Voluntary Agreements – Implementation and Efficiency

Case studies in the sectors of paper and glass manufacturing

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Preface

This report analyses the implementation and efficiency of the Long Term Agreements on energy efficiency in the Netherlands. The report has been published in the series of the project Voluntary Agreements – Implementation and Efficiency (VAIE).

The VAIE project is an EU project supported by »DG XII; Science, Research and Development« through »The Joule Research Programme« (Contract No JOS3CT970021). The 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, 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-á-vis the member states regarding execution of voluntary agreements in member states and on EU level.

The report was written by Martijn Rietbergen and Maaike Breukels under supervision of Kornelis Blok.

Utrecht, 16 February 2000

Martijn Rietbergen

Summary

The VAIE research project studies the implementation and efficiency of (voluntary) agreements on industrial energy efficiency improvement in five European countries. This report deals with the impact of the Dutch Long Term Agreements on the implementation of energy conservation projects on firm level. This study covers two case studies; the paper and board industry and the glass manufacturing industry.

The *first chapter* deals with definition of the research issues, the aims of the VAIE project and this country study and the applied research methodology.

> This chapter shows that the overall research issue must be understood as a complex of three research objects: (1) the national energy policy as the umbrella *agreement scheme*, (2) the *sector agreements* (LTA) and (3) *the energy conservation projects* of the companies. The three research objects are studied in the different phases of policy formulation, negotiation and implementation on the basis of a social constructivist *network approach*.

The *second chapter* starts with a introduction of the LTA in the context of energy policy in the Netherlands and present the main characteristics of the LTA. The end of this chapter evaluates the LTA policy using normative demands, distinguishing organisational prerequisites and prerequisites with respect to the contents of the agreement.

> The LTA approach in the Netherlands emerged as a response to new ideas on co-operative environmental management during the last decade. Since the introduction of the Second Memorandum on Energy Conservation in 1993 LTAs are the main instrument aimed at industrial energy conservation. On average the industrial LTAs aim at an energy efficiency improvement of 20% in the year 2000 compared to the level in 1989. The agreements are supported by several additional policy measures, like monitoring, subsidy schemes, tax reduction and information services.
>
> The second chapter also goes into the process of preparing, implementing and evaluating the LTAs in detail. The process that leads to the concluding of the LTAs starts with strategic talks between the Ministry of Economic Affairs, the branch association and Novem. An exploratory survey is conducted to investigate the organisational and technical options for energy conservation in the sector. The negotiations of the agreement mainly deal with the formulation of the obligations and commitments of involved parties. When the LTA is signed, firms are committed to prepare an Energy Conservation Plan, which includes the firm's individual strategy to energy conservation. After the Novem's approval and the issuance of an environmental permit the firms can start implementing their plans. The firms' results must be reported yearly to the branch association. The individual firm results as well as the sector results are verified by Novem. Sanctions, although very weak, can be imposed to the firms or sectors in case of non-compliance.

The *third* and *fourth chapter* study the impact of the LTAs with pulp & paper manufacturers and the glass industry on the implementation of energy conservation projects on firm level. Both chapters evaluate the sector agreements and the energy conservation projects on the basis of formulated hypothesis and assessment criteria.

Both case studies show that the LTA have stimulated the firms to develop a more structured and systematically way of dealing with energy conservation. Moreover, the LTA has improved the firms' technical knowledge about energy conservation options and possibilities to apply for subsidies and tax reduction. Novem has obtained more detailed knowledge about the applied technologies in the branches as well as better insights in the firms' demands to advisory support.

Although energy efficiency was already a topic of high priority in both the studied sectors, firms consider the LTA mainly as a continuation and strengthening of the previous practice regarding energy conservation. The avoidance of stricter regulations as well as financial and advisory support are the most important motives to join the LTA. The branch association has the task to co-ordinate and stimulate the implementation of the LTA on the sector level. Novem plays a initiating, stimulating, facilitating and verifying role within the LTA process.

Chapter 5 evaluates the formulated hypothesis for the agreement scheme and the criteria for discussing the agreement scheme. The overall assessment is based on the experiences gained through the analysis of the sector agreements and the energy conservation projects. The main results are:

The agreements are an effective and efficient instrument to reach to energy efficiency targets. In 1997 the average energy efficiency improvement of the 30 industrial LTA amounted to about 14.5% compared with the 1989 level. The energy efficiency targets as set out in the LTAs are likely to be reached. The total governmental costs for preparation and implementation of the industrial energy conservation policy is estimated at 1301 MDfl in the period 1989-1999. From the government point of view, the LTAs are a fairly costly policy instrument for the improvement of energy efficiency, but still cheaper than the subsidy instrument. The LTAs has not put the industry to great expenses.

The LTA can be perceived as a flexible policy instrument, although the formal design has not changed dramatically over time. There is no empirical evidence that the LTAs have stimulated the development of new energy efficient technologies.

The implementation of the LTAs requires high institutional demands on both the regulator and regulated. Because of the existing institutional capacity and delegation of task to external consultancies, drastic institutional changes were not necessary.

De-regulation of environmental policies and the aim for an acceptable and realistic energy policy were the main political consideration to choose the agreements as a policy instrument for energy conservation.

Chapter 6 presents some additional remarks.

The structured nature of the LTA-policy seems very impressive and effective, but also shows some weaknesses. First of all CO_2 emission reduction target as outlined in the Second Memorandum will not be met. Secondly, obligatory character of the commitments of the LTA are limited. Thirdly, an effective mechanism for imposing sanction is lacking. Fourthly, no long term impacts of the LTA could be observed.

In the new millennium a benchmarking tool for large energy intensive industries will become the core of the new energy conservation policy. The LTA approach will also be pursued after 2000 on a more individual basis with less energy consuming firms.

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1 Introduction

The research project 'Voluntary Agreements – Implementation and Efficiency' studies the implementation and efficiency of agreements used as a policy instrument for energy conservation in the industry[1]. The project uses four different approaches to analyse the implementation and efficiency of agreements. One of the approaches in the analysis is the country study. The assignment of these country studies is to describe the process of implementing agreements in the countries participating in the VAIE project.

1.1 Definition of the research objects

A voluntary agreement may broadly defined as an agreement between government and a sector in the national economy to facilitate voluntary action with a desirable social outcome, encouraged by the government. This action is undertaken by the participant, based on the participant's self interest [OECD 1996]. In the Netherlands a special version of VA's is developed over the past years: Long Term Agreements on Energy Efficiency (LTAs)[2]. A LTA is a legally binding agreement between the Ministry of Economic Affairs and Industry on negotiated targets for energy efficiency improvements in a sector in the national economy.

The Dutch country study investigates the impact of these Long Term Agreements on energy efficiency improvement and CO_2 emission reduction in the participating sectors. The overall research issue has to be understood as a complex of interdependencies between three research objects on various levels i.e. (1) the national energy policy as the umbrella *agreement scheme*, (2) the *sector agreements* (LTA) and (3) *the energy conservation projects* of the companies. The national energy policy provides the background information for the analyses of the case studies on the sector agreements. The focus of analysis, however, is put on the interdependencies between the sector level (sector agreement) and company level (industrial energy conservation project). The Dutch country study covers two case-studies; the paper and board industry and the glass manufacturing industry. Both case studies cover an investigation of the sector agreement as well as energy conservation projects in the firms.

1.2 Aim of the VAIE project and the country studies

The overall aims of the VAIE project are:

1. To improve the understanding of voluntary agreements dealing with energy efficiency and CO_2 reduction;

[1] In the VAIE research project the following research institutes participate: The department of STS (Science, Technology and Society) from the Utrecht University in the Netherlands, AKF (Institute of Local Government Studies) from Denmark, the Wuppertal Institute for Climate, Environment and Energy from Germany, CERNA/ECOLE DES MINES from France and the Department of Environmental and Energy Systems Studies from the Lund University in Sweden.

