) *The EcoDesign programme* encouraged product developers and industrial designers to take environmental concerns into account during the design process. Although the programme was terminated in 2003[79], information it produced is still disseminated through courses arranged by GRIP and contact with design schools.

Norwegian Pollution Control Authority (SFT)

The Pollution Control Authority (SFT) is a directorate with a staff of 270 under the Ministry of Environment. According to Mr. Per Døvle[80] SFT is currently involved in only two efforts directly related to innovation: a database presenting best practices and lessons learned, and some preparatory work concerning a plan on environmental (technological) innovations commissioned by the MoE. It can of course also be argued that SFT's daily activities, such as issuing emission permits and drafting environmental regulations, indirectly contributes to the development of green innovation, particularly related to end-of-pipe solutions.

Due to the few activities of SFT related to green innovation today, it is appropriate to highlight an example of previous SFT work on the issue. According to Mr. Døvle, SFT's most important effort was its "Program for Environmental Technology". During its existence (1990-1998) the program allocated approximately NOK 310 million[81] to business and industry. The program's aims were threefold: 1) to solve Norwegian environmental problems, 2) to achieve national environmental targets and 3) to stimulate

[78] Telephone interview March 9, 2004.
[79] The final report from the programme is available in Norwegian at: http://www.grip.no/okodesign/dokumenter/2004-02-06_okodesignsluttrapp.pdf (Accessed Feb 23, 2005)
[80] Telephone interview April 27, 2004.
[81] Approximately EUR 37.8 million (exchange rate: 8,2)

Norwegian business and industry to develop environmental technology. A special focus was placed on demonstration and pilot projects promoting radical technical and managerial innovations towards a greening of industry. Several polluting processing industries such as pulp and paper benefited from this programme.

With regard to the current activities, the database on best practices and lessons learned[82] is small and based on voluntary reporting. It is not particularly utilized by either SFT or external stakeholders. Still, the database consists of about 40 initiatives ranging from recycling of waste in a kindergarten to CO_2 injection at the Utsira geological formation in the North Sea. During spring 2004 SFT did some preparatory work for MoE on a report on environmental technology. The work was a response to the EU Environmental Technologies Action Plan (ETAP) presented in January 2004. In a horizontal policy integration perspective it is interesting that this happened less than two months after the presentation of the HIP. In fact, the ongoing work on green technology and response and follow up of the EU ETAP was initialized in February 2004 at the same time as the HIP was launched in a big public event – an event where the Minister of Environment did not even participate. This shows an evident lack of coherence and integration of innovation and environmental policies in Norway. At the same time the preparatory work on environmental technology can be considered to confirm that MoE sees green technology as part of its sectoral responsibility.

5.3.4 Concluding remarks on vertical policy integration for green innovation

Although there have been some interesting environmental technology projects and initiatives the last 15 years, there are few current projects within MoE and MoTI. SFT's program for environmental technology and SND's program on environmental warranties and also its Environmental Fund were interesting and fairly big projects, but are now terminated and there are no evidence that they will be revitalized. Further, given that SND (and now Innovation Norway) always has been in MoTI's portfolio it is interesting to note that all the initiatives related to environmental issues managed by former SND were financed by the Ministry of Environment, not the Ministry of Trade and Industry.

Regarding MoPE the situation is different. Environmental concerns seem to be fairly well integrated in the vertical "operations" of both the energy and petroleum policies, but they are not connected to the horizontal level, presented in chapter 5.2. In the petroleum policy the focus on technology development is high. It is appropriate to emphasize that the petroleum sector is totally dependent on new technology, but for the purpose of this thesis it is interesting to note that environmental concerns seem to be of importance and also integrated in the initiatives for technology development. The National Technology Strategy OG21 is particularly interesting. Furthermore, in many cases development of new technologies, rather than giving exemptions from regulation seems to be the preferred policy option. Thus, traditional environmental regulation by the MoE (i.e. the goal of zero discharges to sea) in many ways forces the operators on the continental shelf to strengthen green innovation.

[82] http://www.sft.no/om_oss/godeeksempler/ Available in Norwegian only (Accessed Feb 23, 2005)

6 HOW AND TO WHAT EXTENT ARE NORWEGIAN ENVIRONMENTAL AND INNOVATION POLICIES INTEGRATED?

In this chapter I will take the benchmarks on Horizontal (HEPI) and Vertical Environmental Policy Integration (VEPI) (Lafferty 2004) as point of departure to evaluate the extent to which environmental concerns are integrated into innovation policy. This corresponds with Vedungs's fourth step of monitoring. The efforts by the MoTI, MoPE and MoE referred to in the previous chapter, are studied.

The benchmarks developed by Lafferty mirror an ordinary policy implementation process, but were originally developed as general benchmarks for environmental policy integration for SD in a broad sense, not for integration of environmental concerns into "niche" policies. I have therefore slightly moderated the benchmarks to accommodate integration of environmental concerns into innovation policies. Because of the limited findings of green innovation initiatives, I have decided to base the discussion in this chapter on what might be referred to as a "thin" version of Lafferty's EPI definition. The evaluation is based on the benchmarks only and will not go into detail on whether or not environmental issues actually are considered "trump" in innovation policies. This will be discussed in the next chapter. It can thus be argued that this chapter merely discusses coordination or coherence of environmental and innovation policies (option 3 of Figure 2, p. 37) rather than integration.

The content of the chapter is as follows: It starts out with an assessment of horizontal environmental policy integration into innovation policies. Then, in section two, I repeat the exercise, but now focused on vertical policy integration. Third, I discuss the findings on the various innovation efforts that are not visible in the HEPI/VEPI framework and assess the extent to which environmental and innovation concerns are integrated.

6.1 HEPI

The horizontal dimension of EPI (HEPI) refers to the overall governmental responsibility of SD. In section 5.2 above, I reviewed a wide range of relevant White Papers, Parliamentary Bills and Policy Plans, mainly from MoTI, MoPE and MoE with regard to innovation and environmental concerns. Below, and in accordance with the benchmarks proposed by Lafferty (2004), I present a summary and discussion of the findings enabling a better understanding of the current status based on the HEPI benchmarks.

