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Voluntary Agreements – Implementation and Efficiency

# The German Country Study

An evaluation of the updated Declaration of German Industry on Global Warming Prevention (1996)

Case studies in the sectors of cement and glass

A Study under the VAIE project (Task C, Germany) funded by the European Commission, DGXII (JOS3-CT97-0021)

Wuppertal January 2000

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# Preface

This country report was prepared as a part of the VAIE project (Voluntary Agreements – Implementation and Efficiency), coordinated by AKF - Institute for Local Government Studies, Copenhagen. The VAIE project investigates the conditions under which voluntary agreements can be expected to achieve environmental targets in an efficient way. This has been carried out through developing models based on economic theory, empirical country case studies of voluntary agreements in five countries, an analysis of the actual outcome of the voluntary agreements in relation to the baseline, and finally an analysis of the role of EU vis-à-vis the Member States regarding execution of voluntary agreements in Member States and at EU level.

The German country case study performs an empirical analysis of the "Declaration of German Industry on Global Warming Prevention (DGWP)" in its updated version of 1996. We like to thank all our interview partners for their cooperation and open communication, and it has to be stressed that all interpretations and conclusions of this report solely express the view of the authors.

Furthermore, the authors are grateful for research funding received from the European Commission under the JOULE Programme (contract JOS3-CT97-0021), and wish to emphasise, that views expressed in this report are their own, and should in no way be interpreted as representative of the European Commission.

Wuppertal, January 2000

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# EXECUTIVE SUMMARY

## Background

Due to the complexity of dynamic economic and social systems, there won't be any "golden key" to the challenge of shaping sustainable energy and production systems. Growing knowledge and changing frame-conditions will constantly impose the need of a search for better solutions and new opportunities. In this context, **climate and energy policy strategies represent not only (static) problems of policy choice but above all dynamic search and learning processes how to design effective policy mixes**. Corresponding to the multitude of factors of influence and impact mechanisms, policy strategies need to comprise legal and fiscal instruments to generate supporting framework conditions as well as targeted programms in the field of R&D, market transformation, information, education, dissemination of best-practice, etc. Within such learning processes, approaches which draw on flexibility, communication and multi-lateral cooperations are of special interest, and especially voluntary agreements have increasingly gained importance as a new type of industrial energy policy instruments in Europe and worldwide. Looking at one prominent example of industrial climate protection agreements in Europe, this study examines the "Declaration of German Industry on Global Warming Prevention (DGWP)" in its updated version of 1996.

## The declaration of German industry on global warming prevention (DGWP)

After first negotiations on energy related voluntary agreements in the early 90‘s, the DGWP initative was launched by the German government a few weeks before the first conference of the parties (COP1) to the UN-FCCC in Berlin in March 1995. Triggered by an urgent need to present national activities to the international public, the preparation and negotiation phase of the first version of the DGWP (BDI 1995) was characterized by extreme time pressure, and a sound assessment of potentials and baselines did not take place. The first version received strong criticism, and a partially updated version was published in March 1996 (BDI 1996a). From there on, no further corrections have been made to the declaration and the related procedures.

The DGWP is published as an umbrella declaration by 18 industrial associations mainly from the basic industries and the energy sector, and it covers approx. 70% of industrial energy consumption and almost all public electricity generation. The DGWP of 1996 expresses the industry‘s willingness to undertake extraordinary efforts on a voluntary basis in order to achieve a reduction of 20% of the total industry's specific energy consumption and/or of specific $CO_2$ emissions until the year 2005 (base year 1990). Under the umbrella declaration, the participating branch associations published their own declarations with branch specific targets.

In exchange for their unilateral declarations, the industrial associations expect that policy will give priority to these voluntary initiatives against other regulatory or fiscal climate policy instruments. In 1995 the federal government announced via press release the withdrawal of plans to introduce a waste heat ordinance and promised an exception from a possible European energy tax. This intention was clarified and assured in 1996. Neither the declaration nor the political reply provide any legal commitment. The implementation of the DGWP takes place entirely under the self-responsibility of industry, and the branch associations are in charge of implementing their declaration. However, a formal obligation such as a firm by firm letter-of-intent does not exist, so that there is no formal power to enforce concrete action on the firm level.

The Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI, Essen) was entrusted to carry out an annual sector-by-sector monitoring on the basis of progress reports provided by the branch associations. As far as possible the self-reported data is checked against official statistics; however, an independent data collection and auditing does not take place.

**Findings and conclusions**

The "Declaration of German Industry on Global Warming Prevention (DGWP)" represents a new type of instrument in the climate policy debate in Germany. The initiative takes a first step towards more flexibility and responsibility of industry within national GHG abatement efforts. Considering the opportunities but as well the problems and risks related to the introduction of the new approach, the political value of the initiative has to be judged by two core questions:

- Does the instrument generate additional and satisfying effects on energy efficiency and GHG mitigation in industry, and are the results achieved in an efficient manner?
- Does the DGWP provide the preconditions for self-maintaining learning and improvement processes, which eliminate conceptual and practical deficiencies, and ameliorate the instrument's performance?

From our empirical analyses we derive the following conclusions:

Although the umbrella declaration promises to achieve its own targets defined in the various sectoral declarations, the performance of the instrument is characterized by **weak impacts on industrial energy consumption**. Especially in the energy intensive sectors, low effects can be found with regard to the most decisive driving forces of industrial energy consumption such as strategic investment planning, changes in material flows and resource inputs, or technology innovation activities. Greater effects can be observed with regard to soft factors such as intra-sectoral communication, climate change related awareness and strengthening of existing energy management schemes. Hence, the DGWP promises to generate mainly indirect supportive effects to improve future energy saving activities. Its particular strength can be seen in its contribution to communication and cooperation within and among companies. Whereas the DGWP itself hardly provides incentives to adapt strategic investment decisions, the related activities ameliorate industry's capacities to contribute to future challenges of climate policy. In addition to the limited impacts on energy consumption and GHG emissions, the DGWP process - and especially the monitoring scheme - suffers from **methodological and administrative problems**, e.g. concerning divergences between official statistics and internal branch data, incompatible target definitions etc.

Considering these flaws identified in the conceptual approach and in the current implementation practice, the **aspect of learning and policy development is of utmost importance**. However, within the time period studied (1996 until the end of 1999), neither the declarations nor the monitoring scheme have been officially revised although a broad range of problems emerged from the start. The further success of the initiative will depend on all actors' ability to find quickly substantial solutions to these problems and to establish a lasting momentum of improving the policy approach. As a starting point, monitoring experience clearly emphasise the need for revision and modification of the scheme in terms of target definitions, data collection, analytical methodologies, quality of self-reporting, etc.

In this regard, the **DGWP process is characterized by a lack of political guidance and insufficient process management**. Without questioning in principle the potential and benefits of flexible and decentral policy implementation by industry, the ultimate responsibility for defining and enforcing targets as well as for keeping time schedules rests with the government. Accordingly, a clear cut procedural framework is needed which specifies more precisely tasks, responsibilities and qualities of interactions in order to avoid delays, losses of time and tactical behaviour. First of all, this concerns the role of the monitoring scheme which has to be strengthened both as an information system for assessing industrial performance as well as an evaluation tool for a continuous improvement of the approach and of the underlying policy strategies. The latter would require the pre-definition of procedures, criteria and policy alternatives to react in a foreseeable and reliable manner on the monitoring results. The objective should be to create a conceptual framework for cooperation and for the political response to activities under the responsibility of industry itself while eliminating the risk that nothing happens until the end of the validity period in the year 2005.

When summing up our observations, the basic question whether the declaration represents an effective and efficient extension of the climate policy mix cannot be answered yet. The declaration of German industry offers new opportunities to support energy efficiency and GHG abatements activities, especially through enhanced communication and inter-firm cooperation. Moreover, in principle it represents an opportunity to establish an interactive framework for managing the policy process and for exploring the scope for sustainable energy use in industry.

At the moment, however, this chance is far from being taken because the approach is applied in a traditional, quite static manner only as a means to block other policy alternatives. In order to utilize and to strengthen the unique but still hidden potential of the DGWP, therefore, industry and policy will have to emphasise much stronger the dynamic character of the scheme. Already existing possibilities to improve the declaration and the monitoring scheme have to be used. Intentions and announcements need to be turned into a dynamic framework of industrial climate policy which enforces ambitious targets and which strengthens the integration of participating companies into effective monitoring, evaluation and learning loops - otherwise the initiative risks to result in a decade of missed chances.

# 1 Introduction and conceptual background

Searching for a path to sustainable development, the global community faces serious environmental, social and economical challenges. Among these, the urgent need to increase energy and resource efficiency drastically, to change industrial structures and to move towards new, less resource demanding lifestyle patterns in the European industrialized countries represent tasks of outstanding importance (Sachs et. al. 1998). In this situation energy and climate policy will hardly be able to achieve success by employing a single, smoothly working instrument which is easy to implement. Due to the complexity of dynamic economic and social systems, there won't be any "golden key" to the challenge of shaping sustainable energy and production systems. On the contrary, policy will always have to live with unavoidably sub-optimal solutions. Growing knowledge and changing frame-conditions will constantly impose the need of a search for better solutions and new opportunities. Starting from this introductory reflection, we understand **climate and energy policy strategies not only as a (static) problem of policy choice but above all as search and learning processes**, which build on continuous iterations of trial, error and revision. Accordingly, policy approaches which draw on flexibility, communication and multi-lateral cooperations are of special interest for policy-making, and especially voluntary agreements have increasingly gained importance as a new type of industrial energy policy instruments in Europe and worldwide.

Looking at one prominent example of industrial climate protection agreements in Europe, this study aims to transfer the dynamic perspective of policy analysis to the "Declaration of German Industry on Global Warming Prevention (DGWP)" in its updated version of 1996.

## 1.1 The VAIE Project

This study is part of the European research project VAIE (Voluntary Agreements - Implementation and Efficiency), which conducts empirical country case studies on energy related voluntary agreement schemes in industry in five European countries (Denmark, France, Germany, Netherlands, Sweden)[1]. It is the basic research objective of the project to undertake a comparative analysis with regard to the interdependencies and relations between the voluntary initiatives on the national or sectoral level on the one hand, and energy efficiency and CO2 mitigation measures on the firm level on the other. The VAIE project was guided by the following generic research questions[2]:

- What are the characteristic features of the respective agreement schemes in the five countries, especially with regard to the implementation and administration practice?

1 The VAIE - Project is funded under the 4th framework's JOULE programme (JOS3-CT97-0021).

2 For a more detailed description of the conceptual frame of the VAIE Project see Kræmer, Hansen 1999.

- What are the decisive influencing factors and driving forces for energy efficiency and CO2 mitigation in industry , and what impacts of the voluntary agreements on industrial energy use and CO2 emissions can be observed?
- What is the future role of voluntary agreements in industry within energy and climate policies on the national and EU level?

## 1.2 The German country case study

Depending on the actors involved in the German declaration, the research issue of our country case study is a complex of interdependencies between three levels:

- the DGWP as the umbrella agreement scheme on the national policy level, i.e. the policy context;
- the different sectoral voluntary agreements on the level of industrial branch associations, i.e. the intermediate sphere of the collective commitment which links individual action with the national policy level;
- the concrete energy efficiency activities undertaken on the company level by the member firms of the sectoral association.

The German country study aims to provide background information for the comparative analysis of the five schemes (Krarup, Ramesohl 2000). The primary emphasis, however, will be put on the second generic research question, above, related to the impact of the German scheme on industrial energy consumption, and to the third research question concerning the future role of voluntary agreements in policy. With respect to the latter, the analysis investigates the process nature of the scheme. From the introduced dynamic perspective, it is of special interest to asks for the inherent opportunities and built-in driving forces of the initiative which allow for a self-dynamic evaluation, improvement and development of the scheme. Hence, the study is centered around two focal points:

- What are the strengths and flaws of the instrument with respect to its current implementation practice and its effects on GHG mitigation in industry?
- Does the DGWP provide the mandatory preconditions for self-maintaining learning processes in climate policy, and what is needed to improve the process of GHG mitigation in industry?

## 1.3 Methodology

The VAIE project follows an empirical approach for investigating the implementation practice of voluntary agreements and combines five country studies of national agreement schemes, which differ significantly in terms of their basic political philosophies, underlying strategic approaches, administrative concepts, implemention practices, etc. Hence, general criteria for analysis and assessment had to be defined in order to ensure the validity of the international comparison while taking into account the similarities as well as the distinct differences between the national approaches. The common framework for the five country studies was elaborated under Task B of the VAIE project (Kræmer, Hansen 1999), which provided the background structure for the characterization of the voluntary agreement schemes and the evaluation.

It has to be noted, however, that in all country case studies the common framework had to be slightly modified and adapted to the national specificities such as the techno-economic specificities of sectoral energy use. Furthermore, triggered by the sectoral approach of the German scheme, special attention was given to the interactions between the national policy level and the sectoral associations as the main player in the policy game. Hence, the study describes sector case studies rather than single company case studies.

**Two sector case studies**

The German country study builds on two sector case studies which were selected commonly by the VAIE project team. In addition to the glass industry, which takes part in the agreement schemes in all five countries, in the German case study the cement industry was selected as a specific example of a sector looking back on a long tradition of collective action.

**Interview concept**

Starting from first evidence taken from available official documents, monitoring reports, existing studies etc., interviews were conducted with 25 actors from the policy, association and company levels who participated in the DGWP process (see Tab. 8.2 in the annex). Their roles ranged from the design and administration of the scheme in the national policy as well as daily energy management on the company level. The questioning helped to fill information gaps - but even more importantly, it allowed to identify and to describe subjective experiences and interpretations of this new policy instrument by the various actors in industry and policy.

For the case studies, a semi-structured interview concept was developed, i.e. the discussions with the actors were based on an interview guideline which defined only the core topics and the general outline of the questioning. This allowed for flexibility and an open discussion with the partners, and gave them the possibility to introduce new aspects into the debate.

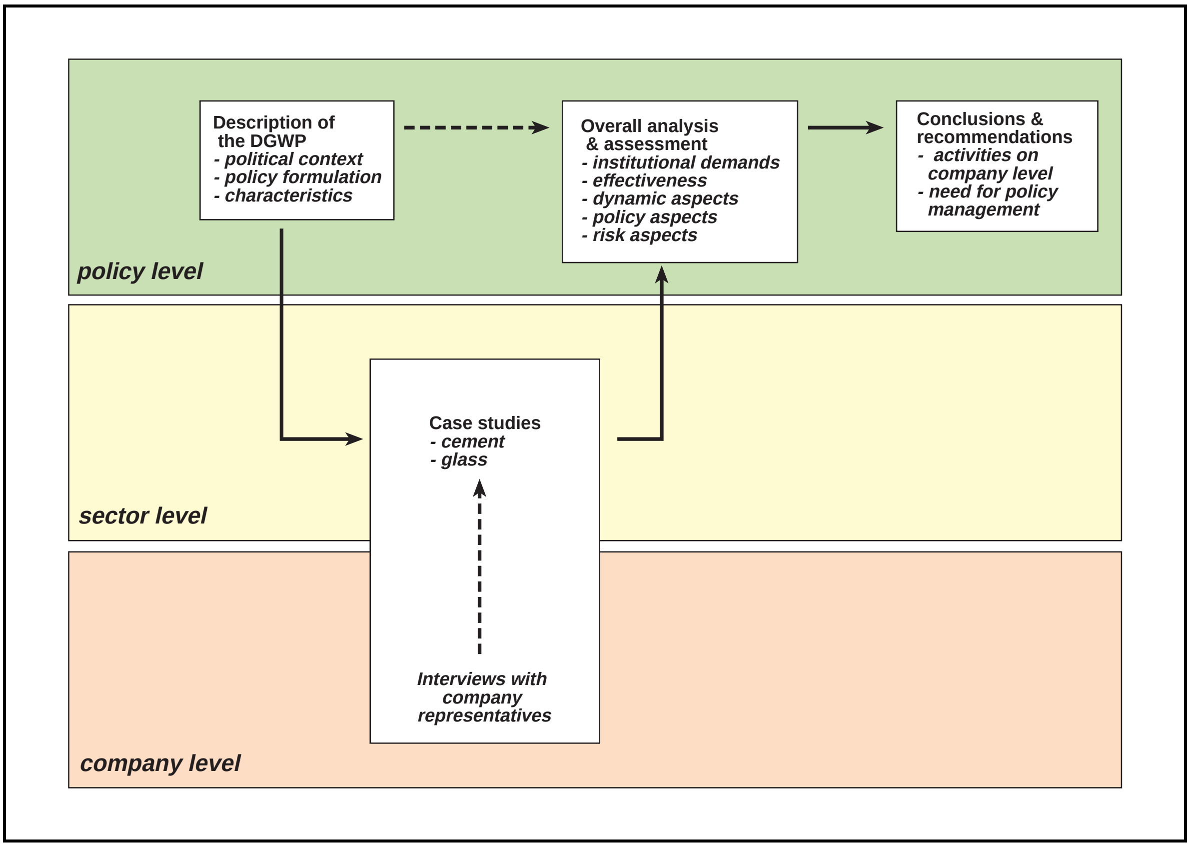
## 1.4 The structure of the report

The structure is depicted in Fig. 1. In the next Chapter 2 the DGWP is presented and described with regard to the policy context, the stage of policy formulation and negotiation and its characteristic features.

According to the umbrella concept, the administrative part of the implementation of the national scheme takes place at the sectoral level. The two case studies are presented and analysed in Chapter 3, and they provide the empirical material for an overall analysis of the agreement scheme in Chapter 4. Here, a general assessment is carried out based on five evaluation criteria (institutional demands, environmental effectivenes, dynamic aspects, policy aspects, risk aspects) set by the common framework.

Conclusions drawn from the analysis will be applied to recommendations for modification and revisions of the DGWP (Chapter 5).