[2] From now on Long Term Agreement (LTA) will used in stead of Voluntary Agreement (VA).

2. To discover under what conditions voluntary agreements can be expected to achieve environmental targets in an efficient way;
3. Via the identification of best-practices of voluntary agreements, to give recommendations on how to improve the policy mix to be used to cope with energy efficiency and CO_2 reductions in industry.

Among other elements country studies are one of several approaches within the VAIE project to evaluate the implementation and efficiency of the agreements in the various countries. The specific aim of this country study is to identify and evaluate parameters, mechanisms and interactions which determine a successful implementation of the agreements in the Netherlands.

1.3 Research methodology

The research methodology for the country studies of the VAIE-project has extensively been described by [Kraemer and Hansen 1999]. In short the methodology is as follows. The VAIE-project takes an explicit process perspective which allows to study the genesis and development of activities and their outcomes in relation to the course of time. In order to structure the specific processes, three phases of policy *formulation*, *negotiation* and *implementation* process are distinguished, see [Winter 1994]. The three research objects (agreement scheme, sector agreement and energy conservation project) in the different phases of policy formulation, negotiation and implementation are studied on the basis of a social constructivist *network approach*. The network approach structures the analysis of the three research objects in the three phases. A network is a heterogeneous collection of actors and their mutual relations. The specific research issues studied in the network are 1) actors in the network; 2) mutual relations between the actors; 3) stability of the network; 4) distribution of knowledge and learning process in the network; 5) effects of actors' activities in terms of changes in behaviour and saved energy.

The empirical findings are subjected to hypothesis and assessment criteria as formulated in [Kraemer and Hansen 1999]:

- A set of normative criteria for evaluating the agreement scheme
- Assessment criteria for evaluating the impact of the agreements at firm level
- Common hypotheses for the various research objects
- A general set of criteria for evaluation policy instruments

A major part of the issues related to the agreement scheme were studied on the basis of official policy documents, reports and existing studies. Information regarding the impact of the sector agreements on the implementation of energy conservation projects on firm level were mainly obtained from monitoring reports and in addition interviews with relevant actors. A list of respondents is included in the report.

1.4 Lay-out of the country study report

The lay-out of the country study report is as follows. The following *chapter 2* deals with the agreement scheme, the frame for the sector agreements on branch level. This chapter describes the policy background of the agreements and present the design and the process of preparing, implementing and evaluating the LTAs. Furthermore, the chapter analyses the agreement scheme on the basis of pre-defined research issues and evaluates the agreement scheme using normative demands. *Chapter 3* and *chapter 4* evaluate the LTAs with pulp & paper manufacturers and the glass industry respectively. Both chapters analyse the sector agreement and the energy conservation projects on the basis of pre-defined research issues. The sector agreements and the energy conservation projects are evaluated on the basis of hypothesis and several assessment criteria. *Chapter 5* assess the country study on the basis of hypothesis for the agreement scheme and criteria for discussing the agreements. *Chapter 6* presents the concluding remarks.

2 Agreement Scheme

The national agreement scheme provides the background of the LTA policy and frames the structure and content of the agreements. The first section describes the LTAs in the context of national energy policy in more detail and provides a background of the energy policy in the Netherlands. The second section analyses the agreement scheme on the basis of the research issues defined by [Kraemer and Hansen 1999]. The third section outlines the main characteristics of the Long Term Agreements on energy efficiency in the Netherlands. This section presents the general design of the LTA, the supporting policy measures and describes the process of preparing, implementing and evaluating LTAs in detail. The last section evaluates the agreements using normative demands.

2.1 Policy background

The first oil crisis in 1973 showed that the national energy policy was very sensitive to international developments. The Netherlands depended heavily on the oil exploitation and oil supply from other countries. In 1974 the first White Paper on Energy Policy [EZ 1974] was published. The energy policy in that time aimed at the balanced development of the demand and supply of energy. In 1979 the second White paper on energy policy [EZ 1979] was published. Energy conservation and diversification were the two main elements of the second White Paper. The energy conservation program aimed at an energy efficiency improvement of 10% in 1985 and 20% in 1990 compared to the level in 1974. The second main element, the diversification, aimed at the dispersed use of energy sources. The government introduced large subsidy schemes and communicative instruments to influence the energy conservation behaviour of the industry [Doelen 1989]. The Dutch nation managed to achieve an annual energy efficiency improvement of 2% in the seventies. However the overall energy consumption went down by less than 2% a year in that period. The slow economic growth in the early eighties combined with a small shift towards less-energy intensive industries made the overall level of energy consumption in 1985 just about the same as it had been in 1973. Due to the sharp fall of the energy prices after 1985 and the abolition of subsidies on energy-saving measures the rate of energy efficiency improvement fell to half of what is has been in the period 1973-1985 [EZ 1990].

First Memorandum on Energy Conservation

Due to the strong developing environmental awareness in the late eighties it was decided to give stronger and new impulses to energy conservation and renewable energy resources. This decision was embodied in new measures announced in the National Environmental Policy Plan [VROM 1989] and the First Memorandum on Energy Conservation [EZ 1990]. On the basis of new insights the governments set the goal of stabilizing CO_2 emission in 1994-1995 at the 1990 level. This corresponded to an annual energy efficiency improvement of about 2%. The First Memorandum also formulated the contribution to be made by energy policy towards the CO_2 emission reduction target of 3-5% by the year 2000 relative to 1989/1990. The Long Term Agreements were officially first announced in The First Memorandum as a policy instrument for energy conservation.

The Second Memorandum on Energy Conservation

The Second Memorandum on Energy Conservation [EZ 1993b] published in 1993 drew up the balance of the developments since the implementation of the First Memorandum. The Second Memorandum indicated how the remaining gap could be bridged to bring the CO_2 target within reach, given the present forecasts of economic growth, structure and prices. In the new forecasts the efficiency objective of 1990 had been superseded. At a relatively low economic growth rate an average annual energy efficiency improvement rate of 1.7% over the period 1989-2000 was needed in order to achieve the target of 3% CO_2 emission reduction by the year 2000. According to the Second Memorandum an intensification of the energy policy was required to achieve the annual rate of 1.7% [EZ 1993b].

Main strategies for energy conservation in the Second Memorandum

The energy policy set out in the Second Memorandum aimed at a reliable, affordable and clean supply of energy. The government defined several main strategies to achieve the optimized combination of these objectives or in other words a sustainable supply of energy. The first strategy was to reinforce the market function by self regulation. Giving encouragement to self organization and measurement and awareness of energy consumption were important elements, among others. Consequently the government expressed the wish to broaden and deepen the long term agreements, also outside the manufacturing industry. The other strategies were an intensified of the use of standardization and financial incentives, the forcefully promotion of the development of energy technology and a further attention to the role of renewable energy.

Three tracks for industrial energy conservation in the period 1994-2000

Since the introduction of the Second Memorandum the LTAs have become the real crux of the industrial energy conservation. In the Second Memorandum on Energy Conservation the LTAs are considered as one of the main three tracks to the energy saving policy for the manufacturing industry:

- The first track are the Long Term Agreements concluded with industrial sectors.
- The second track consists of the light Manufacturing Strategy, designed to achieve energy savings by small enterprises unsuitable for the MJA approach. This strategy is supported by the business licensing procedure based on the Environmental Act.
- The third track is to consolidate the technological base, detailed in technology programs and in specific schemes to encourage new technologies.

An industrial energy efficiency improvement (excluding feedstocks) of about 19% can be achieved by the year 2000 relative to 1989 by means of the above mentioned package [EZ 1993b]. The availability of an effective set of incentive instruments was considered as an absolute precondition.