1. A *"constitutive" mandate* providing provisions for the special status of green innovation policy.

Since the launch of the Brundtland report, Norwegian governments of both the "right" and the "left" have passed White Papers; Long-term plans, a National Strategy and a National Action Plan (NA21) – all proclaiming "sustainable development" as an over-arching goal for the Norwegian society. Strong environmental prescriptions are also

included in the Norwegian constitution (Lafferty, Larsen and Ruud 2004). Except for White Paper 46 (1988-89), however, there has been no special mandate for green innovation in Norway and the issue has hardly been debated in parliament.

2. An *over-arching strategy* for green innovation, with clearly enunciated goals and operational principles, and a political mandate with direct backing from the chief executive authority.

Norway has never adopted a national over-arching strategy for green innovation. In 2002, however, Norway adopted a relatively short, relatively vague and highly controversial "National Strategy for Sustainable Development". The strategy was hastily prepared for the World Summit on Sustainable Development (WSSD) in Johannesburg (Lafferty, Larsen and Ruud 2004) and actually mentions innovation a couple of times, but never systematically. It makes mention of environmental technologies and technological innovation and states that "Norway will play an active role in developing environmentally friendlier technology through research" (MoFA 2002: 35), but this is not further specified and no goals are specified.

3. A *national action plan* with both over-arching and sectoral targets, indicators and time-tables.

There is no national action plan especially dedicated to green innovation. Innovation is hardly mentioned in *environmental* policy documents and environmental issues are hardly mentioned in *innovation* policy documents. Environmental issues are neither mentioned in Parliamentary Bill 51 (2002-2003) "On Policy Instruments for an Innovative and Creative Business and Industry" nor the Action Plan for a Comprehensive Innovation Policy (HIP) published during the fall 2004. This is interesting because the main outcome of Parliamentary Bill 51 was the creation of Innovation Norway, but it appears that the government does not see environmental issues as an integrated part of such an initiative. Further, the National Action Plan for Sustainable Development (NA21), published two weeks prior to the issuance of HIP, states that the HIP "is consistent with NA21" (White Paper 1 (2003-2004): 195), but there is only one very vague reference to NA21 in HIP, and neither environmental issues nor SD is discussed in the HIP.

4. A *responsible executive body* with designated responsibility (and powers) for the overall coordination, implementation and supervision of the integration process.

As there is no strategy or action plan for green innovation, there is no executive body responsible for green innovation. However, a committee consisting of deputy ministers from 9 out of 18 Ministries is established to follow up the innovation policy plan, but MoE is not represented on this committee. Further, an expert group has been asked to develop national indicators to facilitate the realization of the objectives stated in NA21, but innovation is not part of its mandate. In general no efforts are made to supervise, coordinate or implement a green innovation policy in Norway.

5. A *communications plan* stipulating sectoral responsibility for achieving overarching goals, and outlining how intra-sectoral communications are to be structured and made transparent.

No communications plan exists.

6. An *independent auditor* with responsibility for monitoring and assessing implementation of a green innovation policy at both governmental and sectoral levels, and for proposing revisions in subsequent generations of strategies and action plans.

No independent auditor exists.

7. A *board of petition and redress* for resolving conflicts of interest between environmental and other societal objectives, interests and actors.

No board of petition and redress exists.

In sum: The Action Plan for a Comprehensive Innovation Policy (HIP) is not very innovative; and in terms of being an action plan, it is not very comprehensive. This is the case, at least, regarding green innovations. The HIP contains virtually no references to environmental concerns and does not take ecological thresholds or Earth's carrying capacity into account. Indirectly the NA21 emphasizes that sustainable economic development must include a green innovation policy. It is stated that the HIP "is consistent with NA21", but as mentioned above: the HIP does not have any references to environmental issues. In conclusion, horizontal coordination of environmental and innovation policies is virtually nonexistent. There is no such thing as a national green innovation policy in Norway, but perhaps this situation is more promising within the sectoral domains of MoTI, MoPE and MoE?

6.2 VEPI

Again I will use Lafferty's (2004) benchmarks to assess the extent to which innovation and environmental policies are integrated vertically. It is of course possible to pursue a green innovation policy within a sector without an overarching horizontal policy. However, recalling that there is little emphasis on green innovation in the horizontal steering documents referred to in the previous section, it is not surprising if the findings on the vertical dimension are limited.

This holds true, at least, for the MoTI and MoE. The MoPE does have a somewhat different approach which has not been really visible in the assessment of the horizontal integration. OG21 is not a green innovation strategy as such, but it does meet many of requirements in the vertical benchmarks because environmental concerns are integrated and highlighted. It is, however, not connected to MoE or MoTI initiatives, but OG21 certainly brings interesting perspectives to the discussion. Gassnova's national natural gas technology program will also be a major initiative from the MoPE related to green innovation. However, Gassnova started its operations in January 2005 and its actual approach remains to be seen. I will therefore not discuss Gassnova with regard to the VEPI benchmarks, but comment briefly on it in the concluding section of this chapter.

1. A *scoping report* providing an initial mapping and specification of sectoral activity which identifies major environmental/ecological impacts associated with key actors and processes – including the governmental unit itself.

I am not aware of any such mappings or specifications from either MoE or MoTI on sectoral activities regarding green innovation. Inspired by the EU Plan on Environmental

Technologies (ETAP), however, MoE has commissioned a report on current and previous Norwegian efforts on environmental technologies from the Pollution Control Authority (SFT). SFT's report is now pending at the Ministry, but it is highly unlikely that a scoping report will be produced. MoPE's OG21, however, started out identifying five "target areas" for technology development in the oil and gas industry. Environment is one of the five target areas and the major environmental impacts are identified. This is very close to meet the demands of the first VEPI benchmark.

2. A *forum* on green innovation for structured dialogue and consultation with designated principle stakeholders and citizens.

There is currently no green innovation forum in MoE or MoTI, except for the deputy minister committee referred to under the HEPI benchmarks (which does not include the deputy Minister of Environment). The structure of OG21's board does however resemble a forum like the one outlined above. The board is nominated by the MoPE and consists of high ranking representatives from the MoPE (observer status only), all the main operators on the shelf, representatives from the RCN, representatives from or the research institutions and from the oil and gas business federations. *All* stakeholders are not involved, but strategies and action plans on "this technological level" are demanding and one can as a minimum say that in OG21 *most* relevant stakeholders are represented.

3. A *sectoral strategy* for green innovation, putting forth the basic principles and goals for the sector.

There is currently no sectoral strategy for green innovation in MoE or MoTI. The OG21 strategy does partly fulfil this benchmark's requirements. It is an innovation strategy, but it is not entirely dedicated to green innovation. It has, however, integrated environmental concerns into the overall goals of the strategy.