Fig. 1: Structure of the country report



# 2 Description of the declaration of German industry on global warming prevention (DGWP)

## 2.1 The context of recent German energy and climate policy

In 1994, by cabinet decision the German government refined and confirmed the national CO2 mitigation programme which aims at achieving a reduction in energy related CO2 emissions by 25-30% by 2005 compared to 1987 levels. At the first Conference of the Parties to the UNFCCC in Berlin, March 1995, Chancellor Kohl reaffirmed the national commitment and defined a modified target of a 25% reduction within the period 1990 to 2005. During the time before the DGWP, the federal government's measures to reduce energy consumption and related CO2 emissions had emphasised the building sector and the promotion of renewables, whereas a distinct strategy for industry had been missing (Enquete 1995, 152). In this context, industrial energy and climate policy in Germany during the first half of the 1990's was characterized by three dominating topics:

- Coordinated by the Ministry for the Environment (BMU), the federal government discussed an **ordinance for a mandatory auditing and recycling of waste heat** in the industrial and energy sector (Wärmenutzungsverordnung WNVO, UBA 1992). Although the WNVO never reached the stage of official decision, it represented a serious threat to industry, and was therefore heavily opposed and criticised, especially with regard to the bureaucratic approach, the related administrative burden, and the perceived incompatibility to the specific uses of industrial heat.

- Since autumn 1991, the introduction of an EU **energy and CO2 tax** has been discussed with changing intensity, and the implementation of an ecological tax scheme, either on the EU level or as an isolated national initiative, has remained a topic in the political discussion. In April 1999, a national ecological tax reform was finally introduced by the new German government such as it had already taken place in other Europan countries (Tab. 1 next page)[3]. The tax revenues are recycled through a reduction of payments for social security. Manufacturing industry in general pays reduced rates of 20% of household rates, and the maximum tax payment is limited to 120% of the labour cost refunds.

- Corresponding to the EU activities concerning the internal market for energy, the topic of **liberalization of energy markets** and more competition in the monopolistic energy sector was constantly pushed by industry in order to achieve a reduction in electricity and gas prices. Especially in the second half of the 1990's, the question of internationally competitive energy prices became the ruling issue for industrial energy politics. At the end of April 1998 the new Energy Act was adopted, which enforced a comprehensive deregulation of electricity markets, resulting in a remarkable decline in industrial electricity prices (VIK 1999).

3 For a desription of the tax scheme and a first assessment of the tax burden per sector, see Hillebrand 1999, DIW 1999

Tab. 1: Energy tax rates in Germany

| type of energy | unit | tax rate before April 1999 | increase 1999 - 2003 | | | | total tax rate in 2003 | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | total (accumulated) | | | 1.step in April 1999 | | | |
| | | (Pf/unit) | Pf/unit | DM/GJ | DM/t$CO_2$ | Pf/unit | Pf/unit | DM/GJ | DM/t$CO_2$ |
| coal | kg | - | - | - | - | | - | - | - |
| heavy oil (heat)[1)] | kg | 3,00 | - | - | - | | 3,5 | 0,85 | 11 |
| heavy oil (power)[1)] | kg | 5,00 | - | - | - | | 3,5 | 0,85 | 11 |
| light oil | litre | 8,00 | 4,00 | 1,12 | 15 | 4,00 | 12,00 | 3,37 | 46 |
| natural gas | kWh | 0,36 | 0,32 | 0,89 | 16 | 0,32 | 0,68 | 1,89 | 34 |
| electricity[2)] | kWh | - | 4,00 | 11,11 | 71 | 2,00 | 4,00 | 11,11 | 71 |
| petrol | litre | 98,00 | 30,00 | 9,27 | 129 | 6,00 | 128,00 | 39,5 | 549 |
| diesel oil | litre | 62,00 | 30,00 | 8,38 | 113 | 6,00 | 92,00 | 25,71 | 347 |

Source: DIW 1999, 653

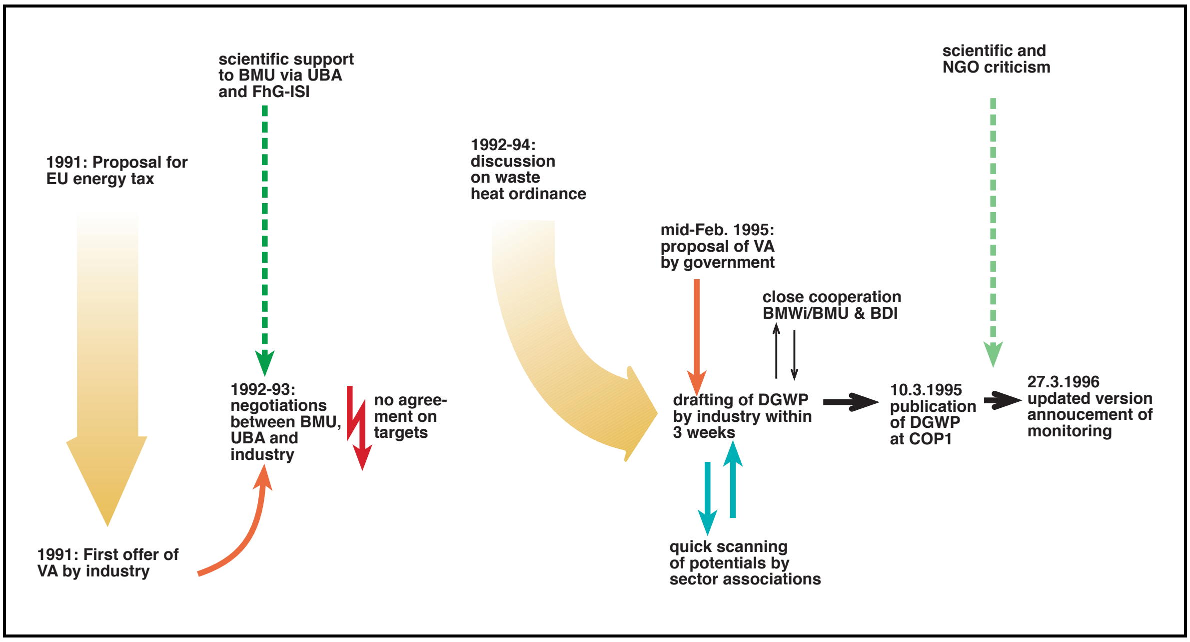
1) from 2000 a unified fuel tax rate for heavy oil has been announced
2) average $CO_2$ emissions of 0,56 kg per kWh for all power stations in 1997

## 2.2 Policy formulation and negotiation of the DGWP

First concrete discussions on energy related voluntary agreements took place in November 1991 (see flow chart Fig. 2), when industry, i.e. the most energy-intensive sectors coordinated by the Bundesverband der Deutschen Industrie (Federation of German Industry, BDI), presented a first proposal for an energy related declaration as a reaction to the EU Commission's plans for an energy and $CO_2$ tax. In July 1992, a more concrete proposal on the operationalisation of the initiative was submitted by industry, but in summer 1993 they failed to reach consensus with the government on the scope and quality of targets. The Government was at that time represented by the Environment Ministry (BMU), which received backing during the negotiations by the Federal Environmental Agency (UBA) and the Fraunhofer Research Institute ISI (FhG-ISI). During the next years, inofficial discussions and contacts were maintained without generating explicit results.

A few weeks before the first Conference of the Parties (COP1) to the UNFCCC in Berlin in March 1995, the German government (BMU, Ministry of Economics (BMWi) and the Chancellor's office) launched a new initiative. Obviously triggered by an urgent need to present national activities to the international public, the government asked industry what contributions to CO2 reduction could be expected from the different branches.

Fig. 2. Genesis of the declaration of German industry on global warming prevention




Abbreviations:

| | | | |
|---|---|---|---|
| *BMU* | *- Federal Environment Ministry* | *BMWi -* | *Federal Ministry for Economics* |
| *FhG-ISI* | *- Fraunhofer Institute ISI (research institute)* | *UBA -* | *Federal Evironmental Agency* |
| *BDI* | *- Federation of German Industry* | *COP -* | *Conference of the Parties to the UNFCC* |

Due to the fact that the agreement needed to be published within the official frame of the COP1, the preparation and negotiation phase of the first version of the DGWP (BDI 1995) was characterized by extreme time pressure, and some sector associations had only a few days of internal consultation to submit their contribution. The resulting immature state of the declaration received strong criticism[4], which was partially taken into account during the industry-government negotiations in the following year. At this stage, targets and procedures on the national as well as the sectoral level were more intensively discussed. An updated version of the DGWP was published one year later in March 1996 (BDI 1996a)[5], and a monitoring scheme was introduced on the national level. From there on, no further corrections have been made to the declaration nor to the monitoring scheme.

## 2.3 Characteristics of the DGWP

The updated DGWP from March 1996 is the official document and the formal foundation for the German voluntary agreement scheme (BDI 1995, 1996a). It was published as an umbrella declaration by 14 industrial associations, mainly from the basic industries (represented by the Federation of German Industries BDI), the Association of the Industrial Power Generators (VIK) and four associations from the energy sector including

4 For comments on the first version, see Wuppertal Institut 1995; DIW 1995; Clausen, Zundel 1995.

5 For comments on the second version, see Rennings et al. 1996; Jochem Eichhammer 1996; UBA 1997; Kristof, Ramesohl, Schmutzler 1997; Kristof, Ramesohl 1999

the two major electricity utility associations (VDEW and VKU). The updated DGWP represents some 70% of industrial energy consumption and almost all public electricity generation. However, considerable parts of industry with increasing economic importance such as investment goods, consumer goods, and the food industry (except sugar) are not participating.

By the updated umbrella declaration, German industry declares its willingness to undertake extraordinary efforts on a voluntary basis in order to achieve a reduction of 20% in the industry's total specific energy consumption and/or in specific CO2-emissions of the same order by the year 2005 (base year 1990).

In exchange for the voluntary commitment, the industrial associations expect that policy will give priority to these voluntary initiatives over other regulatory or fiscal climate policy instruments. As a reply to the initiative, in 1995 the federal government announced via press release the withdrawal of plans to introduce a waste heat ordinance (WNVO) and a possible exemption from an energy tax. In 1996 (again via press release) it clarified and assured its intention, that the participating industries will be exempted from any upcoming CO2/energy taxation on the EU level, e.g. by national compensation schemes (Bundesregierung 1995, 1996).

The following brief characterization of the DGWP describes essential features of the scheme. It builds on criteria and normative demands as compiled by Kræmer and Hansen (1999), which are commonly used in the political and scientific debate to characterize and evaluate the implementation and performance of voluntary agreements (Communication of the European Commission 1996, Börkey et al. 1999, UNEP/EPA 1997). It can be stated that in many respects the DGWP does not correspond to the criteria which are usually applied to assess the effectiveness of voluntary agreements. This stresses the need for a more detailled investigation of the scheme which is presented in the next chapters.

- German industry published an unilateral declaration without binding commitment of either the association or of the individual member company. The political reaction is limited to two press releases and does not present any fixed commitment. Neither criteria and procedures for non-compliance nor policy alternatives and sanctions are explicitly defined. The institutional frame can be characterised as bi-lateral goodwill.

- Under the umbrella declaration, the participating branch associations published their own declarations with branch specific targets. The branch declarations and sectoral targets differ in terms of time frame and compatibility, so that the overall reduction goal of the umbrella declaration cannot be concluded from the sum of branch targets. An overview of the divergent targets is given in Tab. 2.

Tab. 2: Overview of sectoral targets within the DGWP

| Sector and Association | Base year | Reference Variable | Reduction in % |
|---|---|---|---|
| Potash Industry: Kaliverein | 1990 | t $CO_2$/t Raw Salt,<br>mt $CO_2$ | 66<br>78 |
| Cement Industry: Verein Deutscher Zementwerke | 1987 | KJ Fuel/kg Cement | 20 |
| Lime Industry: Bundesverband der Deutschen Kalkindustrie | 1987 | kJ Fuel/t Lime | 15-20 |
| Ceramic Tiles and Slabs: Bundesverband keramische Fliesen und Platten | 1990 | kg $CO_2$/t Tiles and Slabs<br>kWh/t Tiles and Slabs | 20<br>25 |
| Brick Industry: Bundesverband der Deutschen Ziegelindustrie | 1990 | kJ/kg Bricks | 28 |
| Refractory Industry: Bundesverband der Feuerfest-Industrie[1] | 1987 | kg $CO_2$/t Refractory Products | 15 - 20 |
| Iron and Steel Industry: Wirtschaftsvereinigung Stahl | 1990 | kg $CO_2$/t Rolled Steel<br>mt $CO_2$ | 16 - 17<br>21 - 27 |
| Non-ferrous Metal Industry: Wirtschaftsvereinigung Metalle | 1990 | GJ/t NF-Metals | 22 |
| Chemical Industry[2]: Verband der Chemischen Industrie | 1990<br>1987 | Energy Index/Production Index<br>mt $CO_2$ | 30<br>44 |
| Paper Industry: Verband Deutscher Papierfabriken | 1990 | kg $CO_2$/t Paper<br>GJ/t Paper | 22<br>20 |
| Glass Industry: Bundesverband Glas und Mineralfaser | 1987 | kg $CO_2$/t Glass<br>GJ/t Glass | 25<br>22 |
| Textile Industry: Gesamtverband der Textilindustrie | 1987 | PJ/a | 20 |
| Sugar Industry: Verein der Zuckerindustrie | 1990 | kWh/dt Beet Processing | 40 |
| Public Electricity Supply: Vereinigung deutscher Elektrizitätswerke (VDEW)[3] | 1990 | mt $CO_2$ | 12 |
| Petroleum Industry: Mineralölwirtschafts-verband (MWV) | 1990 | Litres Heating Oil/$m^2$ Residential Accommodation | 25 |
| Gas Industry: Bundesverband der Gas- und Wasserwirtschaft (BGW) | 1990 | kg $CO_2$/kWh Net Energy | 34 |
| Association Municipal Enterprises (VKU) | 1990 | mt $CO_2$ | 25 |

(1) The data refer exclusively to the West German states.
(2) In relation to the year 1990, the Chemical Industry expects a reduction in absolute $CO_2$ emissions by 23.8 Mt by the year 2005.
(3) Reduction target by the year 2015. For 2005, the VDEW expects a $CO_2$ reduction in the amount of 8-10%.

Source: RWI 1997, 4

- The branch declarations do not provide formal specifications in terms of obligations of the companies, branch-internal burden-sharing and sanctions, nor of the division of work and share of responsibility between the associations and their member firms.

- There was no independent ex-ante assessment and public discussion of existing energy saving potentials, which could contribute to explore an ambitious scope for efficiency measures and could suggest intermediate sub-targets as an implementation schedule in order to assess the implementation progress. Individual targets and concrete energy saving plans on the level of the participating firms are missing.

- The declaration results from closed discussions between ministerial administration and industrial associations. Parliament or NGO were not involved in any stage.

- Administration and implementation of the DGWP takes place entirely under the responsibility of industry itself. On the national level, the BDI provides the coordinating frame which covers all sector declarations. Together with the other federal association VIK they play a supporting role but are not directly involved in energy efficiency or GHG mitigation measures. On the sectoral level, the branch associations are in charge of implementing their own declaration and of delivering the annual progress report. However, they do not have any legally binding power to enforce concrete action on the firm level, so that the member firms of the branch associations are basically responsible for themselves, and they are free to decide whether to contribute to the branch commitment by energy efficiency measures or not. A formal obligation to participate such as a firm-by-firm letter-of-intent does not exist. An independent agency in charge of the implementation as an intermediate body of competence and authority does not exist.

- Due to the fact that the whole industry benefits from the exemption from regulation and taxation, in principle free rider problems can occur with regard to passive member companies of the association which published a declaration, to non-member firms from the sector not covered by the branch association, and to whole sectors without branch declarations such as food and beverages. Free-rider problems are not explicitly addressed by the DGWP, because under the collective approach free-riding is perceived as an internal affair of industry.

- The Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI, Essen) was entrusted to carry out the first two annual sector-by-sector monitoring reports on the base of progress reports provided by the branch associations and official statistics (BDI 1996b, RWI 1997, 1999). Independent data collection and auditing on the firm level is not required by the monitoring scheme. The monitoring process is analysed in further detail in Chapter 4 of this report.

## 2.4 Specific problems in the energy sector

In contrast to other countries, the German declaration is not restricted to the industrial end users of manufacturing industry, but contains as well the declarations of the four main associations of the energy supply sector (VDEW, MWV, BGW, VKU). They announced measures to increase efficiency of power generation and distribution as well as DSM activities directed towards their customers. Due to this blend of actors, target groups and activities, the energy industries' declarations are not compatible to those of the manufacturing industry. They induce totally different implementation, administration and monitoring requirements, and impose severe methodological and structural problems (Kristof, Ramesohl, Schmutzler 1997, Jochem, Eichhammer 1996). In addition, the announced targets hardly advance beyond business-as-usual action, e.g. in terms of normal replacement of worn out power generation capacity. It has to be noted that the public electricity generation utilities started in 1996 already with a target achievement of 116% which increased to 120% in 1997 (RWI 1999, 155).

Therefore, a separate and comprehensive analysis needs to be undertaken in order to assess the requirements for modified, specific agreement schemes and monitoring procedures in the energy sector which is complicated by the dynamic market changes due to liberalization. however, due to the focus of the VAIE project, which concentrates on manufacturing industry, this aspect will not be discussed further.

# 3 Implementation of the DGWP through the sectoral voluntary agreements

In the previous discussion emphasis was put on a general description of the DGWP as a policy instrument on the national level. In order to get a clearer picture of the actual implementation practice, the operationalization of the scheme, its effects and the resulting needs and opportunities for modification, in the following we will provide a closer look at activities on the level of associations and firms. The study builds on two sector case studies, and in a first step, the two sectoral declarations will be briefly presented and characterized. Inspired by the observed comparability of implementation practice and effects in both sectors, in a second step a comparative analysis is undertaken which points out similarities and differences between the two case studies.

## 3.1 Case Study 1 - The Cement Industry

### 3.1.1 Structure of branch and its associations

The German cement industry comprises 39 firms which produce at 65 production sites with an installed capacity of approx. 134.000t/d (1998). In 1998 total cement production reached 34 Mt[6]. Compared to other European countries, the German cement industry is quite heterogeneous and covers as well as a few large, internationally operating firms, many smaller, regionally focused firms. The industry is organized by two associations: whereas the Bundesverband der deutschen Zementindustrie (BDZ) puts emphasis on political and economical aspects, especially in terms of marketing of the construction material "concrete", the Verein Deutscher Zementwerke e.V. (VDZ) and the associated research institute (Forschungsinstitut der Zementindustrie FIZ) deals with technical-scientific questions of cement production concerning the production process, environmental issues and product quality.