Energy Policy from 1996 and beyond

In 1996 the Third White Paper on Energy was published in response to the wish to improve the sustainability of the energy economy, the internationalization and liberalization of the energy

market and the need for a long term orientation of the Dutch energy policy. The objective of the Third White Paper on Energy Policy remained a reliable, affordable and clean energy supply. The Third White Paper aims at an energy efficiency improvement by 33% in 25 years and a 10% share of renewables in total primary energy consumption by 2020. This implies that significant steps will have to be taken towards a sustainable energy economy, in order to secure a reliable and long–term energy supply and to respond to the threatening climate problem.

Two years after the publication of the Third White Paper there were reasons to review the Dutch energy policy, due to the outcome of the Climate Conference in Kyoto. The countries taking part made a target-based commitment to sharply reduce emissions of greenhouse gasses. The 1998 Energy Conservation White paper [EZ 1998a] reviews the opportunities for further energy conservation policy. The new options considered are Benchmarking in energy-intensive industries, second generation LTA (2000-2010) and an increased attention to energy conservation in Environmental Permits and decrees.

2.2 Analysis of the agreement scheme

The agreement scheme will be analysed according to framework developed by AKF, see [Kraemer and Hansen 1999]. The structure of this section follows the outline of the framework. The following sub-sections will consecutively describe the policy-making and implementation process (section 2.2.1), the actors involved in the LTA process (section 2.2.2) and the effects of the LTA (section 2.2.3).

2.2.1 Policy making and implementation

This section describes the policy formulation, negotiation and implementation of the overall LTA scheme in the Netherlands.

Policy formulation
As shown in the previous section the energy conservation policy for the manufacturing industry was stepped up sharply in the beginning of the nineties. According to the First Memorandum on Energy Conservation a structural change in behaviour with respect to the use of energy was seen as the only long term option for the solution of energy and environmental problems. The government designed a wide set of policy instruments to increase energy efficiency. Among public education and awareness, organizational support, innovation and technology development, regulation and subsidies, the government wanted to introduced agreements as a major element of Netherlands' energy and climate change policy [EZ 1990]. The policy goal of the LTAs is to stimulate energy efficiency beyond existing trends, in a context of low energy prices, without resorting new regulations [EU 1997].

Negotiation
Already before the First Memorandum on Energy Conservation issued in 1989, the Ministry of Economic Affairs initiated talks with Novem and the chemical industry, represented by the

industrial association VNCI on the reduction of the high CO_2 emissions in the sector [Enevoldsen 1998]. The Ministry of Economic Affairs aimed at a *realistic* energy policy, which was *acceptable* for the industry. The Ministry of Economic Affairs promised not to use legal force if the chemical industry was willing to conclude a voluntary agreement on energy efficiency improvement. As a further stimulus the Ministry of Economic Affairs promised to delegate the implementation to the Novem. At the same time the Ministry of Housing, Physical planning and the Environment was also preparing an energy tax for industry. The industry, represented by VNO-NCW (employers' association) strongly opposed the introduction of the energy tax, mainly because of the consequences for the (international) competitive position of firms. In the end the energy tax was limited to households and small enterprises which mainly were not part of the LTAs.

Although the Ministry of Economic Affairs and the Ministry of Housing, Physical planning and the Environment basically agreed that the LTA was a suitable instrument, they disagreed about the target-setting. The Ministry of Housing, Physical planning and the Environment was first of all concerned with the Dutch climate policy and therefor wanted the targets to be expressed in terms of absolute reductions in CO_2 emissions. The Ministry of Economic Affairs on the other hand argued that the demand for absolute CO_2 emission reductions could not stand in the way of economic growth.

Implementation
These negotiations soon developed into a new approach for energy efficiency improvement for a larger industries [Enevoldsen 1998]. Since the introduction of the Second Memorandum on Energy Conservation, the LTAs have become the real crux of the Dutch energy policy. Up till now 29 industrial LTAs have been concluded. The LTAs cover about 90% of the total industrial energy consumption. On average the LTAs aimed at an energy efficiency improvement of 20% by the year 2000 compared with the levels in 1989. The implementation of the agreements on sector level was delegated to the Novem. Chapter 2.3 present the design of the sector LTA in more detail.

2.2.2 Actors

All the relevant actors involved in the policy formulation, negotiation and implementation are already mentioned above. The direct involvement of environmental groups is unknown.

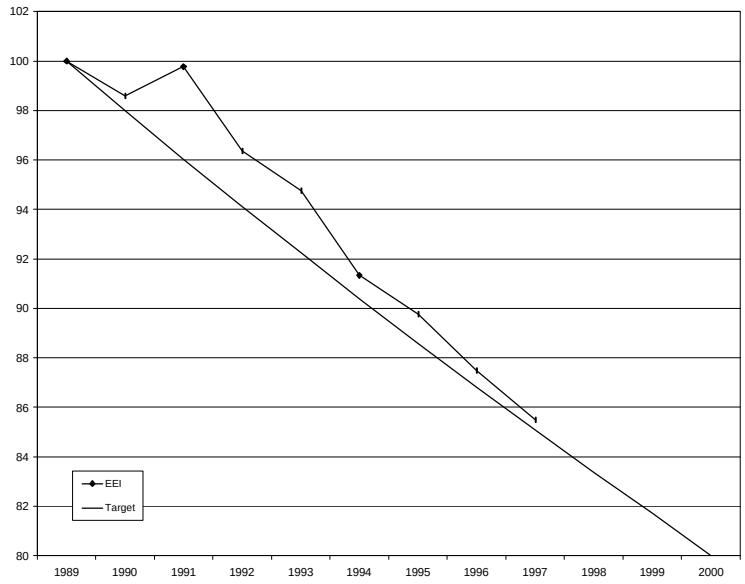
2.2.3 Effects

As of 1 October 1998 30 LTAs have been concluded with industry and 12 with other sectors. Currently more than 1300 firms participate in one of the industrial LTAs. This sub-section presents the aggregated results of the LTAs in the Netherlands, the results by cluster of industry as well as the results of the individual sectors. This section also shortly evaluates the CO_2-emission reductions.

Aggregated results

The total energy use covered by the 29 agreements amounts to 563 PJ in 1997[3]. This corresponds to 90% of the total industrial energy consumption. The average energy efficiency improvement in the 29 industrial amounts to 14.5% in 1997 compared to 1989. This corresponds to a total energy saving of 92 PJ. Figure 1 shows the development of the EEI and the overall LTA target in the period 1989-2000.

Figure 1: Aggregated EEI of all industrial LTAs



Source: [EZ Annual]

The LTAs on energy efficiency improvement in the industry seems to be well on schedule. The average annual decrease of EEI is calculated at 2.0% in the evaluated period (1989-1997). If the results up to the year 1997 are extrapolated, the projected decrease of EEI in the year 2000, when most of the LTAs come to an end, will amount 20%.

Results by cluster of industry

Table 1 shows the number of agreements per cluster of industrial sectors and includes the aggregated primary energy consumption in 1997 as well as the aggregated energy efficiency improvement in the period 1989-1997. Appendix III specifies the clusters and gives the monitoring results of the individual industrial sectors.

[3] The cacao industry has recently concluded an LTA. The monitoring results are not available yet and not included in the monitoring results.

Table 1: Energy Efficiency improvement by cluster of industry

Cluster of Industry	Number of LTA monitored	Primary Energy Consumption in 1997 (PJ)	EEI reduction 1989-1997 (%)
Food and Drink Industry[1]	9	53.3	12
Building Materials Industry	6	30.8	12
Chemical Industries	1	324	15
Other Industries	5	59	17
Base Metals Industry	2	73.4	15
Light Industries	6	22.1	10
Total Industries	29	562.6	14.5

[1] Cacao industry is not included
Source: [EZ 1998b]

The monitoring results show that the cluster of Light industries is relatively far behind on schedule. In this respect it should also be mentioned that the chemical industries are responsible for approximately 60% of the total energy consumption. Results in this sector will highly influence the final results[4].