4. An *action plan* to implement the strategy, with stipulated priorities, targets, timetables, policy instruments, and designated responsible actors.

A sectoral green innovation action plan is not in place in MoE or MoTI. All Norwegian ministries have, however, published sectoral environmental action plans, but none of them are focusing on green innovation. The OG21 partly meets the requirements for this benchmark too. Some targets and timetables are presented and designated actors from the main operators on the shelf are responsible for the specified "technology targets".

5. A *budget* for the integration and funding of the green innovation action plan.

There is no action plan, hence there is no budget in the MoE or the MoTI. OG21, however, has a NOK 5 million budget for the administration of the work on the strategy. In addition, the Petromaks and Demo 2000 programs are to be coordinated fully with the OG21 and have 2005 budgets of NOK 140 million and NOK 50 million respectively, only from the MoPE. In addition, the funding from MoPE and RCN releases substantial funding from the industry. OG21 seems to have sufficient funding for implementation of the strategy.

6. A *monitoring programme* for overseeing the implementation process, its impacts and target results, including specified cycles for monitoring reports and revisions of the sectoral strategy and action plan.

No monitoring program exists (and not much to report on) within MoE and MoTI. I am not aware of a monitoring program for OG21 either.

The degree of vertical policy integration of environmental and innovation policies in Norway is low. Except for OG21, in which environmental technology targets are two of nine specified targets, there are no strategic actions or plans for green innovation in place. Nevertheless, research, financed by the Research Council of Norway, on related issues such as renewable energy and environmental technologies is taking place. Technical research is, however, only the start of a long innovation journey. Focus on development and diffusion towards commercialization is also needed. OG21 has, mainly through the subordinate initiative of Demo 2000, taken this into account, but in MoE and MoTI few policy instruments are in place. I have documented a few green innovation initiatives within Innovation Norway, SFT and GRIP, but they are all insignificant both in relative and absolute terms. Further, the limited public initiatives documented are not related to any overall horizontal strategy for green innovations and in a few cases only informally related to each other.

6.3 Discussion

The result from the evaluation of MoE's and MoTI's initiatives with respect to the HEPI/VEPI benchmarks indicates clearly that integration of environmental concerns into innovation policy is virtually non-existent. MoPE's OG21 stands out as the only "real" innovation policy strategy. But interestingly and surprisingly, OG21 is not related to HIP in any way, although the Oil and Energy Minister, responsible for OG21, also signed the HIP.

OG21 has, however, kept a fairly low media profile and is not well known outside the industry. It is also important to emphasize again that OG21 is *not* a green innovation strategy. OG21 is primarily a general technology strategy for the oil and gas industry which aims at realizing the long term scenario of producing as much as possible of the oil reserves at the continental shelf. Green innovation strategy or not, it is intriguing that OG21 has very clearly pronounced environmental goals, is supported by the relevant actors in the sector, has a professional secretariat, has a budget for integration and funding of the plan and business representatives responsible for the lead parties' work on each of the technology targets. It seems to be an example of a very thorough, robust and systematic way of integrating a strategy.

Environmental concerns are integrated into MoPE's OG21 technology innovation strategy, but is it sufficient to qualify as EPI? Given a discussion of a "thin" version of Lafferty's definition, I would say that the answer is "yes". OG21 is MoPE's politically "enforced" technology strategy. The government has an overall ambition of reconciling Norway's role as energy producer with the role as environmental front runner (White Paper 38 (2003-2004: 53). The goal of zero harmful discharges to sea within 2005, for example, was first formulated already in White Paper 58 (1996-97) and later formally established in White Paper 25 (2002-2003). Thus, the corresponding technology goal is not very progressive by the industry itself (who actually singled out the technology targets)

but merely a result of traditional command and control politics, now integrated in MoPE's innovation policy.

I will argue that it is possible to identify OG21 as a "MoPE master plan" for innovation, and environmental concerns are an integrated part of it. There is, however, an obvious interdependency between the government and the petroleum industry: Norway needs the income from the petroleum resources, both in terms of net income and employment, and the industry needs license from the MoPE to operate on the continental shelf. These licenses also include environmental requirements the industry has to meet. It will be politically almost impossible for the oil and gas industry to get access to the petroleum resources in the environmentally vulnerable northern and arctic areas if the environmental challenges are not solved. A prerequisite to realize "the long term scenario", which includes activities in the northern areas, is therefore that new technology is developed. MoPE has been sitting ringside to all technology development in the industry for years and has seen the need for concerted action. OG21 is a result of the Ministry's observation. In OG21 the industry is "voluntarily forced" to cooperate on research and pick the low-hanging fruits of synergy effects on meeting basic baseline research to meet the environmental challenges of the sector. The vertical integration of environmental concerns into MoPE's OG21 innovation strategy is, in my opinion, relatively strong and the environmental technology targets are in accordance with the overarching environmental policy as formulated by the MoE.

MoPE's *energy* policy, however, is not as systematic with regard to green innovation. The goal of increased use of new renewable energy sources is not coordinated with the overall innovation strategies, and very few policy instruments related to innovation are applied. Enova is MoPE's main instrument in the energy saving campaign, and except for Gassnova, which I will return to shortly, I have not been able to identify other relevant vertical policy initiatives with relevance for the energy policy. To fulfill the energy saving goals, Enova provides investments support of up to 25 per cent, but the projects are based on well proven and commercially competitive technology. This logic applies to the programs on wind, central heating and heat pumps. A clear policy[83] for the allocations is that the different programs do not focus on technology *development*, but technology *use*. There is, however, "weak" coordination between Enova and Innovation Norway with regard to bio-energy, and between Enova and NVE with regard to wind, but as the energy policy in general, the innovation focus is almost non-existent.

Gassnova is also part of MoPE's energy policy. It is organized in a way that resembles both OG21 and Enova. It is established to support projects that are "in between" research and commercialization. In practice that means pilot and demonstration plants. It has solid funding and will be run by a secretariat in close cooperation with the RCN, relevant research institutions and business. Gassnova is the main means for achieving the government's goal of establishing an environmentally friendly natural gas power plant, which in practice implies CO_2-handling. In my opinion it is another example of governmental efforts of integrating environmental concerns into innovation policy.