### 3.1.2 The declaration

#### Content

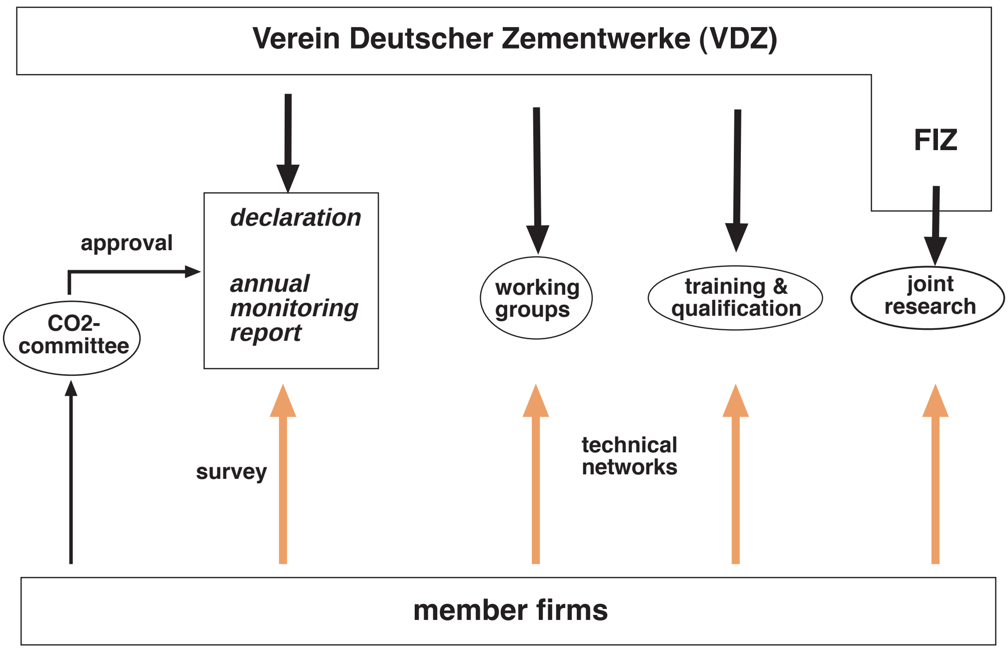
Under the umbrella declaration of the BDI, in March 1996 the VDZ published the updated commitment of the German cement industry to reduce the specific fuel consumption by 20% from 1987 until 2005. Compared to a specific fuel consumption of 3510 kJ per kg cement in 1987, this corresponds to a target value of 2800 kJ/kg cement in 2005. Electricity consumption is not covered by the commitment but documented seperately by the monitoring. The cement industry is participating in the general monitoring scheme coordinated by RWI.

6 Including export of clinker. For more comprehensive statistical information see the BDZ website (http://www.BDZement.de)

## Administration

The VDZ coordinates the declaration of the German cement industry and is in charge of the annual monitoring report. From the 39 firms in Germany, the declaration covers the 33 member firms of the VDZ, representing some 98% of total production and 99% of total fuel consumption. In order to execute the branch declaration, a new "CO2 committee" was established in 1995 within the VDZ (Fig. 3). It assembles high-ranking executives, mainly chief executive officers (CEO) or company owners, of almost all member firms in order to discuss issues of CO2 mitigation, energy and climate policy and the related contribution of the cement industry. Due to the high level representation of firms, the committee represents the authoritive body for the approval of the annual monitoring report, modifications and amendments, and all further activities of the VDZ in the field of climate policy. Although the declaration does not contain a formal commitment by the member firms, the declaration can be seen as an expression of common will, which receives broad backing by the member firms. Moreover, the managers' participation in the committee provides a channel for top-down dissemination of the declaration to the companies.

Fig. 3: Activities and relations for the implementation of the declaration in the German cement industry




Besides the recently founded CO2 committee, the VDZ provides various already existing fora for the discussion of energy issues such as the standing working groups "process technology" and "environmental protection". Due to the close interdependencies of technology questions, energy consumption and emissions, especially the working group "process technology" has put emphasis on questions of energy efficiency and CO2 reduction for a long time. The working group joins technical experts and technical managers from nearly all member firms, so that a direct link of the VDZ to the technical middle level exists. In addition a network among the technical experts could be created which is frequently used for the exchange of problems, experience and know-how.

It is a characteristic feature of the cement industry, that the VDZ itself performs research and technical consultancy through its research facility FIZ (VDZ 1996). Through a long tradition of close cooperation with the member firms and technology suppliers, the FIZ has accumulated comprehensive technological competence and experience concerning almost all German cement plants in operation. In addition, the VDZ provides the frame for further technical training and qualification of staff.

### 3.1.3 Production technology and areas for action

From the technical perspective, cement production can be roughly structured into 4 stages: raw material processing, the calcination during the kiln-process, the grinding of clinker, and the blending with additives (depending on the desired product quality). Within these four stages, the dominating part of the total energy consumption is related to the fuel consumption of the kiln. Electricity consumption accounts for 10% of total energy consumption but for 50% of energy costs. It is mainly broken down into raw material processing (35%, mainly grinding), the clinker production (22%) and clinker grinding (38%). With regard to this structure, three core areas for energy conservation and CO2 abatement measures can be derived:

- technical and organisational energy efficiency measures to reduce fuel and electricity consumption, which includes both major technical investments as well as gradual improvements
- reduction of fossil fuel input by substitution (secondary fuel input)
- reduction of energy consumption for clinker production by substitution of clinker through additives such as blast furnace slack or fly-ash from power plants, i.e. increasing the share of composite cements

### 3.1.4 Monitoring procedures and first results

Once a year, the VDZ performs a survey of energy consumption among all members, which is the basis for the general monitoring by the RWI (VDZ 1999). In addition, it prepares its own branch monitoring report describing the actual development of energy consumption, both fuels and electricity, and CO2 emissions as well as the use of secondary fuels and additives (Tab. 3), and illustrating the branch's previous efforts by exemplary actions.

Tab. 3: Actual development of energy consumption and $CO_2$ emissions in the German cement industry

| year | fuel consumption | | electricity consumption | | $CO_2$ emissions | |
|---|---|---|---|---|---|---|
| | absolute [$10^6$GJ/a] | specific [kJ/kg cement] | absolute [$10^6$MWh/a] | specific [kWh/t cement] | absolute [$10^6$t/a] | specific [$tCO_2$/t cement] |
| 1987 | 119,9 | 3510 | 3,80 | 111,2 | 10,8 | 0,317 |
| 1990 | 109,5 | 3200 | 3,67 | 107,4 | 9,6 | 0,280 |
| 1994 | 102,9 | 3000 | 3,72 | 107,8 | 8,7 | 0,252 |
| 1995 | 102,8 | 3000 | 3,64 | 106,5 | 8,7 | 0,254 |
| 1996 | 99,3 | 2995 | 3,50 | 107,4 | 8,0 | 0,245 |
| 1997 | 99,3 | 2975 | 3,47 | 103,9 | 7,7 | 0,231 |
| 1998 | 100,7 | 2905 | 3,63 | 104,7 | 7,6 | 0,218 |
| target value 2005 | no target | 2800 (-20%) | no target | no target | no target | no target |

Source: VDZ 1999

### 3.1.5 Empirical observations

With regard to all three core areas, the interviews with firm representatives and branch experts gave a clear and unambiguous picture on the impacts of the sectoral declaration:

**a) Technical and organizational energy efficiency measures**

In principle, energy efficiency measures in the cement industry can be divided into major investments for up-grading or replacing the kiln, measures to optimize the heat flows, e.g. by improved recuperation of waste heat from clinker cooler, and improvements in raw material and clinker grinding by improved mills and classifiers.

Concerning the state of activities, all firm and branch representatives pointed out the following aspects:

- Due to the high importance of energy costs (25% of net production value), the thermic process has been continuously optimized during the last 50 years. Today, state-of-the-art technology reaches an overall thermal efficiency of 70%, so that the cement process gradually approaches its thermo-dynamical optimum. Although further minor improvements will be possible, major technical break-throughs in the kiln process are not expected. A process alternative is not available; product substitution or recycling on the level of cement is not in sight. In this regard, the cement industry can be characterized as a mature core process without alternative.

- Principally, a significant contribution to decreasing fuel consumption can be seen in replacing old, inefficient kiln technology by modern processes. During the last 25 years, however, most of the older kilns in western Germany have been replaced by dry-process kilns partially with pre-calcination. In eastern Germany, the technical change took place even faster, the share of dry-process rotary kilns increased to 90% due to the fast and comprehensive modernization of the eastern German cement industry. Taking into account the high capital demand and the long lifetime of kilns of some 30 years an acceleration of investment cycles in this area can, therefore, hardly be expected.

- The industry representatives stressed the fact that, due to permanent optimization, the average operation performance of the German cement plants does not deviate much from the current state-of-the-art. In an estimation of the VDZ, even a complete refurbishment and new installation of all production sites with newest technology is expected to lead to only a reduction in thermal energy demand of max. 9%, while demanding an investment volume of some 1-2 billion € (VDZ 1999, 28).

- In addition to technology improvements, the actual energy consumption of a cement plant depends on the "human factor", i.e. on the quality of operation and maintenance, too. The daily work of staff has a high impact on the detection and prevention of failures, on the exploitation of possibilities for continuous optimization and on the reliable, continuous performance of production. The importance of proper operation and maintenance can be illustrated by the 2-3 years which are needed to calibrate and to optimize newly installed kilns, and by the possibility for gradual efficiency improvements of old plants, which can amount to 2-5% of total fuel consumption. In this regard, firms can differ significantly in their attitude of "hunting for the last kJ" which characterizes the corporate culture.

- Principally, due to the low value of cement and the related cost restrictions for long-distance transport, the domestic demand is distributed among the cement producers by quite stable, regional markets with relatively low competition, which provides little to no room for an expansion of economic activities. Hence, the German cement market has been characterized for years by a rather constant domestic demand and stagnant prices. However, in certain areas, especially in eastern Germany or in close distance to waterways, competition is tightened through imports mainly from Eastern Europe. For that reason, all major investments have to be evaluated with regard to a rather rigid production frame and the lack of possibilities to expand capacities. Concerning domestic activities, the reported business strategies, therefore, correspond to a stance of "operation, maintainance and continuous gradual improvement". Under current price conditions, the reduction in energy costs alone rarely justifies the needed investments, so that large technical measures are mainly linked to mid-term planning concerning replacement investments, re-organisation of production capacity, and enhancing reliability.

With regard to all areas, the interview partners clearly stated that the observed activities represent a continuation of ongoing best practice and of the branch's traditionally high efforts to improve energy efficiency. Regardless of the declaration, energy has always been a topic of high priority for strategic investment planning due to the high share of energy costs. The same holds for motivation and qualification of staff, which has already been addressed by internal training programmes and the qualification offers by the VDZ. In both regards, the declaration is perceived as not providing an entirely new impulse, but as an additional impetus for already existing action.

### b) Substitution of fossil fuels

The input of secondary fuels such as rubber and plastic waste, old tyres, liquids, biomass waste, etc., plays an increasing role in reducing fossil fuel consumption, and the share of secondary fuels has grown to over 18% of total thermal energy demand in 1998 (4% in 1987, VDZ 1999). Being defined as a CO2-free energy source, the cement industry sees secondary fuels as an important contribution to GHG mitigation.

In practice, the substitution of fossil fuels can impose technical problems depending on the technical specifications of the site, the properties of the particular secondary fuel and of the raw material. Investments are needed to assure a reliable level of operation and sufficient product quality, and to provide a suitable logistic infrastructure for handling waste streams. With regard to the future prospects of secondary fuel inputs, two aspects are of interest:

- In Switzerland and other countries some 50-60% of total fuel consumption is already covered by substitutes and a share of 80-90% is targeted (Cemsuisse 1998), which stresses the technical feasibility and economic attractiveness of this option.
- In general, secondary fuels are cheaper than fossil fuels, and in some cases they are even provided for free or the cement plant can charge for the incineration of waste. Due to this economic benefit, the cement industry has a strong interest of its own to increase the share of secondary fuels, and from today's perspective the further development is mainly determined by the political and regulatory framework and the related accessibility of burnable waste.

For these reasons, the substitution of fossil fuels is hardly affected by the branch declaration but represents an autonomous structural change of the fuel mix which will have a significant impact on the fuel related CO2 emissions of the branch.

It must be noted that in terms of CO2 emissions, the substitution of fossil fuel with secondary fuels promises to lower the overall GHG emissions, and to contribute to a systems solution to waste disposal problems. For an ultimative assessment, however, the actual contribution to GHG abatement and the environmental impacts of the incineration in cement kilns have to be carefully evaluated fuel by fuel on the basis of comprehensive eco-balances (cf. Patel 1999). This includes the ecological and toxic impacts as well as structural effects on the material flows and recycling systems. From a long-term system's perspective, the current cost-effectiveness of incineration might induce a stabilization of prevailing practices, and therefore, impede the shift towards less resource-intensive, recycling-based material flows. The evaluation of these effects is a challenging task which was far beyond the scope of this study.

### c) Substitution of clinker with additives

Corresponding to the diminishing scope for technical efficiency measures, the cement industry puts increasing emphasis on an integrated optimization of energy and material flows. In this context, the substitution of clinker with additives (composite cement) such as blast furnace slag, fly-ash from power stations or raw limestone, represents an effective means to reduce energy consumption and to lower the raw material related CO2 emissions of the calcination process while mitigating the disposal problems of the iron and steel or energy industry and saving natural limestone resources at the same time. It is the intention of the cement industry to further increase the share of composite cements, which requires distinct efforts:

- Due to the raw material features, for example the grinding of slag requires higher electric energy and, partially, imposes technical problems in terms of reliability and product quality.
- The logistic infrastructure for processing and handling of additive needs to be established and extended, e.g. both at the steelworks and at the cement plant.
- Due to different product features, composite cement is still confronted with reluctance and, depending on the region, a bad image on the market, which requires comprehensive marketing and sales efforts.

Although significant investments are involved, however, for favourably located cement plants (distance to steel works, access to cheap waterway transportation, etc.), the input of blast furnace slag, fly-ash, etc., represents a technically feasible and an economically interesting option to substitute clinker. In this regard, the extension of blast furnace cement production can for the most part be seen as an ongoing, self-motivated option which will significantly reduce fuel consumption and CO2 emissions of the branch. In addition to autonomous developments, opportunites for increasing the share of composite cements are currently being explored in less evident locations, e.g. in southern Germany, which provides the branch the opportunity to demonstrate its responsibility for climate and resource protection. With regard to the favourable conditions and existing dynamics of clinker substitution, however, all in all the supplementary impact of the declaration on enhancing clinker substitution seems to be modest.

## 3.2 Case Study 2 - The Glass Industry

### 3.2.1 Structure of the branch and its associations

In 1998, the German glass industry comprised 414 plants and some 64,000 employees, and production reached approx. 7.24 Mt[7]. In 1996, energy consumption was 97,3 PJ and CO2 emissions reached 6 Mt CO2 which corresponds to approx. 4% of German industrial consumption or emissions. The sector can be divided into the five glass-producing sub-sectors flat glass, special flat glas, container glass, crystal and domestic glass and mineral wool, and into the sub-sectors of further treatment and refinement of glass products. The five glass-producing sub-sectors account for approx. 63% of total production value but dominate the sector's energy consumption with a share of more than 80%, and the same holds for other emissions. For that reason, they represent the most important arenas for environmental and energy policies, and, correspondingly, these five sub-sectors are the main supporters of the sectoral declaration, on which we will concentrate in the following.

The structure within the five sub-sectors varies; whereas the flat glass industry is characterized by two big companies and some smaller firms, in the container glass sector several medium-sized players can be found. As a distinct feature of the German glass industry, many of the sub-sectors are dominated by the German subsidiaries of international groups such as Saint-Gobain or Pilkington, which influences the background conditions for initiatives on the national level.

The sector is organized by the Bundesverband Glasindustrie und Mineralfaserindustrie (BV Glas), which represents 96 member firms and some 90% of the German glass production. In the context of the DGWP, the already existing environmental committee of the BV Glas served as the principal forum for discussion and implementation of the sectoral declaration. In the environmental committee, all sub-sectors are equally represented. In addition, 5-7 separate working groups are engaged in specific questions among which general issues such as climate policy and the DGWP are discussed, too.

### 3.2.2 The declaration

#### Content

The BV Glass declared to reduce specific energy consumption by 22% and specific CO2 emissions by 25% within the period 1987 to the year 2005. Starting from 16,260 MJ/t glass or 1,040 kg CO2/t glass in 1987, this commitment corresponds to a target value of 12,683 MJ/t glass or 780 kg CO2/t glass. Unlike most of the other sectors, the glass industry refers to 1987 as the base year due to insufficient data for 1990 with regard to the former East German glass industry.

7 For more statistical information, see the BV-Glas webstite (http//www.bv-glas.de)

**Administration**

The BV Glas provides the platform for information exchange and discussion of energy and climate policy issues in the glass industry. Being a typical industrial association without executive power vis-a-vis its member firms, the role of the BV Glas focusses on the coordination of the sectoral declaration and related monitoring activities. The BV Glas collects firm data on energy consumption, energy efficiency measures and CO2 emissions with the help of annual internal surveys. The surveys are targeted at improving the insufficient data basis with regard to the situation in East Germany for the base year 1987 and at contributing to the annual progress report within the official monitoring scheme of the RWI. A separate monitoring report such as in the case of the cement industry is not published.

### 3.2.3 Production technology and areas for action

In all sub-sectors studied, glass production can be basically described by the steps of preparation and homogenization of the raw material (for the most part sand together with other inputs such as soda, lime and other additives), melting, forming (flat glass products, container glass, glass fibres, etc.), and further processing and finishing of products.

Comparable to the cement industry, glass production is characterized by a high share of energy costs in total production costs (typically 20-25%) which are triggered by a very heat intensive core process; the biggest share of final energy consumption (70-80%) can be attributed to the glass melting process. Corresponding to this structure, again three core areas for reducing energy consumption can be identified:

- increasing the **energy efficiency of production technologies**, e.g. through an improvement in the melting process by replacement of furnaces, better heat insulation and waste heat recovery, and improvement in equipment for forming, refining and finishing of glass products (incl. auxiliary equipment)
- improved operation by **enhanced energy management and staff qualification**
- **increased resource efficiency** through substitution of raw material input with increased recycling of waste glass, and material-efficient design of glass products (e.g. lighter bottles)

### 3.2.4 Monitoring procedures and first results

The annual survey of the BV Glas is based on data responses from 58% of the member firms, which represent approx. 90% of production. The official monitoring results (RWI 1999, 107ff.) are given in Tab. 4.