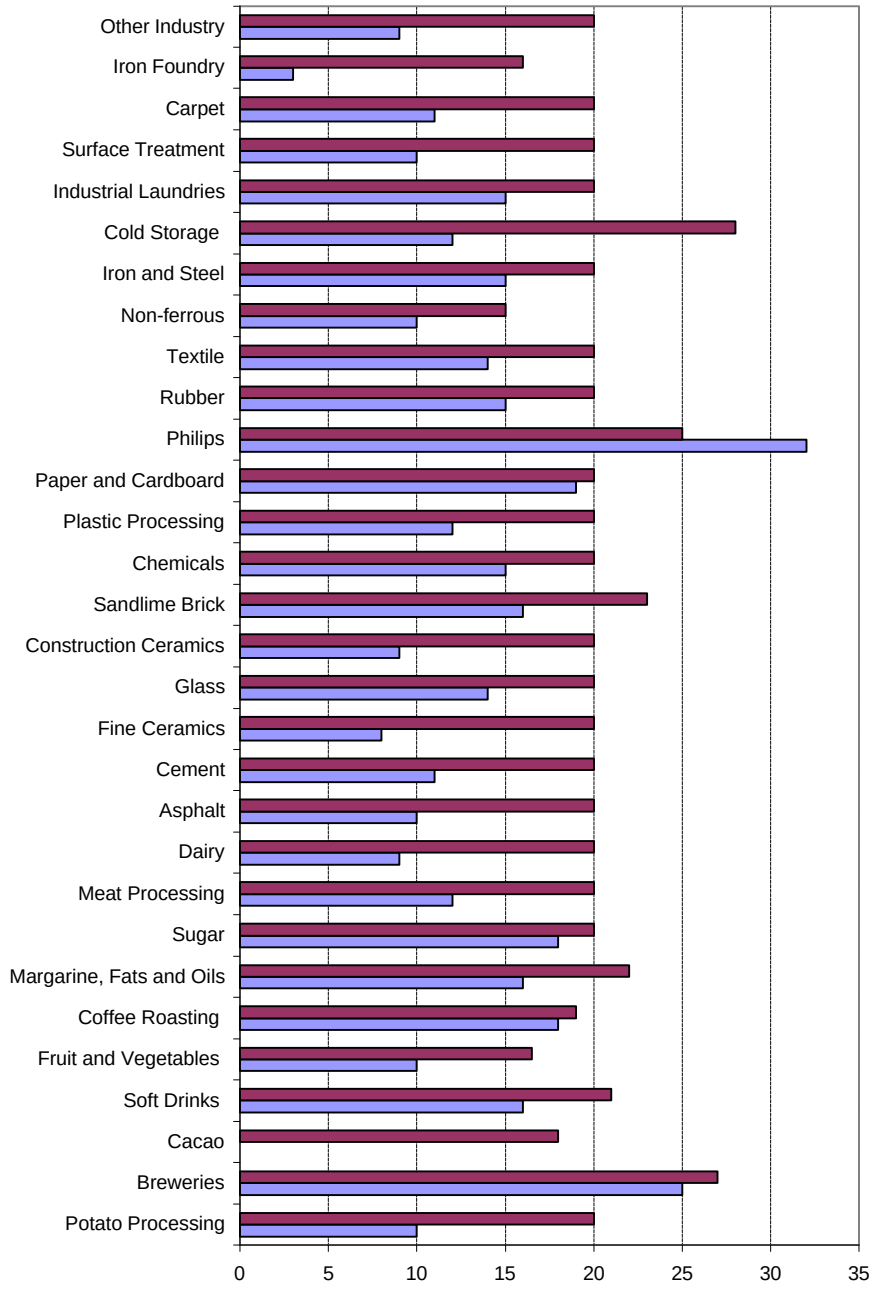
Individual monitoring results
Figure 2 compares the energy efficiency improvement of all the individual industrial LTAs with their targets. It is obvious that the progress of improvements in energy efficiency varies between sectors as investments in industries differ from year to year [EZ 1998b]. The Branch association of the sectors that are behind on schedule are expected to incite their members to greater efforts.

CO_2-emission reduction
The National Environmental Policy Plan 2 [VROM 1993] aims at an overall CO_2 emission reduction target of 3-5% by the year 2000 compared to the 1989-1990 level. However, as a consequence of the disappointing results the Second Netherlands Memorandum on Climate policy [VROM 1996] aimed at a stabilization of CO_2 emission reduction at –3% after the year 2000 compared to the 1990 level.

In terms of CO_2-emission reduction the target is missed. Instead of a reduction in CO_2, actually an increase was observed. In the period 1990-1997 the total national CO_2 emission has increased with 10.8% [RIVM 1998]. Industry (excl. energy sector and refineries) is responsible for about 28% of the total CO_2 emission in the Netherlands [RIVM 1996]. The main reason for the increase of CO_2 emissions is a higher volume growth than anticipated at the time that the framework for LTAs was worked out [Nuijen 1998].

[4] In this respect it is regrettable that in this particular sector there are substantial discrepancies between the energy consumption data of LTA monitoring reports and national statistics.

Figure 2: Industrial LTAs: Energy Efficiency Improvement and targets



Source: [EZ 1998b]

2.3 Presentation of the Long Term Agreements on energy efficiency

This section focuses on the general characteristics of the LTAs in the Netherlands. The first section focuses on the design of the LTAs. The second and third sub-section deals with the monitoring and policy measures that support the implementation of the LTAs. The final sub-section presents the general process of preparing, implementing and evaluating the sector LTAs

2.3.1 The design of the Long Term Agreement

The document signed by the parties starts with the recognition of the greenhouse issue and of the national objective of CO_2 emission stabilisation in 1995 at the 1989 level and a reduction of 3-5% in the year 2000. Also acknowledged is that energy efficiency is one of the important ways to achieve this target and a reference is made to the memorandum on Energy Conservation. The LTA specifies the commitments of both the government and industry, including objectives, targets and how measures can be implemented. The government agrees not to introduce other regulations on energy efficiency in industry and the industry voluntary agrees to reduce its energy intensity [Nuijen 1998]. This section will systematically introduce the major elements of the LTAs in the Netherlands.

Signatory Parties
The signatory parties of the LTA are the Minister of Economic Affairs and the branch Association, representing the firms in the sector. Sometimes the Association of Provinces (IPO) signs the agreement as the licensing authority.

Target & time period
Based on the memorandum on Energy Conservation, the average target of the industrial LTAs is a 20% increase in energy efficiency in the year 2000, from 1989 levels[5]. This target concerns the use of fossil fuels and external electricity, based on the demand for primary energy. The feedstock energy requirement is not included in the target. LTAs with commercial services sector, the non-profit sector, the agricultural sector and the energy conversion sector have different targets and time periods [EZ 1998b]. Appendix III lists the targets in each sector that has concluded an agreement.

Energy conservation approach
The targets in the agreements are set on branch level. There is no formal burden sharing among the firms in the sector. The firms, participating in the LTA must contribute to the achievement of this target to the best of their ability. Accordingly, targets can be fulfilled in the most efficient way and moment [Glasbergen et al. 1997]. Comparing several LTAs [EZ 1993a], [EZ 1992a], [EZ 1996] a general approach towards energy conservation can be discovered. This approach implies that:

- the members of the Branch Association each prepare an Energy Conservation Plan. The confidential ECP contains the firms' individual approach towards energy conservation and their contribution to energy efficiency improvement in the sector and should include [EZ 1996], [EZ 1993a]:

[5] In the early years, some industries felt that the period until 2000 was too long and prone to too many uncertainties to be covered by an agreement. Consequently intermediate targets were set for the year 1995. Such agreements have now been extended to the year 2000 or beyond [EU 1997].