Some of the initiatives I have documented are not visible when reviewing the HEPI/VEPI benchmarks because they are not an integrated part of any policy or *plan* for green innovation. Most of those initiatives are fragmented and limited. Enova's support to

[83] See e.g. Enova's web pages: http://www.enova.no/?itemid=138 (Accessed Feb 23, 2005.)

ScanWind is an example from MoPE, and there are more to be found within the sectoral domain of MoTI. The most interesting finding, however, is that out of all the policy instruments available to the "innovation ministry", hardly any are related to green innovation. Just the fact that Innovation Norway with its NOK 1 billion budget hardly has any activities specifically dedicated to green innovation is sensational. According to MoTI's EPSB for 2004, NOK 312 million were allocated to SND/Innovation Norway projects that contribute to increased eco-efficiency and all projects receiving support have been assessed with regard to environmental issues. The number is certainly high, and the assessment is important although the criteria remain somehow unclear. It has however, been difficult to actually identify the eco-efficient projects, and they are certainly not part of a policy plan. The findings from Innovation Norway are clear evidence that the focus on green innovation is virtually non-existent within MoTI, the ministry responsible for the innovation policy.

In the nineties MoE was responsible for several substantial green innovation initiatives like the program for environmental technology. MoE also financed the Environmental Fund, administered by MoTI and SND. As of the current status, however, I have not been able to identify any initiatives, except for the 2004 NOK 900.000 allocated to Bellona on information activities related to environmental technologies. MoE's focus on environmental technology has surely been declining.

6.4 Concluding remarks

Taking the first part of the definition (i.e. the "thin" version) of environmental policy integration (EPI) and the benchmarks proposed by Lafferty (2004) as a point of departure, the current chapter has, in accordance with research question 2 of the thesis, discussed green innovation policies in Norway and the extent to which Norwegian environmental and innovation policies are integrated. The general conclusion is that the degree of integration between environmental and innovation policies is very low in Norway. The environmental policy contains virtual no references to innovation and the innovation policy contains virtually no references to environmental concerns. MoPE's OG21 have, however, integrated environmental concerns into its core activities. The strategy is not a green innovation policy as such, but I consider the two technology targets of "zero discharges to sea" and "30 per cent reduction of emissions to air" as clear evidence of vertical environmental policy integration into the policy domain of MoPE.

The possibility of pursuing change in terms of strengthened public governance on green innovations without the formal structure of a strategic plan is of course possible, and there are additional fragmented green innovation policy initiatives taking place in the domains of MoTI and MoE. Such 'ad-hoc' approaches are, however, very 'fragile' in the daily workings of sectoral departments – where they must compete on an on-going basis with the dominant interests of more traditional sectoral policymaking – they constitute a point of departure.

In conclusion, MoTI and MoPE seem to have different approaches to innovation and environmental concerns. Whereas a representative for MoTI stated that "it has not been a

goal in itself to highlight certain issues or sectors in the HIP"[84], it is clearly stated by OG21 (in MoPE's White Paper 38 ((2003-2004): 66) on the petroleum activities) that:

> The Norwegian continental shelf has some of the strongest environmental demands in the world. The government should contribute to more environmental research and development because this technology market is limited or takes time to establish internationally. The industry will therefore be reluctant to investment in new environmental technology.

While MoTI appears to be neutral with regard to the *direction* of innovation, MoPE has set targets and taken a stand with at least some preference for environmental concerns, but they do not promote sustainable development.

[84] Telephone interview March 16, 2004.

7 TO WHAT EXTENT DO NORWEGIAN INNOVATION POLICIES CONTRIBUTE TO SUSTAINABLE DEVELOPMENT?

Innovation for sustainable development clearly puts qualitative demands on the innovation process itself. It also puts demands on governance structures for SD. In the case of Gassnova referred to above, the Norwegian government has decided to place environmental concerns "above" economic concerns. A modern natural gas power plant *without* CO_2 handling will yield more energy than a plant *with* CO_2-handling and the CO_2-handling itself will be costly compared to venting the CO_2 into the atmosphere. The electricity generated from the latter will thus be more expensive than the former. In this specific case environmental concerns are given principled priority over traditional sectoral policies, but that is definitely not always the case. When coordinating or integrating different policy fields there will inevitably be situations where policymakers will have to make trade-offs between two or more policy concerns. Especially trade offs between the three pillars of SD – economic, social and environmental – can be highly complex and politically controversial.

In the previous chapter I discussed the integration of environmental concerns into other policy fields by applying what I coined a "thin" version of Lafferty's definition of EPI. In this chapter I will elaborate on EPI in accordance with Lafferty's "thick" EPI definition. The chapter does therefore continue the elaboration on Vedung's fourth step of monitoring.

In Chapter 4 I made an effort to conceptualize green innovation. Although there is no *overarching*, horizontal green innovation policy in Norway there are and have been several *sectoral* (vertical) initiatives aimed at promoting green innovation. This chapter will categorize some of them in accordance with the fourfold typology of green innovation (Table 1, p. 44) with emphasis on the last mode – innovation for sustainable development.

Environmental technology

The initiatives by MoE/SFT and MoTI/SND in the nineties are clear examples of innovation in the *environmental technology* mode. SFT's "Program for Environmental Technology" is a typical example. About 60 per cent of the program's funds were used in a project the goal of which was to develop cleaner technology in Norwegian industry. The balance was offered as grants for the development of environmental technology in particularly pollution-intensive sectors and businesses. A special focus was placed on demonstration and pilot projects promoting radical technical and managerial innovations towards a greening of industry. Another example is SND's "Environmental Fund" established in 1997 and terminated in 2002[85]. Currently I am not aware of any programs aimed directly at innovation in this mode.

[85] Within September 2000, however, most of the funds were allocated (Hartmark Consulting 2003: 5).

Ecological communalism

It is harder to find government programs and initiatives typical for the *Ecological communalism* mode. This is of course due to the overall orientation of a liberal market economy. However, Innovation Norway's investment support to small scale local bio-combustion plants might be considered as an example. In a bigger perspective, however, innovation related to major bio-energy plants replacing fossil fuels could be considered in the sustainable development mode, but there are currently no such initiatives in Norway.