Tab. 4: Monitoring results of the glass industry

| | **Unit** | **base year 1987** | **year of declaration 1995** | **1996** | **1997** |
|---|---|---|---|---|---|
| total fuel consumption | [PJ] | 62,60 | 55,99 | 55,76 | 57,62 |
| total electricity consumption | [PJ] | 37,16 | 41,61 | 41,69 | 42,54 |
| total energy consumption | [PJ] | 99,75 | 97,61 | 97,3 | 100,16 |
| total $CO_2$ emissions | [Mt $CO_2$] | 6,38 | 6,06 | 6,04 | 6,22 |
| production | [Mio. t glass] | 6,135 | 7,197 | 7,053 | 7,194 |
| specific energy consumption | [GJ/t glass] | 16,26 | 13,56 | 13,82 | 13,92 |
| degree of target achievement | [%] | -- | 76 | 68 | 65 |
| specific $CO_2$ emissions | [kg $CO_2$/t glass] | 1040 | 842 | 856 | 864 |
| degree of target achievement | [%] | -- | 76 | 71 | 68 |

Source: RWI 1999, 1997

Compared to the base year of 1987, the declaration started in 1995 with an ex-ante target achievement of almost 76%, i.e. specific CO2 emissions were some 19% lower than in 1987. When analyzing the actual performance of the glass industry between 1995 and 1997 as stated by the monitoring report and comparing it to the internal figures of the BV Glas, a striking contradiction between official and branch data can be found:

- According to the official statistics the performance of the glass industry has deteriorated since 1995, and the degree of target achievement for energy efficiency declined from the level of 76% in 1995 to 65% or to 68% in the case of specific CO2 emissions in the year 1997. For the last monitoring period, for example, the official statistics indicate an increase in specific energy consumption of 0.7%/a.
- By contrast, the internal branch survey of the BV Glas showed for the same period an increase in energy efficiency of 2.1% and a reduction in specific CO2 emissions of 2%.

To a certain extent, this fundamental contradiction can be explained by divergent data structures, methodologies and selection critieria in the two assessments. Especially the different treatment of the glass processing sub-sectors, which are included in the official data but not covered by the internal survey, causes a distortion of the picture. As an example, the energy consumption of the sub-sector "refinement and further processing of flat glass" increased from 7.1 PJ in 1995 to 8.7 PJ in 1997, which corresponds to a rising share in total energy consumption of the glass industry (7.3% in 1995 to 8.7% in 1997).

In general, the differences between official statistics and internal branch data imposes significant problems for the monitoring institution RWI. In order to allow for a transparent and overall consistent apporach, the official monitoring assessment needs to be build on publically available data of the same type, structure and methodology, and so the RWI referred to the official data set. On the other side, in some sectors offical statistics are flawed by data and methodological problems, questioning the appropriateness of offical statistics for the monitoring purposes which gave good reason to create new and more reliable data bases by the sector associations. In any case, unequivocal and commonly accepted approaches for collecting and processing monitoring data are still missing. The case of the glass industry emphasises the need for reaching consensus but discussions between the branch association and the Federal Stastical Office (Statistische Bundesamt, StaBuA) have not yet produced satisfying results.

### 3.2.5 Empirical observations

From the interviews with the company actors and the representatives of the BV Glas, a picture of the energy efficiency activities very similiar to the cement industry can be derived:

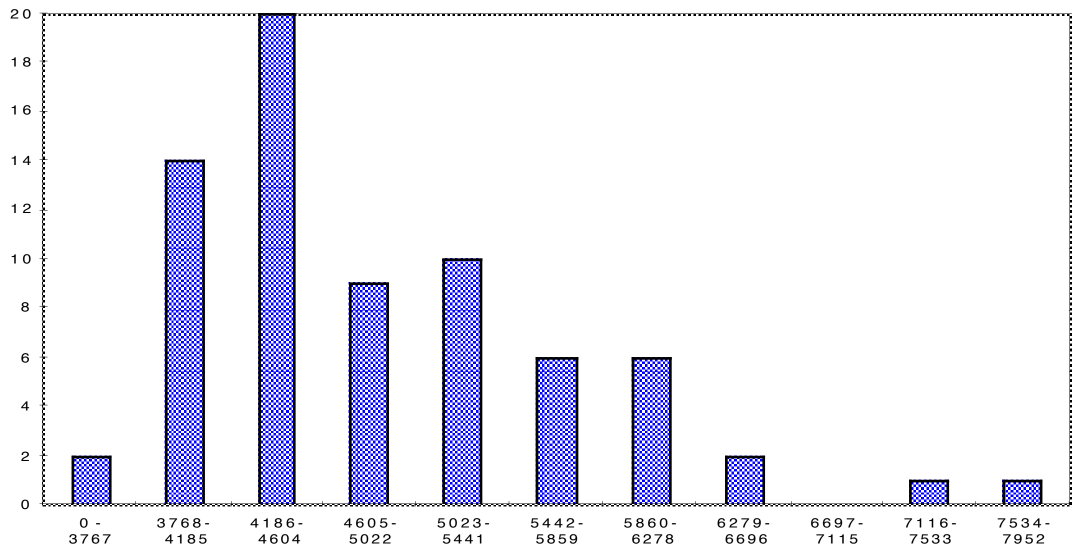
#### a) Energy efficiency of production technologies

In the last 35 years, specific energy consumption of the glass industry has been considerably reduced by 40% (flat glass) to 50% (container glass). Due to the importance of the melting process in terms of production costs, productivity and environmental pollution, emphasis has been traditionally put on improving the performance of the core melting process. Especially in the case of the container glass industry, increased recycling and lower material input per product add to the trend (see below).

It has to be mentioned, however, that total energy consumption of the glass industry has been growing since 1989, mainly driven by an increase in production from 4078 kt in 1988 to 7194 kt in 1997. When looking at further growth potential of glass products, e.g. in the field of heat insulation, building architecture or PV cells, this aspect underlines the problems associated with specific target definitions. Furthermore, technical advances are partially counterbalanced - especially in the flat glass industry - by increasing demands concerning product quality, functionality of the glass products etc., which lead to higher specific energy consumption, e.g. through higher melting temperatures, more comprehensive treatment and finishing of semi-products, coatings, etc. The empirical observation can be summarized as follows:

- From the technical perspective, the interview partners consider the glass melting process to be a **mature technology** comparable to the calcination process in the cement industry. Major breakthroughs can hardly be expected but improvements are much more likely to result from permanent refinement and optimization of components and operational adaptations. Apart from waste heat recovery, the ongoing technical progress in burner technology is especially seen as a major contribution to higher energy efficiency and lower air pollution. A comparison of the efficiency distribution of existing furnaces illustrates the fact that considerable energy savings could be achieved by replacing older equipment with available state-of-the-art technologies (Fig. 4).

Fig. 4: Distribution of melting units of different efficiency (in [kJ / kg glass])




Source: Radgen 1999

- With regard to this theoretical potential, however, the interview partners pointed out the **limited impact of the declaration on replacement investments in general** due to the special characteristics of the glass industry. First of all, they emphasised the fact that normally glass melting units are in use for 8-10 or even 15 years without any interruption, i.e. 24 hours a day, seven days a week. Due to the continuous operation, components cannot be easily added or replaced during regular downtimes but any improvements and changes in the process have to be adapted to the ongoing production. For that reason, interference in the running process is limited, and major gains in energy efficiency can only be achieved when replacing the whole furnace at the end of its lifetime by modern equipment, which in turn represents high investment costs. Therefore, replacement activities are closely linked to regular investment cycles or capacity enhancement plans, which try to distribute the financial efforts for renovating the pool of the firm's melting units equally over time.

- In this area, a **low impact on acceleration of replacement or enhanced diffusion of innovations,** e.g. of oxygen burners, can be observed. The recent activities are seen by the interview partners as a continuation of past efforts of the glass industry for upgrading the melting equipment according to the firms' long-term strategies. Due to the practical restrictions resulting from the continuous operation of the furnace, and the relatively high capital intensity of the glass industry[8], this situation is not likely to change.

- Whereas in the past emphasis was traditionally put on the core process of glass melting, **less attention was given to measures to reduce electricity consumption and to optimize auxiliary equipment**. Electricity consumption, however, constantly gains importance for the sector's final energy demand, and during the period 1987-1997, the share of electricity in total energy consumption of the glass industry increased from 37.3% to 42.5%. Compressed air is especially relevant for the glass industry because its share in electricity consumption is much higher than in other branches. For example, the importance of compressed air for total electricity consumption in the glass industry is 15-30%, a significantly higher level compared to cement 0.5-9%, chemicals 0.5-1,5%, paper & pulp 4-9%, investment goods 10-20% (Radgen 1999). Although the interview partners report a change of attitude and increasing efforts have been undertaken in the area of optimizing auxiliary equipment, the potential still seems to be far from being fully exploited. Moreover, these activities have been launched independently of the declaration, which appears still to have a rather low impact in this area.

### b) Energy management

Contrasting to investment projects, in the field of energy management the interview partners clearly stated a fostering role of the declaration for the establishment and improvement of energy and environmental management systems which have been and are currently implemented in many member firms of the BV Glas. Measures comprise the appointment of energy managers, the pursuit of energy audits, energy related qualification of staff and introduction of environmental management systems (EMAS/ISO14001). With regard to the latter aspect, the glass industry is more advanced in terms of certification than the cement industry, and a general trend towards the ISO14001 can be observed. Within the five sub-sectors, the degree of certification varies. According to the interview partners, 80% of the flat glass producers and 50% of the container glass producers will achieve in short time the certification either on EMAS or ISO14001, whereas in the glass wool sector certification is still in preparation.

With respect to the field of environmental management, all interview partners point out a promising shift of priorities. As already mentioned, energy efficiency has been an important issue for a long time, but it used to be handled in a technical manner with emphasis on investment projects. Over the last years, however, together with ecological aspects energy has become a strategic management issue which increasingly involves both management and staff. Furthermore, information and management systems are being created and gradually established which improve the basis for efficiency activities. Energy efficiency is slowly becoming an organizational issue, too. In this development, the sectoral declaration did not serve as the intial cause but represents an additional impulse

8 In the German glass industry, the ratio of capital stock and employees is more than 36% higher than the average of manufacturing industry (StaBuA 1996).

for the already existing process, and it introduced the topic of climate change to the debate. More and more, technical questions, operation parameters and behavioural aspects are put into the context of GHG mitigation, and a basic challenge seen by the interview partners is to communicate the relations between daily business practice and climate change to the staff.

Given the relatively short implementation period of the declaration, the organizational changes are still at their beginning. The new understanding of climate protection as a daily task is growing slowly, and experience from the NOx debate indicates a time demand of five years and more before these kind of issues are completly spread throughout and accepted in an organization.

### c) Resource efficiency

Significant energy savings in the glass industry are related to higher resource efficiency, i.e. with regard to the substitution of raw input material with recycled waste glass, and by lowering raw glass input for products.

With regard to recycling, for years the recycling of waste glass have represented a major contribution to reducing the sector's energy consumption and air pollution[9], especially in the container glass sector where the recycling rate reached 81% of domestic sales in the year 1998 (compared to some 23% in 1980 and 43% in 1985) (BV Glas).

The second aspect of improved product design is of special importance for the container glass industry where considerable reductions in specific energy consumption can be achieved by reducing the material input per glass container, i.e. by thinner and lighter bottles. During the last three decades, the specific energy consumption per bottle could be drastically reduced (Tab. 5). Increasing competition of materials, especially of plastic bottles and aluminium cans in the beer and soft drink markets, are likely to create further incentives to continue the efforts to reduce the weight of glass containers.

Both trends, however, can be seen to be totally independent of the sectoral declaration because it hardly creates any specific effect on recycling technology and practice in the glass industry but, in turn, benefits from existing dynamics in the field. Especially the regulatory framework in the field of waste management has resulted in considerable efforts to increase the recycling rates, and waste policy is perceived to play the dominant driving force in the future, too. In this respect, the glass industry is a striking example of the strong correlation between energy consumption, resource inputs and material flows in industry, which underlines the close relationship of energy, climate and waste policies as forces behind sustainable production systems.

9 As a general rule, a 10% substitution of raw material with recycled glass results in a 2-3% reduction in energy consumption (Radgen 1999)

Tab. 5: Reductions of specific weight and energy consumption of glass bottles

| | | 1970 | 1980 | 1990 | 1998 |
|---|---|---|---|---|---|
| average weight of drink bottle | *[gramm]* | 415 | 358 | 322 | 297 |
| specific energy consumption of glass production | *[kJ/ton glass]* | 18100 | 12100 | 6000 (1992) | 5400 |
| | *Index 1970=100* | *100* | *67* | *33* | *30* |
| specific energy consumption of product | *[kJ/bottle]* | 7512 | 4322 | 1985 (1992) | 1604 |
| | *Index 1970=100* | *100* | *58* | *26* | *21* |

Source: BV Glas

## 3.3 Comparative characterization of the implementation of the sectoral declarations in the cement and glass industry

Both case studies provided insight into the implementation of the sectoral declaration and its relation to the respective techno-economic background for energy efficiency and GHG mitigation. When comparing both case studies, interesting similiarities as well as differences evolve. They are discussed in the following with regard to the three aspects of the policy context, to the background for collective action within the branch and to the impact on individual firm behaviour which have been introduced in Chapter 1.

### 3.3.1 Policy context

Comparable to other sectors, both branches promote the principle of voluntary action as an effective and efficient alternative to regulation and taxation. With regard to the planned waste heat ordinance, the interview partners judged the regulatory requirements and implementation suggestions as insufficiently adapted to the specific situation of industry, e.g. the isolated location of cement plants far away from any potential heat users, the traditional off-time of kiln operation during winter time, etc. The eco-tax scheme on the other hand threatens to increase energy costs significantly whereas labour cost reductions are of minor benefit for the branches which are very capital and energy intensive but little labour intensive. In contrast to the traditional command and control instruments of environmental policy, the voluntary agreement is seen as a promising approach to investing technological and administrative capacity in an activity responsible for itself instead of using resources for defending and obstructing regulation.

Starting from this common motivation, however, the general marketing attitude and the role of public communication differs between the two branches. In the cement industry, the DGWP initiative is seen to be as politically oriented, and in general, the public marketing of energy efficiency and $CO_2$ mitigation efforts seems to play a minor role for action. The cement market as such provides little demand-side pressure for cleaner products, and media are rarely used to illustrate the branch's engagement in the field of energy efficiency and $CO_2$ reduction on the national level like the chemical industry does for example. Nonetheless, in particular regions distinct efforts to increase the image of the respective cement plant can be observed, e.g. by local events, local/regional media campaigns etc. This holds especially when secondary fuels are introduced which induce fears of the neighborhood concerning toxic emissions etc. Moreover, discussions on ecological building materials forces the cement industry to promote the material "concrete", and thus to improve its environmental performance.

On the other hand, the glass industry perceives climate policy as an arena for proactive promotion of their products in the public. Especially the flat glass (efficiency windows) and the mineral wool industries (buildings insulation) benefit from increased efforts in reducing space heat consumption, and therefore, they strongly support political initiatives in this direction. To a certain extent, production related activities are seen as a logical continuation of this stance to promote energy efficient glass products, and the $CO_2$ issue gains importance as a variable of strategic management[10]. At present, however, the declaration itself still plays a minor role in media and PR campaigns of the glass industry, and it is not as actively used as by the chemical industry for instance.

Both sectors maintain a quite unilateral relation to the BDI, and direct exchange of experience and information with regard to the implementation of the declarations hardly takes place among the various branches. Although being part of a common commitment of German industry and in spite of the fact that delegates participate in working groups on the BDI level, every association seems to concentrate on its own affairs without caring too much about the others.

## 3.3.2 Background for collective action within the branch

The implementation of the declarations is strongly influenced by the particular **cultural backgrounds** in both sectors. Contrasting to other sectors such as the chemical industry, both branches cover a small number of firms which fosters collective action. Firms are usually involved in activities of the sectoral association; especially participation in working groups establishes and maintains fairly dense networks of relations.

Usually, sectoral agreements are considered to have a positive influence on **intra-sectoral communication, cooperation and exchange of innovations**. At the moment, in both sectors the impact of the sectoral VA on communication and exchange of experience, technical information and innovation is definitely positive (new committees, new agendas in standing working groups, etc.) but nonetheless limited because related activities have already taken place independently of the declaration:

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10 One representative of a multinational group stated that in the middle of the 90's a strategic decision to invest in window glass production at the German site was influenced by the German climate policy debate and the resulting prospects for high efficiency windows - in spite of unfavourable economic figures.

- In the **glass industry**, cooperation of energy experts from the firms often takes place within their own group, and for the German subsidiaries of the international companies, the foreign sister firms are the point of reference rather than the domestic branch members. In large firms such as Pilkington or Saint-Gobain, energy performance data are monitored on a monthly basis and then fed into an internal benchmarking system. This enables the parent company to identify trends, improvements or deteriorations in energy consumption at an early stage, and to undertake related measures. At the same time it serves as a screening instrument for best practice in the various countries which can be analysed and replicated within the whole group. This attitude is supported by the fact that - especially larger - glass producers undertake continuous R&D efforts for improving technologies and equipment, and to a remarkable extent they themselves hold the patents for their specific production processes. On the other hand, however, personal links can be found among the technical staff who meet regularily on the occasion of committee meetings or technical associations. The small size of the sector and the limited number of actors enhances the establishment of personal relations even among competitors.

- The latter aspect is particularily true for the **cement industry** where a common feeling of belonging to the "cement family" can be observed which provides a favorable ground for joint activities and fosters group dynamics and solidarity. Many of the smaller firms have been run for decades by the owner family, and the relatively low domestic competition pressure related to the regional nature of cement markets enhances cooperation and mitigates conflicts among VDZ member firms.

  As a result, the cement industry is characterised by close personal relations and frequent information exchange on the technical level. Innovative solutions, practical experience, and best practice are openly communicated and regulary discussed among the technical experts. This includes frequent site visits where new technologies can be studied in operation. Accordingly, the initiative of promoting best practice coordinated by the VIK was of little added value for the cement sector whereas in the glass industry and other branches a more positive contribution could be observed.

  Among the cement firms, only a few large companies of international dimension maintain their own technical competence centres for research and development. This comparative advantage in terms of financial and personnel resources, however, does not exclude smaller firms from technical progress. Due to the fact that most innovations and patents are held by a few, world-wide operating technology suppliers, a commercial interest is given to disseminating advanced solutions. In addition, the suppliers are dependent on the cooperation of the cement plants in order to refine and improve prototype technologies. Therefore, they need partners who are ready to share the risk and to undertake test runnings in return for cheap access to innovative technologies. In this regard, especially smaller firms are of high interest to the supply industry because the prevailing flat hierarchies and the strong position of the owner allow fast and flexible decisions to be made.