- a description of energy consumption in the reference year and the current year;
- the energy efficiency target of the company;
- an indication of possible activities up to the year 2000;
- an estimated timetable of activities;
- the method of monitoring;
- the method of reporting.

An ECP must be written within one year after the conclusion of the LTA [Glasbergen et al. 1997]. The ECP is for a large part based on an inventory of options for energy conservation on the long and short term in each firm. Novem or external consultancies are responsible for this survey. In the monitoring process the ECPs serve as reference documents to see what projects have been completed and which have to be started in the coming year. Firms must update their ECP regularly on the basis of the monitoring results [Das 1996].

- firms should take into account that the energy conservation aspect of investments in new installations or retrofit investments is important when prioritising new investments.
- the projected investments in energy saving measures as outlined in the ECP should be based on normal pay-back periods for investments in the branch.
- firms will implement all measures aimed at energy efficiency improvement if technically, economically acceptable as well as for reasons of health and safety.
- investments in new installations or retrofit investments must correspond with the 'state-of-the-art' technologies, if economically acceptable given the (international) competitive position.
- firms will search for process-integrated measures, optimising energy consumption, product quality, environment etc.
- firms will intend to do joint research projects together and promote knowledge transfer in the sector.

Long Term Plan for Improvement of Energy Efficiency

In most of the LTA a statement is included in which the signatory parties agree that a Long Term Plan for Improvement of Energy Efficiency will be followed to achieve the objectives as set out in the LTA [EZ 1996], [EZ 1992d]. This sectoral plan contains the required energy conservation measures to achieve the objectives in the sector. The Long Term Plan must be flexible to respond to unexpected developments in market economics and technology [Nuijen 1998]. A long Term Plan starts with a description of the sector concerned and the role of energy within that sector [Nuijen 1998]. Furthermore it includes:

- assessment of energy consumption in 1989 as the reference consumption;
- survey of opportunities for energy efficiency improvement;
- drafting of company energy plans;
- monitoring and energy management in each company
- research and development on new low-energy technologies;
- demonstration projects for energy saving measures;
- market introduction of low-energy techniques;

- assistance to individual companies;
- transfer of know-how and information;

The long Term Plan can be revised in case the branch cannot meet the target as outlined in the LTA.

Corporate Environmental Plan / Environmental target group approach
Most of the LTAs specially refer to the Environmental target group approach and the Corporate Environmental Plans. The signatory parties agree that the objectives, projects and measures according to the LTA will be integrated in the Corporate Environmental Plan and the Integrated Environmental Target Plan according to the target group approach [EZ 1992c], [EZ 1992b][6].

Commitments of the Minster of Economic Affairs
In the LTAs the tasks and duties of the Minister of Economic Affairs are committed. The Ministry of Economic Affairs agrees to support the LTA program, including [Nuijen 1998]:

- Financial instruments aiming at industry: tax abatement can be granted if investments in energy efficient (or clean) technologies are realised. This scheme, however, applies to all companies, whether they are signatories to an LTA or not [Nuijen 1998];
- Financial assistance within the framework of the LTA, including various subsidy schemes aimed at e.g. research and development, knowledge transfer, demonstration and pilot project investments in energy saving technologies [EZ 1996];
- Increase of the above mentioned financial assistance if the programme is more promising than expected [Nuijen 1998]; [EZ 1996]; [EZ 1993a].
- Co-ordination of regulatory measures aimed at energy efficiency in industry, including requirements to obtain permits and energy taxes [Nuijen 1998].
- Furthermore the Ministry is responsible for the organisational structure and co-ordination of the LTA process.

The government assures consistency and protection from new regulations aimed at energy efficiency improvement. It also provides financial and technical support in exchange for voluntary participation.

Commitments of the IPO
Some LTAs have also been signed by the IPO. IPO stands for the Association of Dutch Provinces. The IPO signs the LTA if they are the authorities for licensing environmental permits for the sector

[6] An Environmental Target Group approach has been developed to facilitate and co-ordinate the implementation of the Environmental and Energy policies by the specific sectors. The environmental targets and energy efficiency targets relevant for a specific sector are combined in an Integrated Environmental Target Plan (IMT), which can also be considered as convenants. Each individual firm that is a member of a sector with an IMT draws up a company environmental plan which describes the measures that they will take. The company environmental plan has to be assessed and approved by the licensing authority [Broek and Korten 1994], [IEA 1997].

concerned. They agreed that they will deal with energy consumption in and LTAs in environmental permits as outlined in the Circular [VROM/EZ 1994] published in 1994 by the Ministries of Economic Affairs and Housing, Physical Planning and the Environment [EZ 1996].

Clause providing for amendment or premature termination
In case of circumstances beyond the firms' control, like new or changed policy insights, legislation, declining competitive position of firms or the introduction of new policy instruments, the LTA can either be revised or terminated by the firms. Conversely firms can be excluded from the LTA in case firms do not deliver the monitoring report and the energy conservation plan.

Monitoring and reporting
Firms must annually report the LTA results to the Novem. The annual monitoring report must include the energy efficiency index, quantities of purchased energy, net primary energy use. The report must also contain an overview of the implemented projects and measures that have contributed significantly to the energy savings. The list of implemented projects must cover at least 80% of the total energy savings. The firms must also report on a survey of corrections of the EEI (if applied). The progress report and monitoring must be based on the method as outlined in the ECP [Das 1996]. For a more detailed description of the monitoring is referred to section 2.3.3.

Consultation
In the LTAs the signatory parties have agreed that a consultative board will be formed in which all the signing as well as directly involved parties are represented. The Consultative Board has the task to:

- advise involved parties on the implementation of the LTA [EZ 1993a];
- prepare a LTA progress report for the sector and evaluate the results in the sector [EZ 1996];
- discusses the options for the solution of bottlenecks [Das 1996];
- check the methodology for monitoring and report to the Ministry;
- communication and co-ordination between actors involved [EZ 1992d].

The Consultative Board is also the forum for discussion of economic, policy and technological developments which have a bearing on energy consumption [EZ 1998b].

Publicity
The Consultative group will annually publish a progress report on the results of the LTA in the sector. The consultative group is reserved regarding the public distribution of the progress report.

Other
Most of the LTA include a statement which confirms Novem's contribution to the LTA process. In some LTAs special attention is put on the confidentially of firm specific information [EZ 1993a]. In most of the LTAs the signatory parties intend to evaluate the LTA and study the possibilities to continue the agreements.

2.3.2 Novem's contribution to the Long Term Agreement

Novem is the Netherlands Agency for Energy and the Environment. The agency acts as an intermediary between on the one hand the Ministry of Economic Affairs and on the other hand the industrial associations and the firms. Novem is charged with the executive responsibility of the LTAs. Novem plays a initiating, stimulating, facilitating and verifying role within the LTA process. The exact procedures with respect to separation of these varied tasks are difficult to uncover and therefor not easy to judge. Some actors including [Glasbergen et al. 1997] consider the unclear separation of Novem's task as a serious problem

Specific tasks
The specific tasks of Novem in the LTA process are the following. Novem *initiate* the first talks between the branch association and the Ministry of Economic Affairs. Novem prepares the Letter of Intent and the signing of the LTA. Furthermore Novem supports branches and firms with the definition of the LTA target. The implementation of the LTA is *facilitated* by large support provided by Novem. In the implementation phase Novem supports firms with the preparation of their Energy Conservation Plans and the formulation of energy conservation projects. Novem supports the firms in the form of a detailed audit of the industries' facilities, including an inventory of energy consuming equipment within plants, the specification of how energy is used and the identification of cost effective energy efficient investments. Furthermore, Novem *stimulates* firms by providing financial support for energy conservation projects, research and development and demonstration and pilot projects. In addition Novem assists the firms with designing an adequate monitoring system. Novem also *verifies* the individual monitoring results. Novem is responsible for reporting the results in the sector annually to the Consultative group.