Ecological modernization

The environmental aspects of OG21 are examples of *Ecological modernization*. The overall goal of the long term scenario for the continental shelf is to produce more petroleum in a more cost-efficient manner. OG21 is established to realize this goal. Increased petroleum production will obviously contribute to overall increased green house gas emissions during use of the petroleum. Thus the activities are *not eco-effective*. Fulfillment of the environmental targets, however, will make the production more *eco-efficient*. Another characteristic is the win-win approach of the strategy work. The industry is "voluntarily forced" to innovate, resulting in increased cash return for the companies and the government, while at the same time improving the environment. Parts of the zero-discharges to sea technology do resemble an end of pipe approach, but given that fossil fuels will be dominant at a global scale for at least 50 years to come, cleaner production of petroleum is necessary to protect the environment in the seas. There are several off-shore reservoirs around the globe and development of cost-efficient and eco-efficient technology might lead to more environmentally sound oil exploitation also in the less developed world.

Innovation for sustainable development

The government's energy policy is aimed at the formation of values and based on the goal of a sustainable development (White Paper 47 (2003-2004): 5). Gassnova is the only substantial green innovation effort I have identified which *might,* under doubt, be characterized in the *sustainable development* corner of the four field table. Efforts related to new renewable energy efforts would also fit in this mode, but as noted above, the current programs on e.g. wind energy mainly imply investment support to already established and proven technology. Gassnova is clearly formulated by the government as an environmentally friendly innovation initiative. The prerequisite for Gassnova is that the CO_2 from the energy producing process is not emitted into the atmosphere, so called CO_2-handling.

There are two main streams of technology available for separating CO_2 from the fossil fuel[86]. In the first technology CO_2 is separated from hydrogen before combustion of the natural gas (CH_4); so-called "pre-combustion". Together with nitrogen and vapor the hydrogen makes up a mixture, also referred to as fuel gas, which facilitates combustion in existing turbines. But the hydrogen can also be used "as is" in a future hydrogen society. In the second type of technology the CO_2 is separated after the combustion. The post-combustion technology does not produce hydrogen, but combusts the natural gas as it is

[86] A very good source of information on the issue is "Prospects for CO_2 capture and storage" published in 2004 by OECD in cooperation with EIA.

and then "washes" the exhaust. For both technologies the CO_2 can then e.g. be reinjected in "empty" oil reservoirs on the shelf, used as pressure support to enhance oil recovery or injected in geological formations under the seabed.

Natural gas power plants with CO_2 handling are less energy-efficient than conventional natural gas power plants. Already by choosing an "environmentally friendly" solution, the government has therefore made a choice giving environmental concerns priority over economic concerns. Given that the CO_2 stays where it is deposited, natural gas power plants with CO_2 handling are in my opinion sustainable innovation. One will, however, have to make more difficult choices on technology. Hydrogen and the so called Hydrogen society is one plausible scenario for the replacement of fossil fuels in the future, especially related to transport. But production of hydrogen is very energy intensive and we are far from making hydrogen based on new renewable energy sources at competitive prices. Thus, choosing a pre-combustion plant could facilitate a transition to the hydrogen society, a bold technology choice for a sustainable future.

Norwegian innovation policies contribute to SD to a very little extent. As noted above I have only identified one initiative, Gassnova, which may, under doubt, promote sustainable development. A wide range of technology choices must be made in the future. Somehow most of them will have impact on the environment. Integrating environmental policy demands into existing policy fields requires some sort of substantive norm or guiding principle for realizing the integration in practice. "Given that the political system involves the 'authoritative allocation of values' (Easton 1965), some means must be at hand for authorities to determine 'who gets what, where, when and how?'. Such means can only be provided (in a democracy) by transparent norms for specific allocations and the resolution of policy trade offs. Win-win solutions are a blessing when achieved, but such solutions are in general very difficult to realize, and, when realized vis à vis the environment, usually achieved as a sub-optimal solution for long-term environmental degradation" (Lafferty and Ruud 2004: 25). The Norwegian government does not currently seem to realize how demanding innovation for SD is and there are no governing structures in place for innovation for sustainable development.

8 HOW CAN INNOVATION FOR SUSTAINABLE DEVELOPMENT BE CONCEPTUALIZED AND GOVERNED?

This concluding chapter has three parts: First, it will address the main research question of the thesis by summarizing and discussing my findings related to the three research questions. Second, it will draw some lines on how a green innovation policy for SD can be designed, integrating environmental concerns into all relevant policy fields and assigning principled priority to the environment over other policy concerns. Finally, it will complete the evaluation of innovation for SD in Norway by addressing Vedung's "somewhat unusual" fifth step of the monitoring process, namely an "evaluation of the evaluand" (1997: 138). According to Vedung "The strategy of embedding the particular intervention into a more general system setting is a highly commendable one in evaluation, because it widens the evaluation users' perspectives and enhances their conceptual understanding of the activities" (ibid: 152). I will briefly discuss the implications of my evaluation for the broader governance for SD debate.

8.1 Findings

To answer the main research question – How can innovation for sustainable development be conzeptualized and governed? – I first discussed how innovation for sustainable development could be conceptualized. By cross tabulating the notions of decoupling/recoupling and eco-efficiency/eco-effectiveness I arrived on a four fold typology with the following modes of green innovation: "Environmental innovation", "Ecological communalism", "Ecological modernization" and "Innovation for sustainable development". The typology illustrates that there are "different shades of green" and that all green innovation initiatives not necessarily leads to SD.

The typology explains that there exists an implied, but not adequately expressed, presumption that decoupling involves recoupling. It is important to explain the implications of not only disconnecting drivers from pressures on natural resources and eco-systems, but also of finding ways (or not) of surplus-generating development. Furthermore, the typology challenge the assumption that end-of-pipe initiatives require no compensatory growth-maintaining initiatives; or, that achieving eco-efficiency is the same as achieving eco-effectiveness. Apparently there are different approaches and perspectives on how to integrate environmental concerns into innovation policies. The variety of perspectives is important for assessing the overall costs and benefits of innovation in a much broader normative context. The typology indicates what innovation for SD really implies. Furthermore, it is used as a conceptual backdrop throughout the thesis and as reference when discussing the third research question.