In this context, the established and commonly accepted role of the VDZ serves as the forum for collective action in relation to external requirements such as climate policy. The engagement of high level representatives in the association's $CO_2$ committee and the close links on the technical level via the working group "process technology" assures an anchoring of the declaration within the branch. Furthermore, the VDZ functions as a driving force and catalyst of branch activity. It provides the capacity to process and evaluate branch-internal data and information, and as the only sector within the DGWP, the cement industry constantly modifies and improves the sectoral progress report.

It can be concluded that in both sectors - and especially in the cement industry - technology diffusion is hindered to a much greater extent by long investment cycles, capital constraints and strategic considerations than by knowledge deficits and competitive barriers. In this context, the implementation of the declaration benefits from and strengthened existing, sophisticated networks and personal relations, but hardly generates new channels for information dissemination and technology diffusion.

### 3.3.3 Impact on individual firm behaviour

In both sectors, firms are currently active and will continue to undertake considerable efforts to upgrade production technology and to lower energy costs. Hereby, further energy savings and GHG emissions reductions will be achieved. However, as mentioned above the impact of the sectoral declaration on practical firm action appears to be limited, especially concerning the major part of the "hard factors" related to the core process. Referring to the conceptual framework (Kræmer, Hansen 1999, 72), the observations can be summarized with regard to the distinction between technical and organizational effects, both in a short and long-term perspective (Tab. 5):

Tab. 5: Summary of observed changes of energy efficiency practice

| | **short-term** | **long-term** |
|---|---|---|
| **technical changes** | *very low* | *not clearly identifyable* |
| **organizational changes** | *low* | *impact depends on company culture and degree of mobilization of staff* |

- With regard to **technical changes** ("hard factors"), the company representatives reported that the internal discussions initated by the branch declaration tend to contribute to performing more long-term oriented cost-benefit analyses, and that they provide an additional, positive argument for energy saving investments "on the edge", sometimes giving the decisive kick in cases of doubt. The pragmatic consequences of this change in awareness on actual investment behaviour, however, are not clearly identifiable yet. For the most part, the observed energy related investment activity corresponds to the usual modernization activity under a top-down strategic investment plan, and traditional criteria such as pay-back-requirements of 1-2 years as reported for waste heat recovery in the glass industry appear still to be the dominating guidelines. The same holds for technical innovations, and an impact on technology development and accelerated introduction can hardly be predicted.

- By contrast, with regard to **organizational changes** or "soft factors" the impact appears to be more likely but limited as well. All interviewed branch and firm representatives stated that the new focus on CO2 gave an additional impulse for the energy efficiency issue. GHG mitigation has started to become a new topic of discussion and is then added to the existing parameters for strategic decision-making. The general importance of GHG mitigation is widely accepted, and the need to reduce CO2 emissions has become a background variable of political consideration.

In the second area, the distinct impacts of the declarations remain unclear because at the current stage, existing schemes of motivation, training and qualification are already used to communicate the topic of energy efficiency and to strengthen the individual responsibility of every staff member to contribute to an energy efficient operation. Especially in the glass industry, where a comprehensive certification of environmental management systems is already on the way, existing activities are used to operationalize the voluntary initiative. Moreover, in both sectors the collective commitments have not yet diffused through all staff levels in the firms, but still remain a topic for top and middle management considerations.

# 4 Overall analysis and assessment of the DGWP

The previous chapters described characteristic features of the DGWP and its current implementation practice in two branches. Achievements and experience were discussed both on the national policy level (chapter 2) and with regard to intra-branch activities in the cement and glass sector (chapter 3). In order to prepare the conclusions and recommendations further available material was analysed and assessed. Especially the results from the two monitoring reports point out further problems concerning the overall picture of the DGWP.

The evaluation in this Chapter 4 follows a common analytical framework which was set up as a starting point for the comparative analysis of the five country case studies within the VAIE project (Kræmer, Hansen 1999). It draws on the work of Russel and Powell (1996) and defines five general evaluation criteria which aim to answer the questions:

- What are the **institutional demands** related to the implementation of the DGWP?
- What is the performance of the DGWP with regard to target achievement, i.e. **environmental effectiveness**?
- What are the **dynamic aspects of performance and effectiveness**, i.e. what kind of long-term effects can be expected by the present practice of implementation, and what is the instrument's flexibility with regard to altering frame conditions?
- What are the **policy aspects** of the DGWP process?
- What are the **aspects of risk** correlated with the DGWP?

Given the recently changed policy context in Germany following the 1998 elections, it is important to note that the analysis refers to the status of the DGWP in summer 1999, which is still based on the updated declaration of 1996. Considerations about a modification of the DGWP or a link to the new eco-tax scheme could not be taken into account.

## 4.1 Institutional demands

Institutional demands describe the roles, functions and personnel capacities which are required to implement a policy instrument. They indicate focal points of activity and interaction, and, therefore, determine the transaction costs of the scheme[11]. When looking at the course of the DGWP process, the following aspects are of relevance:

- Before concluding the agreement in 1995, an explicit preparation and analysis of potentials did not take place so that negotiations were based on research findings

11 Following a common distinction, e.g. employed by the OECD, transaction cost describe the administrative part of the implementation whereas pollution abatement costs comprise for example all investments undertaken by the target group.

already available and on information reported by industry. The negotiation stage of the first version of the declaration was extremely reduced due to the time pressure related to the COP1 schedule. During the second year, more intensive negotiations took place for preparing the second version in 1996.

- The German approach provides industry with a large amount of freedom and flexibility to define targets, to administer implementation and to organize the monitoring process. In the last three years of implementation, action within the DGWP process primarily took place on the level of industrial associations in order to create an infrastructure for the administration of the declaration. Examples are the foundation of several committees for the authorization of action on branch level, information activities to disseminate and promote the voluntary action among members, and the creation or use of information loops in relation to the monitoring procedure. Within the industrial associations, tasks are usually carried out by personnel who are already in charge of environmental and energy issues, so that the DGWP represents an additional burden, or at least a new focus of work to them.

- Due to the fact that legally defined rules and sanction mechanism are missing, a formal approval of industry activities is not required, and the implementation of the DGWP scheme is characterised by low governmental involvement. Apart from a series of 10 best-practice workshops jointly financed by industry and German government, the scheme acts independently of supporting or complementary measures.

- Total efforts for the monitoring comprise the collection and aggregation of company data by the branch associations, and the compilation and assessment of these self-reported data and official statistics by the RWI.

- Due to the absence of an institutionalized sanction mechanism, the DGWP doesn't require special administrative capacities to assess compliance and to impose penalties on the sectoral or even firm level.

Having these characteristics in mind, the German approach can be characterised by rather low institutional demands which limit administrative requirements and transaction costs for implementing the scheme. Reliable, quantitative data on transaction costs are not available, but as a very rough estimation for the total costs of the German scheme, personnel costs of 1-2 person months (25.000 €) can be attributed to the administration efforts per sectoral agreement per year. Taking the total number of 18 agreements, this would add up to 450,000 €; together with approx. 250,000 € covering the expenses for the independent monitoring institution and accompanying research, and the fairly low costs for governmental administration as well as for the companies, the total costs of the German scheme are not likely to exceed 1 million € per year.

## 4.2 Environmental effectiveness

The criterion of environmental effectiveness represents the focal point of policy evaluation because administration efforts and transaction costs as such do not tell much about the instrument's ability to achieve a given policy goal nor about its efficiency. In this regard, the analysis of the DGWP's contribution to climate policy can be undertaken:

- from a **formal perspective** by asking whether the agreement scheme achieves its own targets which are laid down in the various sectoral declarations, and
- from an **impact-orientated perspective** by assessing the ability to induce supplementary effects on energy consumption and emissions which exceed the reference case.

Recalling the challenge to decrease drastically energy and resource consumption in industrialized countries in order to achieve a sustainable development, the latter aspect gains special importance. Going beyond the formal fullfillment of a self-defined goal as such, the rapid and comprehensive exploitation of all feasible potentials to enhance energy efficiency should serve as point of reference for policy evaluation.

### 4.2.1 The formal perspective of the agreement's own target achievement

Considering the described circumstances of the first launch and the given open structure of the DGWP, the first monitoring reports were of high importance for the policy process. They delivered for the first time an evaluation and quantitative estimation of the state of implementation. The first report for the period of 1995-96 was published at the end of 1997 (RWI 1997), a second report covering the year 1997 was completed in spring 1999 (RWI 1999), and the reprot of 1998 is still pending. Although a comprehensive ex-post assessment cannot be provided after this short time, the monitoring reports shed light on essential features of the scheme and they illustrate how and to what extent the initial intentions have been operationalized by the actors involved. From a formal perspective, the available evidence suggests that the DGWP fulfills the self-defined quantitative targets both on the national as well as on the sectoral level.

- On the national level, the DGWP sets the quantitative overall goal of a 20% reduction in specific energy consumption or CO2 emissions in German industry between 1990 and 2005. At this point, it has to be stated, that due to the uncompatible target definitions (see Chap. 2) sectoral commitments cannot be compared nor aggregated, and the official monitoring report does not give a transparent breakdown of the overall target into the sectoral targets either. Nonetheless, from the scattered evidence it appears realistic that the overall goal will be reached. Moreover, within the period 1990-1997, total industrial CO2 emissions decreased by 17% which corresponds to nearly 35 Mt CO2 (RWI 1999, p.129). In particular, the chemical industry and the iron and steel industry contributed with almost two thirds to that result.

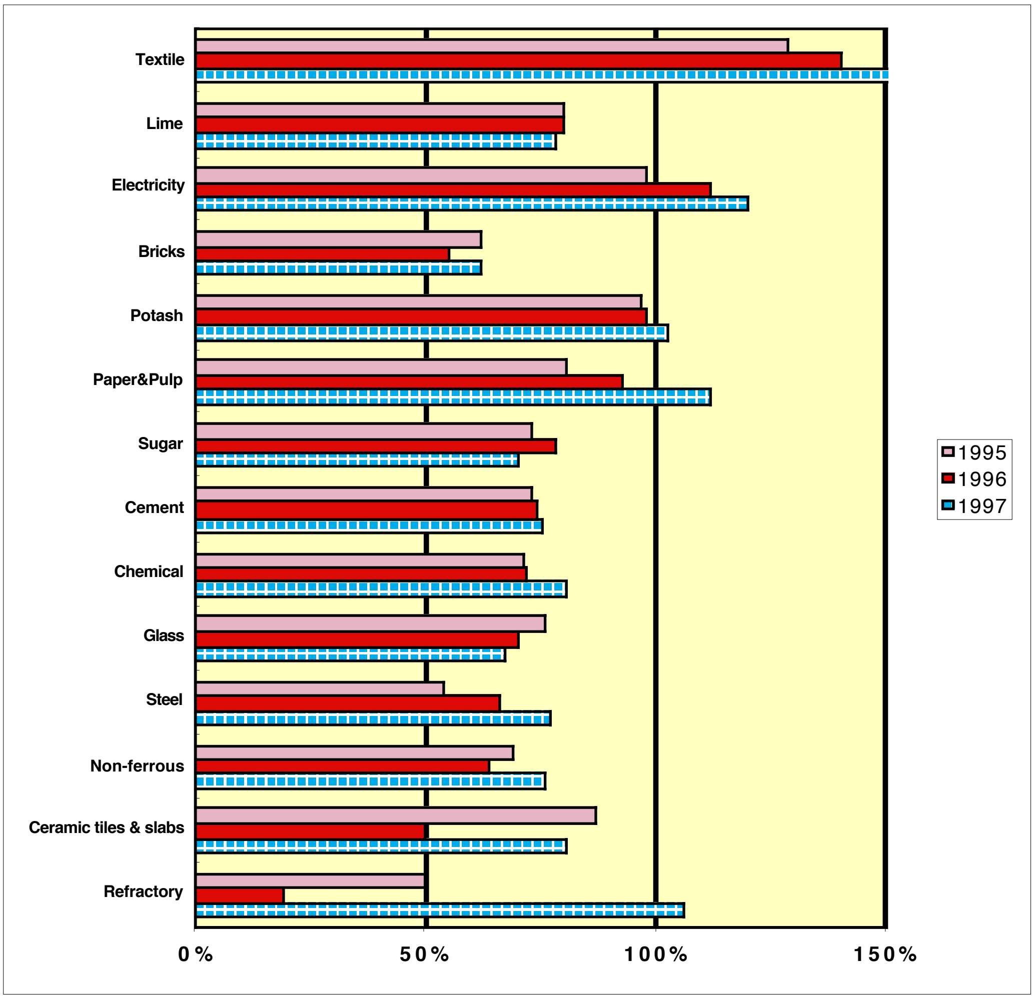
- Second, each sector defined a separate target as described in Chapter 2, and in 1997 target achievement varied from 60–160% (see Fig.5).

At the same time, however, the monitoring results give reason to question the quality of targets and the appropriateness of the monitoring procedures. The following aspects need to be stressed:

- Looking at the quantitative results, a **high degree of ex-ante target achievement** can be stated. Particular problems are:
  - A great deal of the targets for 2005 had already been achieved in 1995 (or 1996), i.e. in the years of declaration before starting any action under the DGWP (see Fig. 5). Being urged to follow the politically defined time frame 1990-2005, the declaration had to cover the period of 1990-1995 when severe structural changes shook eastern German industry after the country's reunification in 1990. This effect is not clearly separated from the commitments after 1995.
  - Furthermore, the majority of the listed measures for CO2 reduction can hardly be classified as the promised "extraordinary efforts"; for the most part the sectoral progress reports describe business-as-usual replacements and long-term planned capacity enhancement investments (such as large capital investments, e.g. blast furnaces) (RWI 1997, 80, RWI 1999, 91).

  Both aspects together give rise to strong doubts concerning the ambition and quality of targets set by the sectoral declarations, and indicate a need for further investigation of potentials and opportunities.
- The experience with the two series of branch reports revealed the **insufficient quality of the information reported by the sectors**. To a large extent, the delivered progress reports were characterized by substantial deficiencies concerning completeness, transparency and credibility of energy data and described activities (RWI 1997, 58f, RWI 1999, 156). Furthermore, in some cases problems of internal surveying and significant divergences between the official statistics and associations' internal data sources evolved as mentioned in the glass case study. In this regard, both the credibility of sectoral data as well as the quality and usefulness of current official statistics have to be critically examined. In this regard, the monitoring experience points out the urgent necessity to establish compatible and methodologically sound frameworks of accounting and data assessment which reconcile the various data sources (RWI 1999, 157).

Fig. 5: Degree of target achievement at the moment of publication of the first version of the DGWP (1995) and the monitoring results in 1996 and 1997

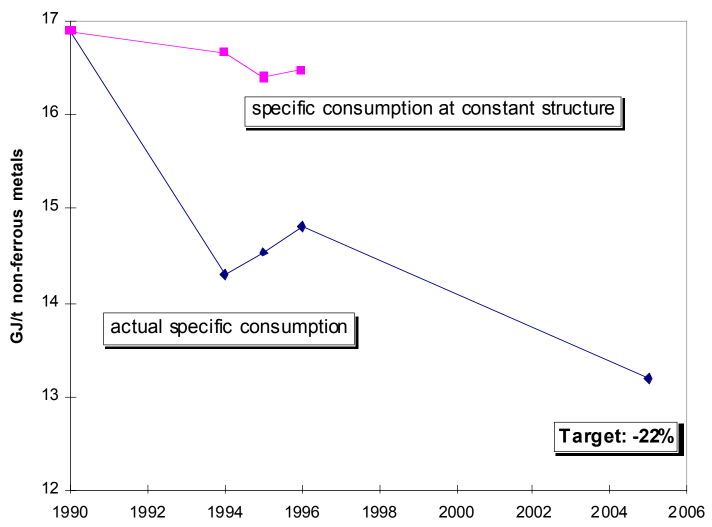



Source: RWI 1997, 1999

- The monitoring procedure revealed **methodological problems** to assess actual efficiency improvements. As depicted in Fig. 5 above, energy efficiency and total energy consumption can be strongly affected by growth effects (e.g. dramatic decline of German textile industry through delocation) and fluctuating degrees of capacity use (e.g bricks). At the moment certain corrections, e.g. with regard to temperature or capacity use, are made by the RWI whereas other crucial parameters such as structural changes are not systematically examined. For an evaluation of the energy efficiency performance of the single sectors, however, these effects need to be identified and isolated. Taking the non-ferrous metal sector as one example, a structural analysis indicates that the majority of the indicated efficiency improvements result from intra-sectoral changes (RWI 1999, 89). Just by a simple breakdown of the non-ferrous metal branch into primary aluminium production and other non-ferrous metals, significant structural effects can be decovered, and the degree of target achievement of the non-ferrous metal sector drops from the reported 60% to some 10% (Eichhammer 1998, see Fig. 6).

This divergence stresses the need to reach a general conclusion how to deal explicitly and systematically with structural effects and the interrelations between the DGWP and other policy areas, e.g. in the field of waste management, recycling, etc. At the moment, however, the analytical tools employed under the monitoring scheme appear to be insufficient to address these aspects more thoroughly, and it has to be questioned whether sufficient resources and personnel capacity are devoted to the monitoring task.

Fig. 6: Specific energy consumption of the non-ferrous metals branch in Germany: actual and at constant structure (only taking into account structural changes stemming from primary aluminium production)




*Source: Eichhammer 1998*

### 4.2.2 The impact-orientated perspective of inducing supplementary effects

Although the formal targets are likely to be met, the decisive question whether these objectives really represent a substantial contribution to the national climate policy is still left open. As seen above, severe doubts are triggered by the first monitoring results which call for a more thorough assessment of the case. Interestingly, industry itself expressed the qualitative ambition to undertake "extraordinary efforts" to lower energy consumption and CO2 emissions, which corresponds directly to the need of inducing supplementary effects mentioned above. In the course of implementation of the DGWP, however, the practical problems of the concept of "additionality" have been frequently discussed, and it imposes severe methodological difficulties and data problems to figure out the supplementary effect of a single instrument[12]. Nonetheless, in our view the aspiration to identify the additional impact of the DGWP should be kept because only policy instruments which make a supplementary contribution justify any costs incurred by their implementation - no matter how low these are.