Novem plays also part in the licensing procedure. Novem assesses the energy conservation plans and the corporate energy plan of LTA firms for the licensing authorities and advises the licensing authorities on energy requirements in the environmental permits. Finally the Novem provides the secretary of the Consultative group and is responsible for the knowledge transfer between the actors in the LTA process [Das 1996], [Glasbergen et al. 1997].

2.3.3 Monitoring of Long Term Agreements

Monitoring is a key element in the LTA process. It makes the progress of the LTA in terms of energy efficiency visible per sector. Energy efficiency is expressed as the dimensionless Energy Efficiency Index (EEI). The EEI can be preferably obtained by calculating the ratio of the actual energy consumption to manufacture the entire production in a year and the reference energy consumption:

$$EEI = 100 \times \frac{Actual \quad Energy \quad Consumption}{Reference \quad Energy \quad Consumption}$$

The reference energy consumption is the energy consumption required when the same production had been made with the energy intensities of the various facilities in the reference year (1989). The EEI consequently eliminates the effects of changes in product volume and product mix [EU 1997]. As the preferred method based on physical production volumes can not be used in all cases, a few other variants have been elaborated[7].

Further assumptions for calculating the EEI are:

- Electricity consumption is converted to primary energy requirement and a fixed efficiency rate in the electricity production sector of e.g. 40%;
- The feedstock energy requirement is not included in the calculations of the EEI;
- The efficiency effects from high efficiency conversion systems (CHP, heat pumps) are included;
- Renewable resources are not included as energy sources in the calculation (i.e. application of more renewables contributes to lowering of the EEI).

In some cases firms can apply corrections for i) environment, safety or health requirements, ii) new product specifications, iii) changes in manufactured or purchased intermediary materials [Nuijen 1998]. These corrections have to be agreed upon by both parties involved in the LTA.

To assure the reliability of the data at least 80% of the claimed energy savings (with respect to the reference situation) should relate to concrete energy saving projects. The actual execution and anticipated savings of the projects outlined in the ECPs are checked as well [EU 1997].

The EEIs of all individual process are annually aggregated on firm level. The EEI of the individual companies participating in the LTA are aggregated to yield a sectoral EEI. Only the aggregated data are published, since firms insist on the confidentiality of the figures.

In the beginning of the LTAs problems existed regarding the monitoring of energy efficiency. In each sector a method had to be developed to monitor the energy efficiency improvement. Some sectors had to adapt the existing monitoring system to meet the LTA requirements. Nowadays each sector has there own specific monitoring system. A uniform monitoring system is therefore lacking.

In the early years firms and sector were a bit suspicious regarding the confidentiality of the monitoring data. Sectors had to trust Novem that the firm specific information was treated confidentially. On the one hand the monitoring of energy efficiency was required to supervise and regulate the LTA as well as the business licensing procedure. But on the other hand the monitoring provided a detailed analysis of energy consumption and savings, which was valuable for the firms.

[7] The basic methods for the calculation of the EEI are: a) Energy consumption related to physical unity of product; b) Energy consumption related to added value of production; c) Energy savings based upon energy saving projects; d) energy consumption per unit operation. For more details on these monitoring methods is referred to [Glasbergen et al. 1997] and [Novem 1995a].

[Glasbergen et al. 1997] have assessed the monitoring system. Here the results of this evaluation are presented.

1. *Differences in monitoring systems among the sectors*. In most of the sectors the monitoring of energy efficiency is based on measuring the energy consumption per weight unit of product. Project-monitoring results do not represent reliable figures on energy efficiency improvement. Finally, the conversion efficiency of power plants used in the monitoring methods appeared to differs among sectors.

2. *Unclear aggregation*. The EEI on firm or sector level is often an aggregated value of the energy efficiency of several products. The way in which the energy efficiency of several products is aggregated remains unclear in many cases, even for the verifying authorities.

3. *Use of factors for the correction of the EEI.* First of all the use of factors for the correction of the EEI seems to only have a positive impact on the EEI. Secondly the use of correction differs among the sectors. Until now, the effect of the corrections on the EEI seems however to be quite low.

4. *Contents of the monitoring reports.* Novem must verify the sector monitoring reports. The contents of the reports are however not detailed enough for a thorough verification.

5. *The use of energy carriers for non-energy purposes.* The non-energetic use of energy carriers according to the LTA progress reports can differ widely from the feedstock energy as reported by the Central Bureau of Statistics, especially in the iron and steel industry [Farla and Blok forthcoming].

6. *Differences between CBS energy statistics and LTA results.* In some sectors substantial differences can be observed between energy consumption data published in the LTA monitoring reports and in the annual energy statistics by the Central Bureau of Statistics.

2.3.4 Supporting policy measures

The drafting and implementation of the LTAs are supported by a set of measures particularly relevant to LTAs, but not exclusively available for LTA companies. The following set of supporting measures is available [EZ 1993b]:

Information and consultancy
The LTAs provide a base for selective information towards sectors and individual firms. The branch associations are expected to provide information to their members to the best of their ability. In addition, agreements were made with Gasunie (Natural gas supplier) and the energy distribution companies about the information given to individual firms [EZ 1993b].

The EMA scheme (Energy and Environmental Advisory Support) has been introduced to assist firms in using external consultants to provide screening and consultancy services for their process operations in the field of energy savings and environmental matters. A subsidy of about 45% is granted for energy and environmental audits, with a certain maximum. It has been found that most firms implement more than half of the proposed measures within two years [EZ 1993b]. The EMA scheme does not exist anymore. The scheme has been replaced by the subsidy scheme 'Energy efficiency and environmental advice Cleaner Production' [EZ 1998c].

Gasunie's activities in the framework of the environmental Plan for Industry (MPI) may be regarded as complementary to the long term strategy. The MPI performs energy audits in firms. Gasunie's expertise as natural gas supplier coupled with the expertise of its customers is regarded as a potential source of technological innovation [EZ 1993b].

Energy Management
Energy management plays an important role in working out long term agreements for individual firms. Important elements in a management system are auditing and monitoring. For this purpose, the Energy Potential Scan (EPS) and Energy Monitoring Systems (EMS) have been developed [EZ 1993b]. The integration of energy management with other management systems, notably environmental management within firms was considered as a priority item in the Second Memorandum on Energy Conservation [EZ 1993b].

Investment subsidies and fiscal incentives
To achieve the targets as set out in the long term agreements investments in energy saving projects must continue, especially in less familiar technologies. The BSET is a subsidy scheme that aims at the encouragement of energy conservation technologies, like CHP and the application of selected new technologies like heat pumps and energy recovery. Up to 1994 a subsidy for co-generation of 25% on investment could be received. Through this subsidy scheme the amount of electricity generated by co-generation increased from 15% of total electricity production to more than 20% in the period 1990-1995. In 1994 it was recognised that CHP projects on average projects were sufficiently profitable and did not need extra incentives. The subsidy was replaced by the NEWS scheme, which only grants subsidies on innovative CHP projects with severe conditions with respect to overall energy efficiency [EU 1997].

The VAMIL scheme provides firms the possibility for a free depreciation of investments in environmental technologies under certain conditions [EZ 1998c]. The technologies are published in a list that is regularly updated. In the energy investment tax facility (EIA scheme) 40% of the additional investments can be subtracted from the fiscal profit in the year in which the investment is made. Further tax incentives can be found in green funds [EU 1997].