Second, I discussed how and to what extent Norwegian environmental and innovation policies are integrated. This part of the evaluation is related to Vedung's fourth step of monitoring and can be illustrated by the third option in Figure 2 (p. 37), "strengthened

interaction of environmental and innovation policies. Based on what I coined a "thin" version of Lafferty's definition of EPI and guided by Lafferty's HEPI/VEPI benchmarks (in accordance with Vedung's third step of monitoring), I scrutinized white papers, parliamentary bills, directorates and other policy efforts in search for indications of a green innovation policy. The findings were limited. For example: although the national Action Plan for Sustainable Development (NA21) stated that the Plan for a Comprehensive Innovation Policy (HIP) will be consistent with the NA21, HIP does not consider environmental issues at all. The two documents were written and published at the same time and by the same government. Despite this, they have nothing in common at the policy level. The general conclusion is that the degree of integration between environmental and innovation policies is very low in Norway.

There is no *horizontal* coordination of environmental concerns and innovation policies. The environmental policy contains virtually no references to innovation and the innovation policy contains virtually no references to environmental concerns. This is also the case with MoPE. Neither the petroleum nor the energy white papers I assessed addressed any green innovation strategies or efforts that demand horizontal coordination. Furthermore, the OG21 technological innovation strategy is not related to the HIP, although the Minister of Petroleum and Industry has signed the HIP.

There is also surprisingly little evidence of *vertical* integration of environmental policy concerns into the sectoral policies of the "Ministry of Innovation", MoTI. However, MoPE seems to have a slightly different approach. The OG21 strategy for technological innovation in the oil and gas industry has incorporated the two fairly challenging environmental technology targets of "zero discharges to sea" and "30 per cent reduction of emissions to air". Although MoPE does not have a special green innovation plan, I interpret OG21's approach and the recently initiated Gassnova entity as clear evidence of vertical environmental policy integration into the policy domain of MoPE. The findings from MoPE do, however, not challenge the overall impression of weak vertical integration of environmental policy integration into innovation policies. This can be illustrated by the findings from Innovation Norway established to spearhead the Norwegian innovation policy: Despite more than 700 employees and an annual budget of almost NOK 1 billion there is only one small project related to green innovation, and environmental concerns are hardly mentioned in the preliminary version of Innovation Norway's strategy plan (Innovation Norway 2004).

There are some fragmented green innovation policy initiatives taking place in the domains of MoTI and MoE. Such 'ad-hoc' approaches are, however, very 'fragile' in the daily workings of sectoral departments – where they must compete on an on-going basis with the dominant interests of more traditional sectoral policymaking. It must also be noted that the Research Council of Norway is supporting some green innovation initiatives. That is however, not sufficient to alter the impression of a very weak vertical integration of environmental concerns into innovation policies. In conclusion: the integration of environmental and innovation policies is very weak, both horizontally and vertically.

The third research question addresses the extent to which Norwegian innovation policies are contributing to SD. This is a continuation of my respond to Vedung's fourth step and can be illustrated by the first option in Figure 2 (p. 37). To discuss the third research question, I related my empirical findings to the four-fold typology of green

innovation. The exercise illustrated the different shades of green innovation represented by (the relatively few) Norwegian green innovation efforts. I further showed that only one public policy initiative, Gassnova, might be considered as an initiative for green innovation for SD. Innovation efforts related to new renewable energy would also most probably qualify for a place in this mode of green innovation, but as discussed earlier, except for basic research financed by the RCN there are few innovation efforts in place to promote new renewable energy in Norway. (Enova's efforts on wind energy are primarily related to investment support for proven technology). My conclusion on the third research question is thus that Norwegian innovation policy contributes to SD to a very little extent.

In sum: Norwegian environmental and innovation policies are only integrated to a very little extent. There is virtually no horizontal coordination of a green innovation policy. The vertical integration I have been able to detect is found in the Ministry of Petroleum and Energy, not the Ministry of Trade and Industry, responsible for the innovation policy. Furthermore, grounded in the four-fold typology of green innovation I developed, the only green innovation effort that *might* promote a SD is Gassnova. Based on Lafferty's definition of EPI the main conclusion of the evaluation is that Norwegian environmental and innovation policies are integrated to a very little extent in order to promote SD. Consequently there is significant room for improvement. In the efforts of achieving SD a green innovation policy can be a highly relevant, highly necessary and broadly applicable instrument for change.

8.2 An innovation policy for sustainable development[87]

The thesis has discussed integration of environmental concerns with regard to process and output. The extensive documentation provided has clearly indicated that there is very weak integration between environmental and innovation policies. Except for the initiatives by MoPE there is currently no such thing as a green innovation policy in Norway. In accordance with my theoretical and analytical approach, a logic consequence of integrating environmental concerns into innovation policies would be to strengthen horizontal governance (HEPI) and vertical governance (VEPI). This section will first elaborate on these dimensions and outline a green innovation policy for sustainable development. Finally I discuss the implications for innovation policy design and for solving actual trade offs at the sectoral level if environmental concerns are assigned principled priority.

8.2.1 A strengthening of horizontal governance

Achieving greater cohesion through horizontal governance means that policy efforts must be coordinated and funding allocated. A first and very important measure would be to *develop a Green Innovation Action Plan* (GIAP) for Norway that is compatible with other national policy efforts such as the National Action Plan for Sustainable Development (NA21) and the Plan for a Comprehensive Innovation Policy (HIP). It is further important that the OG21 initiative is compatible to the plan. Given that the goal is

[87] As noted in section 2.3 above, parts of section 8.2.1 and 8.2.2 have been published in Ruud and Larsen (2004).

to contribute to SD, such an effort would have to be more "radical" than the efforts undertaken in the EU with regards to the Environmental Technology Action Plan (ETAP).

I will not propose specific content for such a green innovation action plan. It is important, however, that it includes aspects of governance and that it addresses how actual activities of, for instance, a greening of industry, could be managed by various ministries and directorates. It is further important that an eventual plan be integrated and coordinated with other efforts undertaken by the Government to strengthen the national innovation policy.

A central authority specifically entrusted with the supervision, coordination and implementation of green innovation policy should be established. The authority should primarily be located at a high political level – e.g. the Prime Minister's Office – to ensure policy integration, allocation of resources and a stable and long-term commitment to the task of promoting green innovation in Norway. The central authority for green innovation should be closely cooperating with the committee coordinating the National Action Plan for Sustainable Development (NA21). A strengthening of green innovation should be a crucial and necessary concern of a body entrusted with the task of strengthening SD. By strengthening governance for green innovation, the NA21 committee could make a significant contribution to the strengthening of SD in Norway – integrating economic, social and ecological improvements.