As a contribution to the debate, a pragmatic attempt to approach the problem of "additionality", was used for a qualitative impact assessment which describes the DGWP's ability to induce changes in energy use patterns. It draws on a systematic characterization of energy efficiency options and a related impact assessment.

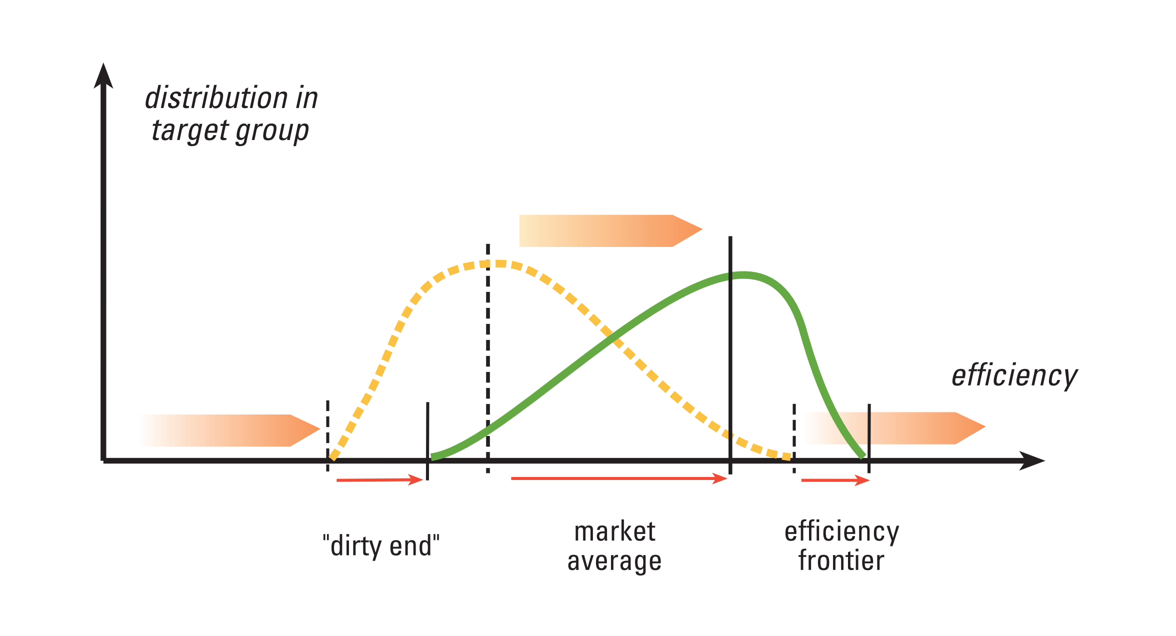
#### 4.2.2.1 Characterization of options to reduce energy consumption in industry

In principle, the impact of the voluntary agreement on industrial energy efficiency can be described in relation to its capacity to move (Fig. 7):

- the technological efficiency frontier by enhanced innovation,
- the average energetic performance of the target group by accelerating the diffusion of efficient technologies and organisational practices, and by
- the minimum performance ("dirty end") by abandoning the worst and most inefficient practices.

12 For a more detailed elaboration on this aspect see Rietbergen, Blok 1999.

Fig. 7: The three principal strategies to improve the average energy effficiency in industry




At this point, characteristic differences between the various types of voluntary agreements can be illustrated[13]: whereas environmental agreements often concentrate on the challenge to eliminate a certain product or practice from the market (e.g. by phasing out a specific toxic chemical), product related agreements often build on an accelerated market introduction of high-efficiency solutions and/or the enforcement of minimum efficiency standards. In both cases, a limited number of product types and suppliers are concerned. By contrast, agreements which generally aim at increasing energy efficiency of industrial production cover all three areas, and they comprise a far larger range of technologies, actors and possible solutions. Often, these options on the company level are connected to many other parameters in the production process which complicates the assessment and induces additional management demands. In order to generate a systematic approach to this complexity, in our analysis the multitude of different measures was classified by seven major options to affect the companies' energy use in industry.

Depicted in Tab. 6, each of these options can be characterized by requirements for business decision-making and the time frame of implementation. Starting from this principal distinction, in the following we will discuss the degree to which the DGWP currently induces impacts in the seven areas.

13 For a more comprehensive classification and description see for example Börkey et al. 1999, UNEP/EPA 1997, UNEP 1998

Tab. 6: Options to enhance energy efficiency in industry and related scope for impact of the DGWP

| *Options* | *Management requirements* | *Time frame* | *Scope for impact of the DGWP* |
|---|---|---|---|
| Re-design of product mix and resource use: | Strategic commitment and long-term decisions with regard to a change of technical paradigms, process technologies and resource structures | Long term | **Minor scope** due to strategic nature of decisions |
| Change of energy supply structure (e.g. CHP, renewables): | Strategic commitment and long-term decisions with regard to energy infrastructure and fuel input | Mid/long term | **Minor scope** due to strategic nature of decisions |
| Technology innovation: | Strategic commitment and long-term investments in R&D | Long term | **Minor scope** due to strategic nature of decisions |
| Enhanced investment: | Change in strategic and operative business goals as well as altered decision criteria and procurement procedures | Short/mid term | **Some scope** depending on changes in management culture |
| Technology diffusion: | Increased communication, exchange of practical experience, dissemination of best practice and generation of new network links, and even energy-related co-operation of competitors | Mid term | **Larger scope**, depending on intra-branch competition & communication |
| Improved energy management: | Integrated approach & systematic search for improvement options, changes in organisational routines, staff empowerment. | Mid term | **Some scope** depending on prevailing management culture |
| Awareness and motivation: | Mobilisation of firm actors, provision of information, know-how and expertise, and continuous discussion of the issue. | Short/mid term | **Larger scope**, depending on prevailing management culture |

#### 4.2.2.2 Impact assessment

As seen in the two case studies, the most important opportunities to lower energy consumption and GHG emissions are related to the domain of the core processes which is valid for other energy-intensive sectors, too. With regard to the possible technology options in this field, the DGWP appears to have a minor effect on general investment activities and the strategic planning of firms. Whereas in single borderline cases the DGWP might have given the decisive impulse in favour of the abatement measure, a substantial shift of attitudes and practices in German basic industries cannot be expected:

- A **re-design of product mix and resource use patterns** represents a major decision of strategic dimension. Especially in basic industries, measures to change material composition, to close resource cycles and to reduce material flows by enhanced recycling or the design of lighter products, play a prominent - if not the most important

- role to reduce energy consumption and CO2 emissions of production (as seen in the cement industry (blending of clinker with blast furnace slack) or the container glass industry through thinner and lighter bottles, and waste glass recycling). Although these measures represent very important options to achieve energy efficiency targets, changes in this field are mainly triggered either by general cost cutting actions or by distinct environmental regulation, e.g. in the field of waste management. The energy related declarationss tend to play a minor role as a supporting factor but hardly induce significant achievements on their own. The future role of energy related agreements for product development can hardly be predicted and will depend on the (international) framework of environmental policy.

- The same holds for **technology innovation** and the search for new break-through solutions to reduce energy and resource inputs. For the most part observable R&D activities in place reflect the natural interest and traditionally high engagement of the energy-intensive industries in process improvement. Often, energy-consuming companies belong to international groups which are even among the worldwide leading technology suppliers who develop new process innovations in their own R&D facilities. Under these conditions, the declarations might foster single projects but hardly change the underlying strategies.

- Changes in the **energy supply structure**, e.g. by increasing the share of CHP, is another important option to reduce total energy demand for production. Considering the strategic role of a secure and competitive energy supply on the one side, and the boosting dynamics in de-regulated energy markets which threatens the survival of industrial power generation on the other side, the particular impact of the DGWP on CHP-investment decisions can be considered to be rather low. Moreover, the extension of CHP in industry is affected by action from the utilities under their separate agreement scheme, so that it has to be questioned which part of the achievements can be attributed to the respective comittment[14].

- On a more operative level, an **acceleration of replacement investments** and a relaxation of decision criteria especially in terms of payback requirements would have a strong influence on the energy efficiency of production technology. In general, however, these decisions are determined by technical life cycles (often 10-15 years or more) or by re-structuring effects which take place independently of voluntary action. The declarations tend to have little impact on investment criteria and planning, and - apart from occasional exceptions - a broader shift in investment attitude, e.g. in terms of a relaxation of payback requirements, could not be observed. A particular problem occurs in sectors with a high share of foreign capital ownership. Especially in the case of the national subsidiaries of international business groups, strategic investment decisions are hardly taken by the actors represented in the declaration but by the international head offices which enforce uniform policies for the whole group. Here, the

14 In this regard, statistical and methodological problems occur especially concerning a sound separation of industrial and public utility (CHP) generation capacities.

national subsidiaries are facing strong internal competition for investment capital, and national policy discussions are just one aspect among many other.

On the contrary, the case study observations suggest that much better prospects and opportunities can be expected with regard to the soft options of enhancing energy efficiency. From our empirical findings we derive the following conclusions:

- The stimulation of intra-branch discussions and exchange of best-practice by DGWP activities can lead to an enhanced dissemination of information and, thus, to an **accelerated diffusion of new solutions**. Although the agreements have basically utilized already existing institutional settings, communication channels, networks and personal relations stemming from traditional inter-firm collaboration (e.g. in associations), they seem to provide new fora for the discussion of environmental and technology issues. Therefore, positive effects on technical progress and collective learning are possible, e.g. in the case of a continuation and intensification of the VIK best-practice initiative. As a precondition, however, a culture of open communication and free exchange of technical competence among firms has to exist which questions this kind of benefit in highly competitive sectors.

- Concerning the aspect of **energy management and integrated optimization**, a clear distinction has to be made. On the one hand, in a basic industry such as chemicals the design and the management of complex energy and production systems are core elements of strategic investment planning. Hence, continuous efforts of optimization can be found so that the DGWP appears not to add much to already existing activities but serves rather as a supporting impulse, e.g. with respect to motivational and communicative aspects of energy management (see below).

  On the other hand, in branches of low energy intensity such as investment and consumer goods, usually little effort and manpower is dedicated to energy issues, and sophisticated energy management is far from being a widespread standard (InterSEE 1998). Here, an intensified discussion on energy efficiency and CO2 mitigation under the DGWP could contribute to focusing attention on the forgotten aspects of energy management. Furthermore, in all sectors auxiliary equipment usually plays a subordinate role and therefore risks being neglected both in strategic considerations as well as in daily practice. Due to its generic nature the latter area is characterized by less competive pressure, and industrial associations can help more easily than in the case of process technology to provide information, expertise and best-practice experience.

- At present, the DGWP makes a contribution to **climate policy awareness building** which is likely to continue. Especially on the level of firm representatives, who are delegated to the negotiation talks, the associations' committees, working groups, etc., CO2 mitigation is likely to gain importance as a topic for discussion. In this target group, which is familiar with far-reaching political considerations, the declarations and related monitoring procedures serve as a stimulus to reflect their actual mitigation performance in relation to their own and the sectoral responsibilities. Concerning aspects of staff motivation, communication and qualification, however, the case studies indicate that the process is still in an early stage.

Accordingly, the future impact of the DGWP will depend on its ability to mobilize companies to commit themselves in a credible manner to a stance of pro-active climate change abatement, to staff empowerment and to an energy efficiency culture, e.g. as part of a superior ecological business policy.

## 4.3 Dynamic aspects of performance and effectiveness

It is common to most of the options discussed above that measures need time to be developed, to be realized and to create an effect. For this reason the static impact analysis has to be completed by dynamic considerations in order to cover the long-term effects of activities. The following assessment can be derived:

- For the time being, the DGWP seems to have the greatest effect in the area of intra-sectoral commmunication, energy management and awareness building. These aspects represent important background conditions for energy conservation, and they will gradually improve the opportunites for energy efficiency projects. However, as known from other fields such as quality control or environmental management, the development of management practices and behavioural changes requires time and continuous exercises before lasting improvements can be achieved (InterSEE 1998, SORGET 1998). Hence, in this field the DGWP promises to generate indirect and long-term effects, but the practical and quantitative impact of these changes will be hard to trace[15].
- Concerning direct changes in process technologies and energy infrastructures, in energy intensive industries the scope for short-term changes is rather limited due to long investment cycles and unevitable planning requirements. These constraints are valid for any policy instrument so that any policy activities in this field will contribute mainly to mid-term to long-term changes in energy consumption. Industrial climate policy can be characterized by a "time lag" between policy intervention and GHG mitigation. In order to stimulate significant investments, which are not yet triggered under today's conditions, it is needed to generate early enough strong incentives and reliable policy frameworks which affect long-term strategic investment planning. Looking at its modest impact, however, it is highly questionable whether the DGWP will create enough momentum and innovation pressure to enforce far-reaching strategic decision-making.

Our conclusion is that the DGWP will mainly generate supportive effects to improve future energy saving activities. Its particular strength can be seen in its contribution to communication, cooperation and management structures within and among companies. Whereas the DGWP itself hardly provides incentives to adapt strategic investment decisions, the related activities ameliorate industry's capacities to react to policy settings and to transfer policy goals to the business sphere. These interactions and opportunities

15 A still unsolved methodological challenge for management review and policy evaluation.

emphasise the DGWP's possible contribution to a social learning process which can and should be used more deliberately for policy-making.

In addition, these areas of importance influence the compatibility and flexibility of the scheme with regard to a changing climate policy framework. Although the basic idea of the voluntary initiative is to substitute other policy instruments, the ongoing debate on reconciling the DGWP with the recently introduced German eco-tax points out possibilities to use the agreement as the background frame to organize exemption rules. The same holds for flexible instruments of the Kyoto Protocol (emissions trading, clean development mechanism), where the agreement can provide the setting for exchanging emissions reductions and credits. In both cases, however, it would be necessary to transfer the current open concept of the DGWP into a more formalized and institutionalized set of procedures and rules.

## 4.4 Policy process aspects

In the introduction we have pointed out the impossibility to design perfect instruments. The capacity to learn and to adapt strategies quickly, therefore, represents a primary precondition to avoid delays and a loss of time in GHG mitigation. In this context, policy aspects describe the learning process connected with the implementation of the DGWP and the involvement of policy makers, stakeholders, etc. therein. Having the revealed substantial weak points of the current design and implementation practice of the DGWP in mind, the crucial question for this section is:

What are the essential background conditions and driving forces of the policy process, and what are the prospects for adaptation and improvement of the scheme?

### 4.4.1 Background conditions

**Little public attention and third party involvement**

On the policy level, the most striking observation is that - apart from the actors directly involved - the scheme appears to be detached from the broader political debate. Whereas articles on the DGWP can be found in scientific and sector specific technical journals, a broader political discourse about the pro's and con's of voluntary agreements in the field of climate change is missing. The first monitoring report was published within the context of the Kyoto conference, and, therefore, received at least some media attention, but the second report issued in spring 1999 was more or less ignored by media. Interestingly, German environmental NGO hardly used the DGWP as an arena for lobbying but focussed on other topics such as fuel efficiency of cars, etc. From the very beginning, influence either from parliament or from non-industrial interest groups was limited.

**Limited administrative capacities and missing political strategy**

Especially in the beginning, key actors in the BMU and the BMWi were confronted with significant resistance within their own administrations: civil servants in the BMU, who uphold the prevailing tradition of regulatory environmental policy, have remained very sceptical and reluctant to enter new "soft" cooperations with industry; whereas in the BMWi, defenders of the liberal tradition criticized the corporatistic approach and the resulting competitive problems. In both administrations, the DGWP still appears to be a stand-alone measure without access to larger personnel capacities. The situation is aggravated by the so far absence of a superior strategy of German climate policy[16], and the new government tends to concentrate forces on their new priorities of the eco-tax and the decommissioning of nuclear power plants. For the same token, the most evident drawbacks of the 1996 declarations have not yet been erased although an early revision of the scheme was possible. This can be explained by insufficient political pressure, too. As a result, in our view up to now German climate policy has failed to generate convincing incentives for industry to strengthen their engagement in the DGWP process.

### 4.4.2 Perception of the monitoring results and evaluation of further prospects for self-dynamic development

During the interviews, the actors involved in the policy process stated that they have been well aware of weaknesses and the intermediate status of the scheme all the time. From the perspective of the key actors on the governmental side and within the BDI, however, the lack of detailed preparation and the urgent need for action in spring 1995 did not have only negative effects. On the contrary, to a certain extent the "quick-and-dirty" approach was even beneficial for the whole process. It offered the chance to push the new idea of voluntary agreements, to overcome reluctance, to cut normal discussion procedures short and to start working. Being aware of unavoidable mistakes, from the very beginning the DGWP was perceived by the key actors as a dynamic process of learning and development. In principle, the need to operationalize these initial aspirations by continuous evaluation and modification of the scheme was accepted but so far, convincing and viable signs for substantial progress are still missing:

- Not surprisingly, from the first monitoring report German industry derived the conclusion that the DGWP represents a promising and effective instrument for climate policy strategies (BDI 1997). Although the first report already indicated the significant problems mentioned above, the BDI's interpretation completely ignored all criticism expressed by the monitoring institution RWI but exclusively emphasised its interpretation that the DGWP could make a higher contribution to climate protection

16 At the 5th Conference of the Parties to the UNFCCC held November 1999 in Bonn, German government announced a comprehensive climate policy action plan to be published in summer 2000.

than a waste heat ordinance[17]. The positive assessment of the DGWP is shared by the federal government (Bundesregierung 1997, 1999)[18], although the high degree of ex-ante (and even partial over-) achievement of targets imposes a severe threat to the political credibility of the approach. An additional CO2 reduction potential of 10-20 Mt/a was identified by the federal government as a starting point for negotiations on modification of targets and procedures (Bundesregierung 1997).

- Both parties involved perceive the industry's promise to deliver "extraordinary efforts" as the most critical parameter for modification, both from the political perspective as from the methodological view. Underestimated by industry in the beginning, the inherent freedom of interpretation of this expression principally provides a lever for politics to increase ambitions of target setting and to enforce measures beyond the business-as-usual. In practice, however, appropriate methodologies and data to specify the extraordinary character of action are still missing. Significant efforts, therefore, will be needed on both sides to work out new targets, task lists and time schedules in order to overcome the current stage of vaguely defined commitments which we consider to be a precondition for a substantial improvement of the DGWP.