Demonstration
According to analysis in the First Memorandum on Energy Conservation half of the potential energy savings had to be achieved through technological innovation. The Tenders for Industrial Energy Conservation Support Scheme (TIEB) has been introduced as an instrument available for

promoting of industrial energy conservation. The subsidy percentage varies according to the type of project, but never exceeds 40%. It has however appeared this scheme was just considered as a normal investment subsidy scheme which possibly stimulated extra investments but not technological innovation.

Novem Programmes
Novem should play a co-ordinating role within the sectors as a promoter of activities in the field of energy conservation. Within the sector programmes Novem's role aims at performing monitoring activities and guiding sectors in implementing the agreements. Through these programs, funds (BSE scheme) are made available that can be most flexibly tuned to the LTA-process. Industries can apply for support of studies and Research & Development projects as well as support for communication efforts and monitoring. Depending on the type of project subsidies can range from 10-50% of the total project costs [EU 1997]

MINT Programme
On the basis of the LTAs a clear need has been identified for the improvement of general, broadly applicable technologies which in due course will be needed to enable the conservation potential to be realized. The Long term programme on Intersectoral Technologies for Manufacturing Industry (MINT) is intended to meet this specific need [EZ 1993b]. It must be explicitly emphasised that the MINT programme has not been designed to support the LTAs in contrast with the other policy measures and fiscal incentives mentioned earlier.

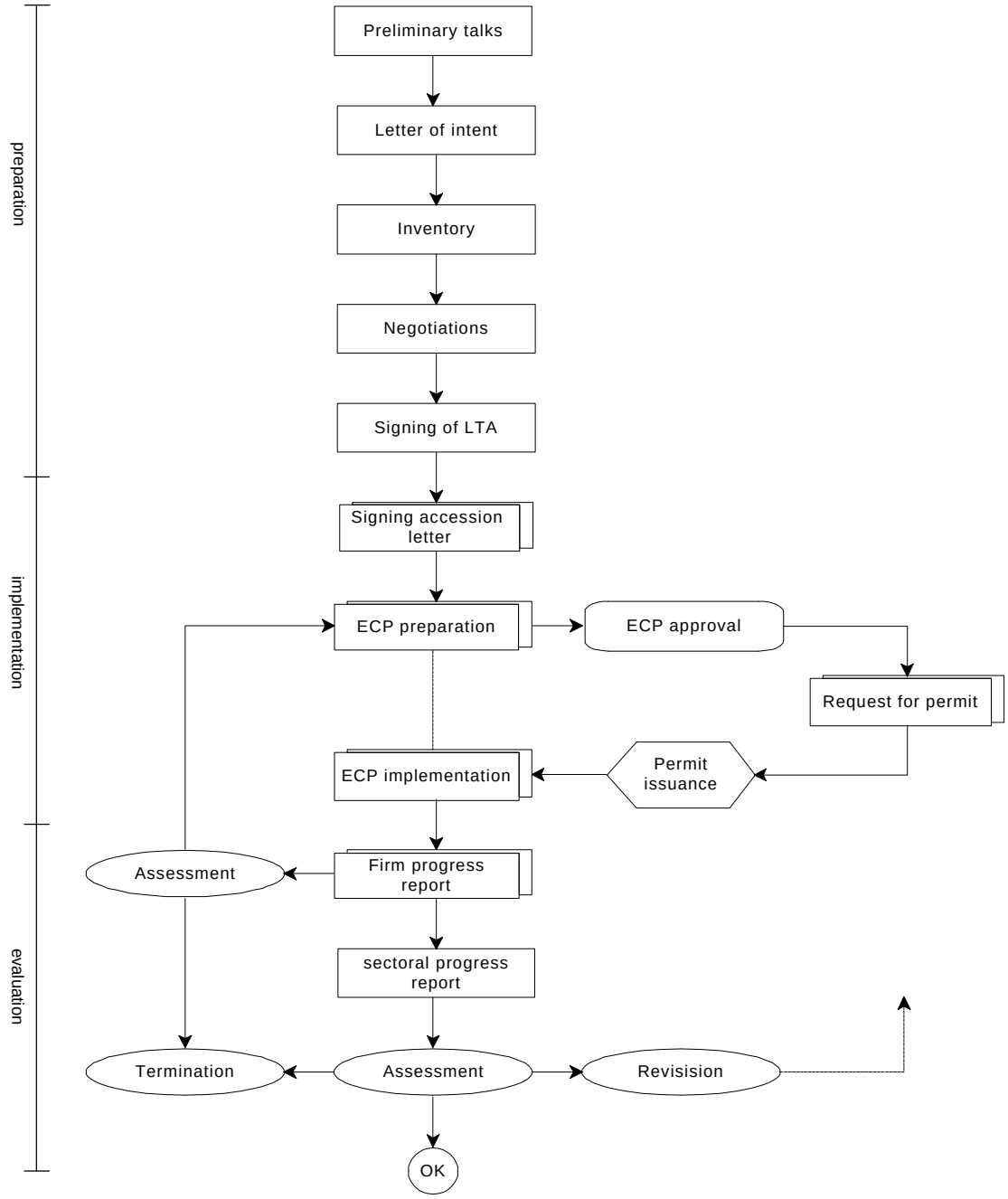
2.4 The process of preparing, implementing and evaluating LTAs

This section describes the general process of preparing, implementing and evaluating the LTAs. The preparation phase is considered to be the period prior to the signature of the agreement. In the implementation phase the LTA is signed and put into effect. The evaluation phase deals with assessment and adjustment of the LTA process. Figure 3 sketches the LTA process and distinguished the three phases.

Preparation
The preparations begins with strategic talks between the Ministry of Economic Affairs, the branch association and Novem on the possibilities of concluding an agreement. Potential signatories are consulted to check their willingness to participate in such an agreement. In [EZ 1993b] the following general steps that lead to the signature of a LTA are considered.

1) Novem approaches an industrial sector for the preliminary discussions about the LTA. Novem makes a preliminary assessment of the potential for energy efficiency improvement in the sector.

Figure 3: Flowchart of the LTA process*



* Single and double boxes refer to sector and firms respectively.

2) The industry association records its willingness to go for energy conservation. The industry association signs a Letter of Intent to undertake energy efficiency improvements, addressed to the Ministry of Economic Affairs.

3) An exploratory survey of the possibilities for conservation and its associated potential is conducted. This can involve both organisational and technical measures. Novem financially supports the inventory of economically feasible measures (with acceptable pay-back period) that can be undertaken in major companies within the industry association. Experience shows

that this inventory usually indicates a much higher potential than companies previously estimated as feasible [EU 1997]. The inventory usually takes about six months.

4) Next the agreement is negotiated between the branch and the Ministry of Economic Affairs. The negotiations mainly focus on the formulation of the agreements, the obligations of the firms and the branch as well as the commitments of the Ministry [Enevoldsen 1998]. The inventory provides the basis for the negotiations on the economic viability and later on the target for energy efficiency improvement. The negotiating phase can take from 6-18 months [EU 1997]. Although individual companies do not participate in the negotiations on regular basis Novem usually asks top managers of the major companies whether they are interested in going ahead [Enevoldsen 1998].

5) The LTA is signed by the industry association, the Ministry of Economic Affairs and Novem. Sometimes the Association of Provinces, representing the licensing authority, also signs the LTA.

The LTA is supported by the 'Long Term Plan for Improvement of Energy Efficiency' in the branch. The total costs involved in the preparatory phase amount on average to about250,000 [EU 1997].

Implementation

In the implementation phase the LTA is signed and put into effect. The following steps can be distinguished:

6) Individual companies express their participation by signing accession letters.