As part of these efforts a *communications plan* stipulating sectoral responsibility for *overarching goals* on green innovations should be worked out by the central authorities. Further, *timetables and targets* for the green innovation policy should be developed and periodical *reporting* of progress with respect to targets at both the central and sectoral levels should be carried out, preferably in accordance with the National Environmental Monitoring System (NEMS). Finally, it is important to promote an active and monitored usage of *assessments* for all governmental policies related to green innovation. This should be a crucial task for the high-level committee entrusted with the challenge of horizontal governance for green innovation.

8.2.2 A strengthening of vertical governance

The *central authority* specifically entrusted with the supervision, coordination and implementation of green innovation policy referred to above would, however, only be capable of making broad strategic decisions on policy priorities and assuming overall responsibility for the efforts. Fulfillment of the actual objectives of a green innovation plan also requires vertical, and more "hands on", governance initiatives.

This "hands on" coordination could be achieved by establishing a *green innovation committee* consisting of public servants from relevant ministries and directorates. Acting as a clearing house and coordinating body for the policy instruments in use, it should be capable of covering the whole innovation chain from invention to diffusion, and it could build up valuable expertise and experience on green innovations. It is important that the committee operates with transparency and predictability, and – most crucially – with long-term financial and other resources at its disposal. The committee should also involve some sort of stakeholder management, and act as a secretariat, forum and meeting place for discussing, presenting and getting feed-back on actual green innovative efforts taking

place in society. Acknowledging that innovation is not a linear process, there must be guidelines and goals, but also considerable room for creativity and unorthodox ideas and solutions.

A green innovation policy plan with central government responsibility for coordination and control could more effectively make use of financial, organizational, technological and human resources in the search for both development and diffusion of green innovation towards SD. This could enable a strengthening of vertical governance, not only through new policy efforts but, also with reference to already existing policy instruments.

8.2.3 Principled priority and innovation for sustainable development

If Lafferty's "thick" definition of EPI – and thus giving the environment principled priority over "other" policy concerns – is applied, it is clear that the overarching goal of the horizontal and vertical initiatives referred to above should be to realize the fourth field of the four-fold typology of green innovation: innovation for SD. This will have implications on at least two levels: 1) when designing innovation policy instruments, and 2) to resolve possible trade offs between environmental and other policy concerns at the sectoral level.

First, the authorities responsible for green innovation must, whenever possible, design policy instruments that aim at contributing to SD. The evaluations of the wide variety of policy options available at any time will have to take into account the carrying capacity of Earth as the primary evaluation criteria. The central aim will be to turn the overall innovation policy in a more sustainable direction. However, in many cases it will be practically impossible to strive for the green innovation for SD mode. The implications of Lafferty's full EPI definition would anyway be that whenever possible, the policy instruments should be designed to promote innovation for SD.

A policy designed to promote green innovation can for example be illustrated by the *SkatteFUNN*-scheme, which currently does not promote a certain "direction" of innovation. Here between 18 and 20 per cent of costs related to company R&D activities is reimbursed as tax deductions. It would be possible to increase the rate of deductions by, for example 5 or 10 per cent if environmental improvements could be documented. This would be a relatively cheap alteration of an existing instrument and it would show that there is political will to reward those who want to improve existing products, or develop new products that are more environmentally sound. Such an increase in tax deductions would encourage companies to promote environmentally sound solutions, and to focus their research and development in a more sustainable direction. The Pollution Control Authority should be able to verify actual improvements in these areas. If companies choose not to apply for extra tax deductions by developing environmentally friendly solutions, the scheme will not imply extra costs for the government. One could also expect that projects that are clearly environmentally harmful would not be eligible to tax deductions.

Second, at the sectoral level, the same reasoning will apply. The executive officers responsible for the actual approval of applications to the various public innovation programmes and initiatives will have to give priority to projects which can contribute to promotion of SD or at least projects more eco-efficient than the competitors. *SkatteFUNN* can again serve as an example: If there is no change in the incentive structures in the scheme, like the one outlined above, one cold picture a situation where the executive

officers had to decide who should be eligible for grants. If the reasoning of giving principled priority to environmental concerns was applied, this would imply that the officer in question would have to give preferences to environmentally sound projects, probably regulated by certain guidelines to ensure equal treatment of the applications. The guidelines will necessarily vary from policy field to policy field and also change over time. It is therefore impossible to suggest guidelines, but the overarching principle for the guidelines is in place.

8.3 Evaluation of the evaluand – Implications for the debate on governance for sustainable development

This last section concludes my evaluation and offers "some general observations on the governance situation the intervention under scrutiny is a part of". It is thus in accordance with Vedung's fifth step of monitoring (Vedung 1997: 155). What are the implications of my evaluation for the broader debate on governance for sustainable development? I will take the OECD (2002b) checklist on "Improving policy coherence and integration for sustainable development" as point of departure to address the question. This brief discussion will also shed some more light on the prerequisites for a green innovation policy, and some indications on why there is not an innovation policy for SD in Norway.

OECD has been an important reference for the thesis with regard to the issue of decoupling. Furthermore, OECD has clearly taken the lead in providing empirically based prescriptive knowledge on the challenge of strategic sustainable development implementation and innovation and the environment (e.g. OECD 2000; OECD 2001; 2002a; Lafferty 2004c). According to a checklist on "Improving policy coherence and integration for sustainable development", the criteria presented (OECD 2002b: 5):

> … constitute some of the fundamental elements that need to be borne in mind when assessing institutional and decision-making practices for sustainable development (…) The guiding principle in the design of these criteria is improving policy coherence and integration. In this context, effective implementation of sustainable development goals requires:
>
> – A common understanding of sustainable development
> – Clear commitment and leadership
> – Specific institutional mechanisms to steer integration
> – Effective stakeholder involvement
> – Efficient knowledge management

To further cumulate knowledge on governance for SD I will in the following discuss the implications of my evaluation to the three first points of the checklist.

With reference to the first point of the list I have elaborated on a common understanding of *innovation for* SD. The four fold typology of green innovation indicates how demanding innovation for SD actually is, i.e. the *"differentness" of innovation for SD*. It must be made clear, however, that the typology is not the only approach to operationalize innovation for SD or differentiate approaches to green innovation. But: Except for a few contributions to the issue (Lafferty and Ruud 2004; Lafferty, Ruud and Larsen 2004), I have not found any efforts to clarify the concept of innovation for SD in the terms I have done in the thesis. Although my findings do not indicate whether or not the concept of innovation for SD is clearly understood by the public or across

government, it is clear that the issue has not been addressed by the Norwegian authorities in any of the relevant policy documents published the last two decades.