- After the first monitoring report, bilateral talks (so called "confession talks/Beichstuhlgespräche") between government and single sector associations have been introduced or intensified. They provide the government the opportunity to directly access the branch associations and a considerable number of firm representatives, and to discuss the specific problems and flaws of the various sectoral declarations. The key actors from industry and politics judge the "confession talks" to be an effective means of communication and cooperation, which contributes to learning on both sides and to progress in the DGWP process. However, concrete official results such as a re-negotiation of targets or procedures have not been achieved yet.

- The DGWP process entered a critical stage when the informal talks were interrupted after the elections in September 1998 when the new government announced the introduction of new energy taxes as the central pillar of an ecological tax reform (see Chapter 3). From the perspective of industry, the introduction of the energy tax offended against the spirit of the declaration and the bilateral agreements under the DGWP. As a first reaction it was considered cancelling the whole initiative, but after going through hot internal debate among the various sectors within the BDI it was finally decided to continue with the DGWP even though the eco tax scheme remains in place. The voluntary approach is perceived as a new and promising paradigm of policy-making by industry, and - having future challenges of environmental policy in mind - it

17 Without questioning the problems of the regulatory approach of the waste heat ordinance, however, in our view this interpretation was wrong and resulted from a misinterpretation of a comparison made in the monitoring report between the declarations of selected sectors with base year 1990 and the reference path of the Prognos study with base year 1992 (Kristof, Ramesohl 1997; RWI 1997, 5; Prognos 1996). In particular, the BDI neglected the dramatic decline of the eastern German basic industries in the period of 1990-1992 and the related significant reductions in energy consumption.

18 In its reaction to the second monitoring report, for example, the government emphasised the "significant" contribution of the DGWP to reducing absolute CO2 emissions which contradicts the RWI's conclusions on the autonomous character of the majority of achievements (Bundesregierung 1999, RWI 1999, 129)

should be successfully terminated in order to preserve the initiative from the bad image of failure.

At that point, the BDI as the coordinating institution was confronted with the heterogeneous interests and very divergent engagement of the various sectors which had to be harmonized. Driven by the tactical interest to keep the umbrella declaration as the credible expression of the common will of German industry, the BDI faced the dilemma of having to demonstrate progress and engagement to the public as well as serving the reluctance and objections of the hesitating and passive sectors. The same situation can be found on the level of associations which have to serve the expectations of all member firms, and therefore, usually tend to orientate themselves towards the slowest among its members. As policy actors reported, they experienced single member companies to be much more advanced and engaged than the official standpoint of the association suggests. In principle this divergence of stances and engagement offers the possibility of differentiating incentives within a policy mix in order to create both push and pull effects by rewarding the vanguard and sanctioning the rearguard among sectors and companies

- Bilateral negotiations and "confession talks" on a modification and refinement of the initiative were announced for summer 1999 by the government's press relase reaction to the second monitoring report (Bundesregierung 1999). As main topics were envisaged: an extension of the target definitions in order to cover all six GHG from the Kyoto Protocol, an adaptation of the time schedule to the Kyoto target period of 2008-12 as well as an expansion of the initiative to include new sectors. Furthermore, an extension of the declaration in terms of product efficiency should be discussed, and a separate modification and tightening up of the energy sector's declaration. To our information, however, at the end of 1999 the process is still underway, discussions have been delayed, and results have not yet been achieved. Adding to this picture it has to be noted, that the annual monitoring reports are out of schedule and in spring 2000 the third report which was due in autum 1999 is still pending.

With regard to the dynamic aspects of the policy progress and the needed momentum and capacity for learning, our observations can be summarized as follows:

Whereas the DGWP process induced informal interaction and communication between governmental administration and industry representatives, on the official level progress cannot be observed. Neither the various declarations nor the monitoring scheme have been modified yet, and the open approach of the DGWP does not provide for any guideline or schedule on how to achieve this. So far, evidence for a conceptual and practical development and improvement of the scheme is missing which points at the need to strengthen the policy process aspect of the DGWP.

## 4.5 Aspects of risk

Aspects of risk can be discussed on various levels and from different perspectives, and the perception of risk strongly depends on the underlying motives and expectations related to the policy instrument:

- The absence of any formal obligation by the government has represented the primary risk factor for **industry**. From the very beginning, the political framework allowed for the possibility of introducing policy measures regardless of any commitment or successful performance of industry. In April 1999, the introduction of the eco-tax demonstrated the risk of shifting policy priorities, especially when government changes[19]. In addition, the strong interest of industry to establish voluntary agreements as accepted policy instrument incorporates the risk of "burning" the favoured alternative in the case of a failure of the DGWP. In this regard, the threat of loosing political (and to a less extent public) credibility is seen by industry as a crucial incentive for compliance and as the central sanctioning option.

  The practical relevance of these risks relies on the seriousness of intentions to make a pro-active contribution to GHG abatement. If the DGWP is primarily understood as a tactical means to block or at least to hinder the implementation of other climate policy strategies, even in case of failure each year of delay can be seen as a success.

- From the **view of climate policy**, the latter aspect is of special importance. Whereas the given setting provides flexiblity to both the political and industrial actors, at the same time it is left open how to perform evaluations, revisions and improvements. At the moment, years can pass by without any substantial progress. This time will be irrevocably lost while problems accumulate, and the resulting (international) pressure to act might enforce severe and sharp changes which could be avoided by forward-looking political (risk) management.

  In addition, the inconsistent and mostly specific target definitions of the DGWP represent a risk factor for German climate policy, because the factual contribution of industry as a whole to national GHG abatement remains uncertain. In the end a political dilemma situation could evolve, whereby absolute emissions increase due to growth effects, structural changes, etc., although specific energy efficiency targets have been successfully achieved in the sectors[20].

As discussed in the previous section, the process can be characterized by weak momentum and insufficient attempts to improve the quality of arrangements and implementation procedures. Hence, from our view the process is dominated by the risk of delaying the design, introduction and enforcement of effective climate policy strategies. In this regard, the analysis stresses the need for more effective structures for guiding the policy process.

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19 Some industrialists explicitly referred to this risk when justifying their own reluctance, and the absence of a credible offer was perceived as an important factor for not expanding activities and goals.

20 This situation could be found in the late 90's in the Netherlands (Rietbergen, Breukels, Blok 2000)

# 5 Recommendations for modification and revision of the DGWP

In the previous chapter, the empirical findings on the sectoral level and the overall performance of the DGWP on the national level have been discussed. The analysis revealed substantial drawbacks of the DGWP approach but at the same time the findings indicate that the DGWP can play a role in the German climate policy mix. As an interaction and communication orientated approach, it is the particular strength of the DGWP to offer an opportunity to establish, to use, and to intensify relations between all levels of industrial climate policy activity, i.e. within and between policy, associations and companies. However, in order to exploit this potential and to use the declaration as a platform for coordinating GHG mitigation activities in industry, conceptual and practical changes will be requested. Two aspects are of special importance for the modification and development of the DGWP:

- The analysis points out the fact, that the most important driving forces for industrial energy consumption and GHG emissions are currently not or only insufficiently affected by the DGWP. In order to intensify the search for all kind of abatement options the related commitments need to be elaborated more thoroughly and the **discussion of potentials, targets and actions** needs to be strengthened. Accordingly, the individual companies need to be integrated more intensively in the process.
- In order to benefit better from the monitoring experiences and to enhance learning processes in climate policy it is necessary to strengthen discussions and feedbacks on commitments, achievements and further opportunities on all levels, i.e. it is needed to improve the **management of the policy process**.

## 5.1 Strengthening the discussion of potentials, targets and actions

In order to overcome the problems concerning the insufficient quality of the sectoral targets and the implicit vagueness of individual commitments, it is necessary to induce and to intensify the search for options on the company level and to direct attention to all kind of measures for enhancing energy efficiency and reducing GHG emissions. The following recommendations to enhance the declarations' ability to affect industrial energy use are inspired by the experiences from business practice, that "things which get targeted get measured, and what gets measured gets managed". In other words: commitments should be specified more comprehensively and precisely so that all relevant driving factors become subject of negotiation and target setting, and that they are covered by the related monitoring schemes. By this, discussions within and among companies on the possibilities and limits of action can be strengthend which in addition would improve the integration of the single companies into the sectoral declaration.

### 5.1.1 Expanding the scope of target definitions

As depicted in Chapter 4, energy consumption and GHG emissions in industry depend on a wide range of determinants which includes changes in material flows and energy supply infrastructures, etc. Especially for process energy intensive industries, therefore, the **target definitions need to be expanded** in order to address the most important driving forces of industrial energy consumption. An integrated assessment of the company's energy system should be undertaken which accounts for all energy and resource inputs including

1. industrial CHP,
2. feedstocks (non-energetic use of fossils[21]), and
3. new resource inputs, e.g. by recycling or renewables.

A proper and comprehensive specification of **all energy flows** and related measures would increase transparency and avoid double counting, and would prepare the ground to derive **more ambitious but feasible targets**[22]. It has to be kept in mind, however, that significant methodological problems still have to be solved before reduction potentials can be identified and targets can be set, e.g. when accounting for substitution of fossils with secondary fuels such as waste.

In order to enhance the compatibility of the DGWP with international climate policy, it is recommended **to adapt target definitions to the Kyoto Protocol**[23], and to include all six GHG if these are relevant to the specific sector technologies (e.g. in the case of the chemical or aluminium industry). In addition, besides reducing CO2 emissions, energy efficiency contributes to mitigating other energy-related environmental impacts such as SO2 or NOx. Therefore, links between energy-related and climate policy agreements and other instruments of environmental policy should be taken into account in order to benefit from synergies, especially by linking the agreement to generic environmental management or integrated pollution prevention control.

In addition to quantitative target setting, **qualitative objectives** need to be specified with regard to adaptation of energy management systems, organizational changes, altered procurement procedures and decision criteria etc. Moreover, activities need to be

21 Here, the share of non-energy use, which is oxidised immediately during the production process is of particular importance. Most important are feedstocks in the steamcracking process and the total amount of hydrocarbons used for ammonia production (cf. Patel 1999)

.22 Our recommendation starts from the current design concept of the DGWP which aims at covering many different sectors and technologies. In addition to this, more specific and focussed initiatives such as the US-american "Green Lights" or "Motor Challenge" programms can of course make a useful contribution to push progress in particular fields of action and should be investigated.

23 cf. the announcement of the German government (Bundesregierung 1999)

explained more precisely and should be embedded in action plans. The related time schedules can serve as point of reference for internal planning for the participating companies as well as for external assessment of progress e.g. with regard to defined intermediate targets and milestones.

Besides improvements in production, the amelioration of the **energetic performance of products** on the end-user side gains increasing political importance as a field of voluntary action. Especially with regard to household appliances, voluntary approaches can play a role in introducing highly efficient solutions and increasing minimum standards. Without questioning the need for increasing energy efficiency of investment and consumer goods, however, product related targets and measures incorporate different methodological challenges, evaluation problems, etc. They cannot easily compared with and added to energy savings in production and, thus, should be treated strictly independently of process improvements in order to avoid a weakening of commitments, e.g. in terms of double counting between suppliers and users of equipment.

### 5.1.2 Profound analyses and a careful quantitative preparation of targets and procedures

When trying to expand the scope of commitments, better knowledge is needed to specify ambitious but feasible targets which represent a satisfactory advance compared to the reference case. On the one hand, profound analyses and a careful quantitative preparation of negotiations are needed before targets can be set and checked by the monitoring system. In this regard scientific research can play a role, but research will hardly be able to provide a complete picture of energy saving opportunities *ex-ante*. On the other hand, knowledge needs to be gradually accumulated so that the continuous evaluation of experience and professional expertise from business practice is most likely to represent the major source of knowledge. This emphasises the role of the monitoring as an information gathering system.

### 5.1.3 Target group specific design of commitments and procedures

When expanding the scope of targets and increasing the detailness of commitments, the declarations still provide to industry all flexibility and freedom to search for options and to suggest feasible targets. Moreover, by putting more emphasis on preparatory analyses and target definitions, the commitments made by the various branch associations can be elaborated and specified in more detail while taking particular sectoral conditions into account. This would open the possibility to investigate - as well as to communicate - the potentials and limits of voluntary and self-responsible action in the branches more thoroughly.

**Segmentation of the target group "industry"**

Obviously, the relevance of technologies and options for GHG abatement differs between the various industrial sectors, and in order to understand the particular conditions for action better, a differentiated representation of industrial energy and production systems is needed. Inspired by the techno-economic characteristics of the two case studies and comparing them to energy use in industry in general, two principal dimensions can be derived which we use as a first attempt to generate a segmentation of target groups (cf. Kristof et al. 1999):

1. The first dimension can be called the **energy intensity aspect**, which corresponds to the role of the energy intensive core processes and the related importance of process know-how as a competitive strength. Usually, core process technologies are very capital intensive and are subject to long investment cycles (e.g. blast furnaces or rotary kilns), so that achievments in this regard are very closely linked to strategic investment planning and long-term R&D activities. Especially in material processing basic industry, energy inputs are directly linked to product composition and quality aspects.

2. On the other hand, industrial energy systems are characterized by the number and interdependencies of energy consuming processes and applications. Examples are the different levels of process heat which require an integrated optimization of heat use cascades (e.g. by pinch point analyses) or . the design, procurement and operation of the peripheric infrastructure of auxiliary equipment. This dimension can be called the **complexity aspect**.

Being fully aware of the rudimentary character of this simple distinction, a first segmentation and differentiation of the target group by four segments can be derived (see Fig. 8). These four segments can describe single companies as well as distinct organisational units, so that within the different parts of the same firm different characteristics can be found:

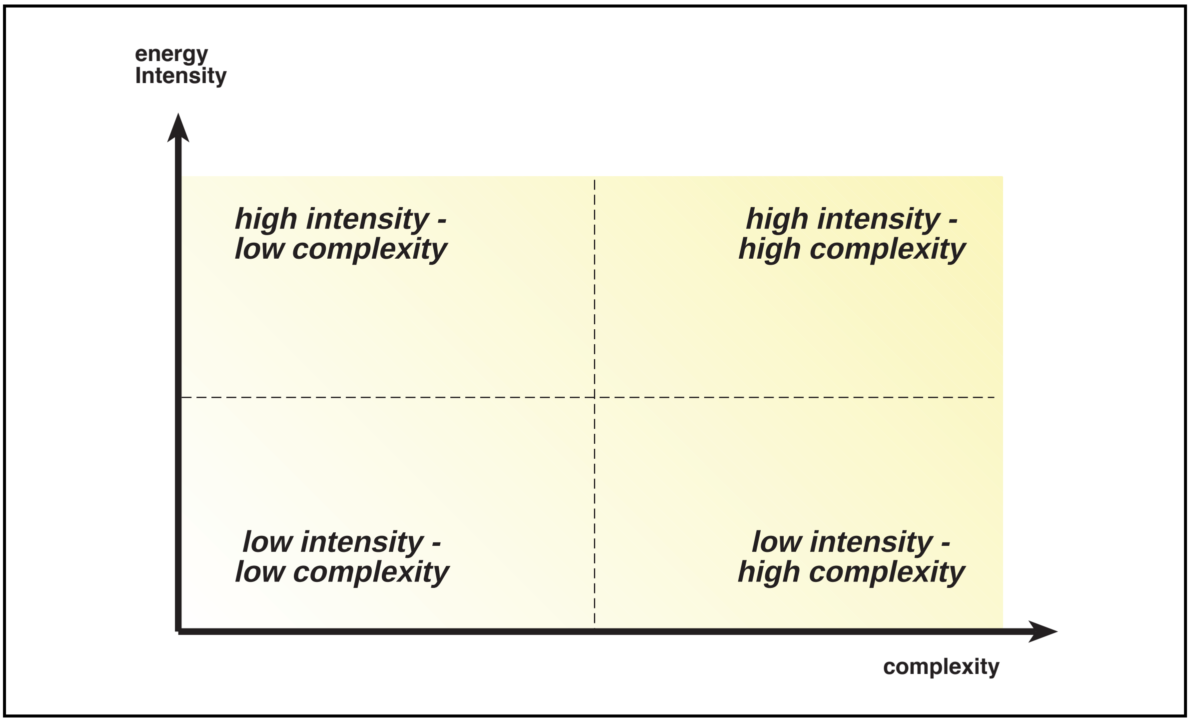
- The segment "**high energy intensity - low complexity**" is described by a focal position of a few highly energy intensive core processes which dominate the energy system. Due to their importance, core technologies have been continuously optimized, and often thermo-dynamic limits have been approached gradually. Often, the opportunities for substitution of process technologies are limited due to missing technology alternatives. Other energy technologies such as auxiliary equipment and, therefore, the complexity aspect play a subordinate role. Due to the limited scope for technical improvements, broader questions of resource efficiency and material flows gain special importance in this segment as a challenge for action. The cement industry is an example of this segment.

- The segment "**high energy intensity - high complexity**" combines very energy intensive core processes with a high number of energy technologies. Contrasting to sectors with a dominating core process, in this area substitutions of processes or technologies are more likely. The different energy uses are strongly interdependent and often integrated in complex networks and internal heat systems. The interlinkages and optimal management of processes represents an important domain of the technological competence of the firm. Due to the strong interlinkage of energy and material flows, in this segment broader questions of resource and material efficiency, new products etc. are very important, too. Large chemical production sites are examples of this type.

- The segment "**low energy intensity - high complexity**" is characterized by a high number of energy technologies, mainly in the field of cross-cutting technologies and auxiliary equipment such as drives, pumps, compressors, etc., which call for an integrated optimization as well as proper operation and maintenance of the peripheric infastructure. Dominating core processes and excessive heat demands are missing, and energy technologies as such are hardly related to the product nor to the technological competence of the firm. Due to the great number of applications, frequent replacement and regular procurement of similiar technologies can be found. Large companies of mechanical or electrical engineering are examples.

- The segment "**low energy intensity - low complexity**" characterizes companies of low energy intensity production and a rather simple energy system. Energy is needed for auxiliar equipment such as lighting, space heat, etc., but has no significant importance for product quality or production costs. Typically, small and medium sized enterprises from the investment and consumer good sector can be atttributed to this segment.

Fig. 8: Segmentation and differentiation of the target group industry by four segments




A differentiation like this could open the possibility to investigate the conditions, potentials and limits of action in the various segments more precisely and it suggests different priorities of action:

- At present the DGWP covers mainly branches which correspond more or less to the upper segments "high energy intensity - low / high complexity". By this, the DGWP covers the major part of industrial energy consumption but, as the above analyses show, it induces only modest impacts on the decisive parameters of influence in these sectors, such as strategic decision making concerning material composition, resource inputs and technology innovation. In addition to voluntary action on the company level, therefore, especially in these sectors strong and far-reaching policy incentives are needed which can serve as a reliable **landmark for strategic planning and R&D initiatives**. Examples such as improved waste management or advances in combustion technologies due to $NO_x$ regulation illustrate the links between technical and managerial progress on the one side and a demanding environmental policy framework on the other. At the current stage, comparable impulses are missing in the DGWP process.