Not even EU's ETAP (which outclasses any public Norwegian efforts to get closer to the issue) is clear on the issue: Green innovation was put fairly high on the agenda when the Commission released the ETAP – of which the full title is "Stimulating Technologies for Sustainable Development: An Environmental Technologies Action Plan for the European Union" – in January 2004. The Plan gives a clear mandate for green innovation in the EU and aims to "implement the EU Sustainable Development Strategy and to pursue the Lisbon Strategy, while also helping the developing countries" (EU Commission 2004a: 3). Thus there is a "commitment to joining innovational efforts with environmental concerns; a commitment which is very ambivalent as to how a balance between the two tasks should be achieved. This ambivalence is most crucially manifest in the political challenge to reconcile an increasingly obvious conflict of priorities between the Lisbon and Gothenburg strategies for European development" (Lafferty, Ruud and Larsen 2004). However, as noted in chapter 4 the definition of green innovation in the ETAP is not necessarily pointing towards innovation for SD. The implications of my evaluation also indicates that clearer guidelines and principles as to reconcile the conflict between the goals of the Gothenburg and Lisbon strategies must be addressed if SD is the goal.

I will argue that my findings related to the typology add weight to the first OECD criteria for effective implementation of SD goals, namely that there must be a common understanding of innovation for SD. A thorough understanding of the different shades of green can be useful for policy makers and business leaders alike.

The second point on the OECD checklist, "Clear commitment and leadership", is even more relevant for the findings of the thesis. That political will is crucial is not a new insight in policy research. Related to the EPI discourse e.g. Andrew Jordan's analysis of EPI in the UK illustrates the point. Inspired by an analogy of Weale (1993: 214), Jordan (2002: 36) differentiate between "the necessary 'hardware' (that is, the organizations and procedures of governance) needed to coordinate policy across the various strands of government activity, and the intellectual 'software' (that is, the knowledge needed to implement EPI) to make the government machine run in a more environmental direction". According to Jordan both prerequisites are in place in the UK, but "EPI is manifestly failing to permeate the 'core' areas of government activity". One of Jordan's main explanations for the lack of integration is that it is not backed by the "core executive" (the prime minister and his/her cabinet). According to Jordan *Political will* "is the vital catalyst – the electricity, so to speak – which energizes the hardware and the software of the government to work in pursuit of sustainable development. Without it, the UK has foundered on the rocks of interdepartmental wrangling. Simply put, EPI has failed to advance as far as one might have expected in the UK because a succession of governments has seen no political reason to promote it."

The point is also made by Lundqvist (2004: 116ff) who argue that the rather successful SD initiatives in Sweden and the Netherlands can particularly be explained by the fact that governments in both countries sought and achieved parliamentary backing for their programmes. There was political will to SD commitment. Lundqvist also speculate on that much of the commitment manifest in the two systems can be related to Sweden and the

Netherlands being two small European corporate democracies[88] with unitary political systems, making the number of possible veto points relatively few.

However, Norway is also one of the small European states, and in the immediate aftermath of the Rio Summit Norway was a clear frontrunner on several aspects of SD. That changed gradually and by the turn of the century Norway was evaluated as "reluctantly carrying the torch" (Langhelle 2000). Norway has some of the hardware necessary for EPI (NEMS and EPSB as I will return to shortly) and there is clearly also software available, but the *electricity* Jordan refers to seems to be lacking, especially when it comes to innovation for SD. I believe that my evaluation clearly illustrates that political will is essential, especially when implementing SD, an issue that does not have broad public support and is dependent on "outside-in" prescriptive politics (Lafferty 2004c: 339, 346). Talk is cheap in politics. MoTI's Parliamentary Bill 51 (2002-2003), for instance, refers to SD as one of four main goals in the government's economic policy, but SD is not further mentioned or treated in the Bill. Furthermore, in MoTI's EPSB for 2004 it is stated that one of three central aims of the Ministry's environmental policy is to *"To contribute to the development and use of environmentally friendly technology, products and services"* (MoTI Parliamentary Bill nr 1 (2003-2004)). But this initial statement is not followed up. Talk is certainly cheap, but the efforts of MoPE, with regard to OG21 and Gassnova, illustrate how environmental concerns can be integrated into other policy fields. This said, there are also several examples of initiatives where the MoPE has not integrated environmental concerns.

In general, there seems to be a clear lack of commitment and leadership to promote innovation for SD in Norway, a finding which backs up the relevance of the second OECD criteria, Jordan's findings on EPI in the UK and Lundqvist's study of Swedish and Dutch experiences. The current lack of political will also seems to be the most obvious reason for the weak integration of environmental concerns into innovation policy in Norway.

Regarding OECD's third criteria "Specific institutional mechanisms to steer the integration", the evaluation has clearly documented that there are no mechanisms in place to integrate environmental concerns into the innovation policies in Norway. Furthermore, in the EPI framework as outlined by Lafferty, such mechanisms are clearly seen as prerequisites for actually implementing EPI in real life. There are, however, general institutional provisions for EPI in place in Norway. Both the National Environmental Monitoring System (NEMS) and the Environmental Profile of the State Budget (EPSB) are established to integrate environmental concerns into other policy fields. However, as showed elsewhere both provisions are "well thought out systems in theory, but without the necessary administrative and political follow up to realize the potential for strengthening EPI" (Lafferty, Larsen and Ruud 2004). Both systems have a potential for improvement and, as for the issue of this thesis, none of them are really concerned with innovation for SD.

Green innovation strategy or not, MoPE's OG21 can again be used as an illustration, this time on how important institutional mechanisms are for integrating environmental and innovation concerns: With regard to the OG21 there seems to be a will to integrate environmental concerns and innovation: it has very clearly pronounced environmental

[88] See e.g. Katzenstein (1985: 32ff)

goals, it is supported by the relevant actors in the sector, it has a professional secretariat, has a budget for integration and funding of the plan, and business representatives responsible for the lead parties' work on each of the technology targets. It seems to be an example of a very thorough, robust and systematic way of integrating a strategy. If there were similar strategies in place aiming at innovation for sustainable development the Norwegian government would have highly relevant, highly necessary and broadly applicable instruments for change.

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