- By contrast, in the segments "low energy intensity - low or high complexity" - or with regard to cross-cutting technologies in the above sectors - a different strategy needs to be applied. In these areas reducing energy consumption and GHG emissions is less a question of technical innovation, and many appropriate solutions are already available on the market. Contrasting to process energy intensive sectors, in these areas the challenge can be seen in a **rapid diffusion and adoption of already existing energy efficiency technologies**. Moreover, due to the frequent procurement of less capital intensive technologies, better possibilities exist to influence recurrent decisions, which emphasizes the role of efficiency orientated management and life cycle orientated procurement schemes[24].

Summing up, an interesting asymmetry of impacts and coverage evolves. At the moment the DGWP is focussing on the upper sectors which are characterized by driving forces beyond the reach of the DGWP process. On the contrary the DGWP seemingly offers the most promising opportunities in the areas of motivation, behavioural change and amelioration of management practices which are of importance for the lower two segments. Currently these are not yet participating in the DGWP, but an extension, e.g. with regard to mechanical and electrical engineering, is under discussion.

Starting from this observation, it can be recommended to intensify the activities aiming at non-core technologies and energy management, especially in less energy-intensive sectors. Within such a strategy, however, industrial associations will have to play a much more active role concerning the organization of mobilization campaigns and events, provision of information materials, dissemination of technical and organizational know-how, market studies, coordination of networks and working groups, best-pratice dissemination, training and qualification, access to third party assistance, etc. It can be questioned whether industrial associations have access to sufficient capacity and expertise to fullfill these tasks. For the major part, an empowerment of the associations, e.g. through additional budgets is not intended by the members - on the contrary, the general trend of downsizing threatens to erode even the existing ability to act. In this context enhanced cooperation with regional energy agencies or the planned federal agency might offer new opportunities to promote energy efficiency in industry.

24 See for example the approach of the Swedish EKO-Energi-Programme, which explicitly integrates guidelines for procurement (ENEU94) in a voluntary agreement scheme (Kågström et al. 2000).

## 5.2 The need for managing the policy process

With respect to the task to develop sustainable energy and production systems, energy and climate policy is far from having sufficient knowledge on driving forces, interdependencies and appropriate strategies. Moreover, politics suffers from asymmetric information with regard to potentials, measures and barriers on the level of company actors which limits the efficacy and predictability of policy intervention. In this context, the DGWP introduced a new quality of policy-making into industrial environmental policy in Germany:

- **shared responsibility:** Different to the traditional approaches of regulation and taxation, the DGWP incorporates a new concept of shared responsibility. The instrument has not been introduced top-down but it has been created and launched in cooperation from policy and industrial actors, i.e. actors with equal status but different roles within the process. Accordingly, both parties bear the responsibility to develop and improve the scheme.

- **common learning**: contrasting to traditional approaches the cooperative approach builds on regular interactions which promises to mitigate information asymmetries and to serve as a new sources of knowledge. In this regard, the instrument represents an innovative exercise without past examples and experiences to rely on, and it opens a new opportunity to search jointly for answers to the sustainability challenge.

- **stepwise development:** Comparable to any other innovation, the impact mechanism, implementation practices and the ultimate success of the exercise cannot be determined in advance. Knowledge needs to be gradually built up so that the approach can only be tested and refined step by step (trial and error). In this regard, the DGWP represents a dynamic approach, and, in principle, it offers a flexible framework to analyse problems and to search jointly for better solutions.

Summing up, the special quality of the DGWP can be seen in the fact, that during the course of implementation all parties involved have the possibility to assess regularily the progress and to adjust both the concept as well as details of administration. In this regard, the basic concept of the DGWP is far more flexible than traditional policy instruments.

Looking at the current status and implementation practice of the declaration, however, these promising opportunties are missed. By conserving the status of implementation of 1996 and related drawbacks, the particular strengths of the dynamic approach are not utilized. In order to benefit better from the still hidden potential, therefore, learning needs to be organized and managed, e.g. by defining the framework how the parties involved should collect information on problems, generate knowledge on solutions and how to reach consensus on further steps. The future contribution of the DGWP as a useful contribution to climate policy will depend on the quality and the effectiveness of managing the policy process.

**Two management cycles as the foundation of the DGWP process**

Well-known from business science and practice, the management of complex problems can benefit from decentral responsibilities and flexible implementation given the crucial conditions that

- targets are clearly defined and enforced by the superior levels, and
- an effective feedback and controlling mechanism is provided which ensures appropriate reactions in the case of deviations from planned schedules.

In order to initiate self-maintaining progress, therefore, it is required to stimulate repetitive management cycles of target setting, action, evaluation and revision of activities both on the company and the policy level:

- **Industrial energy management cycles:** On the company, the tasks basically correspond to the conceptual frame of effective (energy) management systems. As discussed earlier, suitable procedures are often already applied, especially in energy intensive firms where the continuous assessment of operation practice and investment opportunities represents a key to enhancing competitiveness. On the industrial side, therefore, suitable management structures to start from are principally given, but the monitoring schemes need to be used more deliberately to search for GHG mitigation options and to strengthen the role of energy and climate change issues in business practice, including aspects of staff empowerment and upgrading of auxiliary equipment.
- **Policy process management cycles:** By contrast, on the policy level the mandatory prerequisites for successful process management are still underdevelopped. Even if the DGWP is understood as an open, flexible and self-responsible scheme, ultimate control and decision power needs to stay with climate policy. Appropriate capacities for target setting, monitoring, verification and evaluation have to be generated. Neither of these conditions is given at the moment:.
  - Concerning target setting and negotiation, German climate policy is missing both a public debate on national burden-sharing among all end-use sectors[25], and a clear cut strategy how the German government intends to meet the Kyoto targets is still under preparation.
  - Concerning evaluation and revision, the DGWP process suffers from insufficient use of monitoring information for an assessment of performance and modification of the scheme. At present, it is left open what consequences will result from the evidence already available, e.g. concerning the rapid over-achievement of targets, the limited impact on core process technologies, methodological problems, etc.

25 In the Netherlands, for example, environmental goals and sub-targets are much more precisely discussed and agreed upon (Rietbergen et al. 2000; EZ 1998).

From these findings we derive the conclusion, that further specifications of procedures and management rules adaptated to the dynamic nature of the DGWP process are urgently needed. The purpose has to be to create a demanding but reliable framework which

- defines ambitious mid-term and long-term policy targets in order to provide at least some orientation for strategic investment planning;
- forces industry to specify means and measures more precisely on how to use the provided flexibility with regard to GHG mitigation options; this includes a more thorough assessment of potentials and an open debate about the scope for action in the various sectors (see above);
- provides sufficient data quality as well as clear schedules, milestones and assessment criteria for the evaluation of progress, i.e. the available monitoring data should be much more intensively used and delays in the political reactions have to be avoided;
- allows for revising and adapting targets, procedures and schedules according to monitoring results and to international political trends, economic conditions, technical progress, etc.

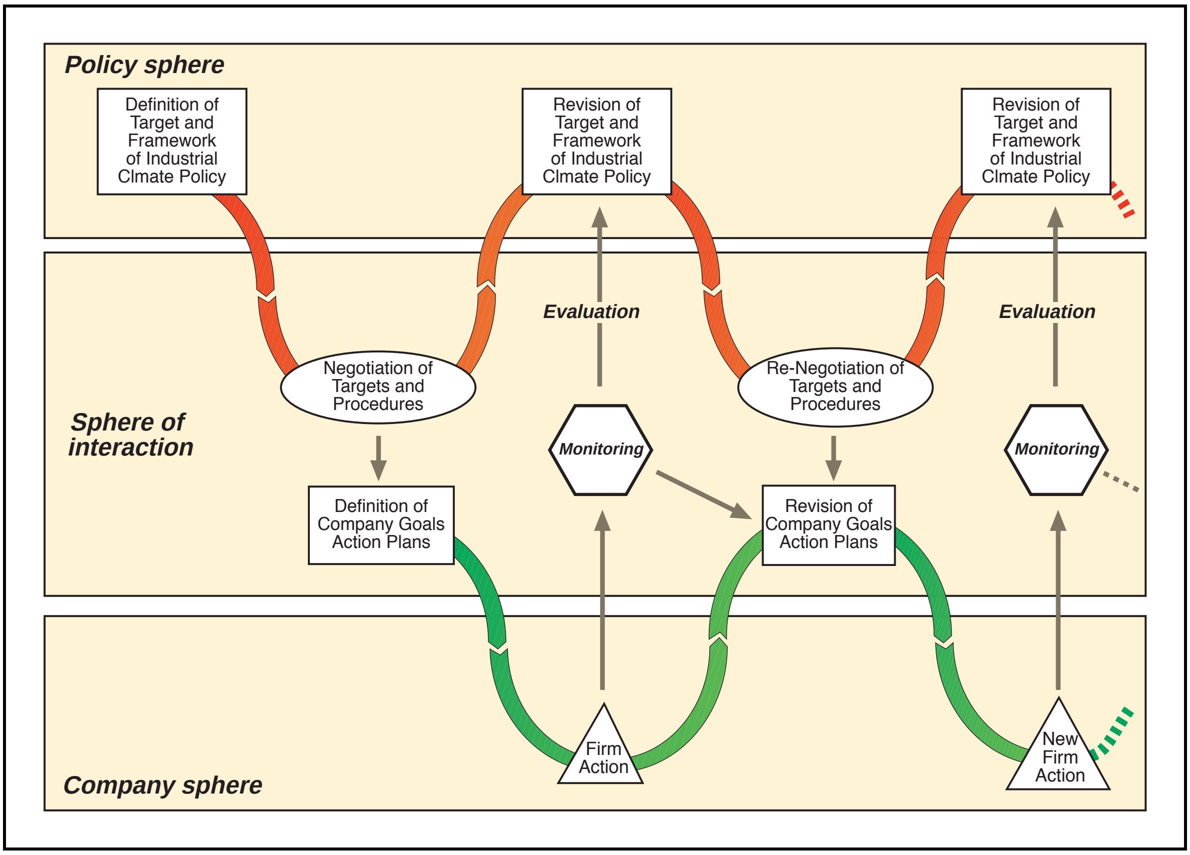
## 5.3 The DGWP as link between business energy management and political process management

The DGWP can and should link the mentioned long-term orientated energy management approaches on the company level with the superior policy process management. In this regard, the monitoring plays an important role as the interface of both spheres, i.e. by transferring experiences and knowledge between firms, and between policy and industry, which increases the mutual capability to act. It is necessary to use the monitoring data

- to assess performance on company level, and to provide information and orientation for business decision-making,
- to evaluate the course of the DGWP process, and to identify the need and options for policy revision.

These interactions can be described as a twofold management cycle of dynamic policy-making (Fig. 9), which results from regular feedback loops and intervention situations within a given time schedule. Clear timing of actions and reactions will provide sufficient incentives - and if necessary the needed negative experiences by sanctions - which are a basic preconditions for learning.

Fig. 9: Twisted management cycles of dynamic climate policy-making




Obviously, administrative costs will be associated with such a dynamic approach, especially in the beginning with regard to the institutional demands concerning the analysis of future potentials, information dissemination, best practice clearinghouses, energy efficiency consultancy and training. At the moment, appropriate institutional arrangements and the personnel capacities for an operationalization of such a dynamic policy approach are still missing or not yet activated.

In the long run, however, implementation efforts are likely to decrease, e.g. through learning effects on all levels, better data availability, increased activity on professional energy efficiency markets, synergies of enhanced energy management with eco-management (EMAS, ISO 14000), etc. In this regard, the DGWP may serve as a tool for strengthening the generic capacity of industry to respond to the coming challenges in the field of environmental, climate and energy policy.

# 6 Conclusions

The "Declaration of German Industry on Global Warming Prevention (DGWP)" represents a new type of instrument in the climate policy debate in Germany. The initiative takes a first step towards more flexibility and responsibility of industry within national GHG abatement efforts. Considering the opportunities but as well the problems and risks related to the introduction of the new approach, the political value of the initiative has to be judged by two core questions:

- Does the instrument generate additional and satisfying effects on energy efficiency and GHG mitigation in industry, and are the results achieved in an efficient manner?
- Does the DGWP provide the preconditions for self-maintaining learning and improvement processes, which eliminate conceptual and practical deficiencies, and ameliorate the instrument's performance?

From our empirical analyses we derive the following conclusions:

Although the initiative is likely to achieve its own targets defined in the various sectoral declarations, the performance of the instrument is characterized by **weak impacts on industrial energy consumption**. Especially with regard to the energy intensive sectors, the approach fails to address the most decisive parameters of influence such as strategic investment planning, changes in material flows and resource inputs, or technology innovation activities. Greater effects can be observed with regard to soft factors such as intra-sectoral communication, enhanced energy management and climate change related awareness. Hence, the DGWP promises to generate mainly indirect supportive effects to improve future energy saving activities. Its particular strength can be seen in its contribution to communication, cooperation and management structures within and among companies. Whereas the DGWP itself hardly provides incentives to adapt strategic investment decisions, the related activities ameliorate industry's capacities to contribute to future challenges of climate policy.

In addition to the limited impacts on energy consumption and GHG emissions, the DGWP process - and especially the monitoring scheme - suffers from **methodological and administrative problems**, e.g. concerning divergences between official statistics and internal branch data, incompatible target definitions etc. The monitoring reports and empirical evidence clearly emphasise the need for revision and modification of the scheme in terms of target definitions, data collection, analytical methodologies, quality of self-reporting, etc. The success of the initiative will depend on all actors' ability to quickly generate substantial solutions to these problems.

Considering the flaws identified in the approach and in the current implementation practice, the **aspect of learning and policy development is of utmost importance**. However, within the time period studied (1996 until the end of 1999), neither the declarations nor the monitoring scheme have been officially revised although a broad range of problems emerged from the start.

In our view, therefore, the **DGWP process is characterized by a striking lack of political guidance**. Without questioning the potential and benefits of flexible and decentral policy implementation by industry in principle, the ultimate responsibility for defining and enforcing targets as well as for keeping time schedules rests with the government. Accordingly, a clear-cut procedural framework is needed which specifies tasks, responsibilities and qualities of interactions more precisely in order to avoid delays, losses of time and tactical behaviour. First of all, this concerns the role of the monitoring scheme which has to be strengthened both as an information system for assessing industrial performance as well as an evaluation tool for a continuous improvement of the approach and the underlying policy strategies. The latter would require the pre-definition of procedures, criteria and policy alternatives to react in a foreseeable and reliable manner on the monitoring results. The objective should be to create a conceptual framework for cooperation and for the political response to activities under the responsibility of industry itself while eliminating the risk that nothing happens until the end of the validity period in the year 2005.

When summing up our observations, the basic question whether the declaration represents an effective and efficient extension of the climate policy mix cannot be answered yet. The declaration of German industry offers new opportunities to support energy efficiency and GHG abatements activities, especially through enhanced communication and inter-firm cooperation. Moreover, in principle it represents an opportunity to establish an interactive framework for managing the policy process and for exploring the scope for sustainable energy use in industry.

At the moment, however, this chance is far from being taken because the approach is applied in a traditional, quite static manner only as a means to block other policy alternatives. In order to utilize and to strengthen the unique but still hidden potential of the DGWP, therefore, industry and policy will have to emphasise much stronger the dynamic character of the scheme. Already existing possibilities to improve the declaration and the monitoring scheme have to be used. Intentions and announcements need to be turned into a dynamic framework of industrial climate policy which enforces ambitious targets and which strengthens the integration of participating companies into effective monitoring, evaluation and learning loops - otherwise the initiative risks to result in a decade of missed chances.

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# 8 Annex

## 8.1 Publications of the VAIE Project

The reports with * are already at the web-site (January 2000): http: // www.akf.dk/vaie
All VAIE-reports will be at the web-site soon.

Krarup, S. and S. Ramesohl (2000): Voluntary Agreements in Energy Policy – Implementation and Efficiency« – The Final Report from the project Voluntary Agreement – Implementation and Efficiency (VAIE). AKF Forlaget, Copenhagen (Final Report and Synopsis).*

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## 8.2 List of Interview partners

| *institution* | *name* | *level* |
|---|---|---|
| **Bundesverband der Deutschen Industrie (BDI)** | Dr. J. Hein | industrial association |
| **Federal Ministry for the Environment (BMU)** | Mr. F.-J. Schafhausen | policy |
| **Federal Ministry of Economics (BMWi)** | Dr. W. Ressing | policy |
| | Mr. Hasse | policy |
| **Verband der Industriellen Energie- und Kraftwirtschaft (VIK)** | Dr. J. Schulz | association |
| | Mr. W. Niebisch | association |
| **Rheinisch Westfälisches Institut für Wirtschaftsforschung (RWI)** | Dr. B. Hillebrand | monitoring institution |
| | Mr. H.-G. Buttermann | monitoring institution |
| | Mr. A. Oberheitmann | monitoring institution |
| **Verein Deutscher Zementwerke (VDZ)** | Dr. V. Hoenig | association |
| | Dr. Schneider | association |
| | Prof. Dr. S. Sprung | association |
| **Heidelberger Zement AG** | Dr. Otto | company, CEO |
| | Dr. Scheuer | company, head of technology center |
| **Dyckerhoff AG** | Dr. Gardeik | company, CEO |
| | Mr. N. Schultz | company, controlling |
| | Mr. G. Schrell | company, director of production |
| | Mr. J. Kirsch | company, technical director |
| **Teutonia Zementwerk AG** | Dr. Rolshoven | company, member of board |
| | Mr. R. Hoffmann | company, head of production |
| | Mr. A. Lange | company, head of production |
| **BV Glas** | Dr. H.-E. Lennertz | association |
| **G+H ISOVER** | Mr. F. Julier | company, senior manager environment, health and safety |
| **Pilkington Automotive** | Mr. H.-P. Karies | company, senior adviser environment, health and safety |
| **Oberland Glas AG** | Dr. W. Schaefer-Rolffs | company, senior manager environment, health and safety |
| **VEGLA** | Mr. C. Gläßer | company, head of environmental management |