7) The firms that have signed the accession letter are committed to prepare a confidential Energy Conservation Plan (ECP). Sometimes the ECP is required to be completed prior to the signature of the sector LTA. In other cases the LTA requires that company plans have to be completed within a fixed time frame, after signing the LTA.

8) In the following step Novem assesses the ECPs.

9) Next, the firms have to submit a request for an environmental permit. The normal licensing procedure requires a Corporate Energy Plan (CEP). The firms that have signed a LTA can however submit a summary of the ECP.

10) The Licensing authority assess the application for the permit, including the ECP. Novem advises the licensing authorities about the assessment of the plan. In the LTAs the licensing authorities agreed that they will deal with energy consumption and LTAs in environmental permits as outlined in the Circular [VROM/EZ 1994] published in 1994 by the Ministries of Economic Affairs and Housing, Physical Planning and the Environment. According to the Circular, the licensing authority will only include a reporting requirement and requirements to

implement all certain (decided) energy conservation measures in case the firm meets the LTA requirements.

11) After the issuance of the permit firms can start the implementation of the ECP. The firms with several production sites can implement energy saving measures cost-effectively among the different sites.

Evaluation

In the evaluation phase the outcome of the LTA on firm and sector is assessed. Accordingly further actions to improve the implementation process are taken. The following important steps can be distinguished in the evaluation phase:

12) Firms must report the results of LTA annually to the sector association or Novem. In the monitoring reports the firms must include the Energy Efficiency index, the quantities of purchased energy, net primary energy use, including a survey of corrections. An average monitoring cycle per sector costs about50,000 a year for the participating sector and about the same amount for the supporting organisation. On average the monitoring costs do not exceed 10% of the total funds, available from Novem to the participating sectors [EU 1997].

13) On the basis of the annual progress report firms have to up-date their ECP every 2 year.

14) Novem reports the aggregated sector results annually to the Consultative Board. The Consultative group prepares an annual progress report for the sector. The sectoral progress report evaluates the overall evolution of the LTA at branch level. The report aims at informing the public and provides recognition for industries that they have successfully improved their energy efficiency. Novem supports this process as an independent agency and assures the quality and objectivity of the published figures.

15) Firms can be excluded from the LTA under certain conditions. In the newer LTAs a failure to provide an energy conservation plan and annual monitoring reports can be a valid reason to exclude the firms from the LTA [Glasbergen et al. 1997]. When an entire sectors fails to meet the goals as agreed and the sector is not able to give a suitable explanation the sector LTA as a whole can be terminated [Nuijen 1998]. In both cases of termination or exclusion the firms will be subjected to normal existing regulations, i.e. the environmental permit [Nuijen 1998].

16) Conversely firms or sectors can terminate the contract as well. Each LTA specifies that if significant policy changes occur before 2001, the parties may consider revision of the contents of the agreement. The contract may be terminated by either party if no consensus is achieved. Valid reasons for revising the contract can be [EZ 1992d], [EZ 1993a], [EZ 1996]: new policy insights regarding energy and environment; new technological insights regarding energy and environment; the introduction of new legislation; a changing economic growth and (international) competitive position of firms and the introduction of new policy instrument like an energy tax.

2.5 Evaluation of LTAs using normative demands

[Kraemer and Hansen 1999] present a number of normative demands which should be used to evaluate the agreement scheme. Since the Dutch agreement scheme itself has however no characteristics with respect to the contents and organisation, we will evaluate the general characteristics of the LTAs using the normative demands. The normative demands are based on the recommendations and considerations of the European Union research network on market-based instruments for sustainable development [Ekins 1998]. The recommendations (presented in italics) deal with organisational prerequisites and with the contents of the agreement.

2.5.1 Organisational prerequisites

A clear statement should be articulated concerning the role, rights and responsibilities of all parties

The LTA includes a statement concerning the firms' implementation strategy of the LTA and a statement concerning the contribution the Ministry of Economic Affairs. Sometimes a confirmation of Novem's contribution to the LTA process and the contribution of the Association of Provinces is included, in case they have signed the agreement included. The role, rights and responsibilities as outlined in the LTA are relatively clear.

According to the LTA the firms are committed to prepare an energy conservation plan and deliver monitoring figures to the branch every year. The firms have the responsibility to contribute to the LTA to the best of their ability. By signing the agreement the firms have also committed themselves to the adoption of a certain energy conservation strategy.

The Ministry's contribution to the LTA has been clearly formulated in the LTA, taking into account the Ministry's involvement (see section 2.3.1). Novem is charged with executive responsibility of the Ministry's policy. Novem's contribution has been articulated where necessary. The contribution of the Association of Provinces directly refers to the Circular [VROM/EZ 1994], which states in detail how the association should deal with LTA companies and energy requirements in the environmental permits.

The rights of the branch Association mainly concern the circumstances under which the branch can terminate and change the contract. Less clear are the responsibilities of the branch associations, especially regarding the stimulation of energy efficiency improvement (LTA implementation) among the firms in the sector. Although the branch association has a strong co-ordinating and administrative role in the process, not many formal obligations are included the agreements.

The government should have an agency close enough to industry to understand both the concerns and the potential of business, but in turn under the control of an upper administrative branch to limit collusion (agency capture) between agencies and the industrial interests

In the Netherlands Novem acts as an intermediary between on the one hand the Ministry of Economic Affairs and on the other hand the firms and the branch. Novem has an initiating, stimulating, facilitating as well as verifying role in the LTA process. Novem can understand the concerns and potential of business, due to the direct involvement in the negotiations as well as due their long-standing experience with industrial energy conservation. Novem is a company with the Ministry of Economic Affairs as shareholder.

The jurisdiction in question should have an administration to interpret the terms of an agreement scheme

The daily administration of the LTA is managed by Novem. The consultative board in which all the signing parties and other directly involved parties are represented is the forum where problems related to the agreements can be discussed.

Environmental interests should be sufficiently organised and informed concerning the environmental performance and potentials of firms and industrial sectors

The involvement of environmental interests groups has not been studied in such a detail that we were able to verify whether the interest groups are sufficiently informed during the LTA process. The environmental interest groups are not involved in the negotiations and monitoring of the sectoral agreements. According to Novem the interest groups have however had the possibility to influence the framework of the LTA in early beginning.

A system involving concerned parties, independent of industry, should be established to monitor and verify progress towards, and achievement of, targets

The firms monitor the results of the LTA themselves or in close co-operation with external parties. Novem verifies both the results of the sector and the firms. The consultative board which represents all involved parties finally approves the sectoral monitoring and progress report.

2.5.2 Contents of the agreement

Improvement targets and procedures should be transparent, known and understood by the key stakeholders involved

The improvement targets as outlined in the agreement are clear. On average the agreements aim at an energy efficiency improvement of 20% in the year 2000 compared with the level in 1989. The procedures to monitor energy efficiency improvement can however differ among the sectors, as there is some room for interpretation. More uniformity in the monitoring seems to be desirable.

The commitments of the firms as outlined in the agreements (see section 2.3.1) are not unambiguous. The firms are committed to follow a certain approach towards energy conservation

while implementing the LTA. The approach is not a strict set of procedures. The lack of transparent and obligatory commitments concerning the implementation of the agreement corresponds however to the nature of the collective agreement, which takes into account the economic performance and competitive position of individual firms. The energy conservation plans articulate the self-committed obligations of the individual firms.

There should be a mechanism for imposing sanctions in the event of non-compliance

In case of non-compliance the authorities force the firms to better observe the regulations. As a consequence of disappointing 1997 results in some sectors the authorities have forced the branch associations to put more pressure the firms' efforts [EZ 1999]. After a warning firms can ultimately be expelled from the LTA. Even the LTA contract itself can be terminated. In both cases of termination or exclusion the firms will be subjected to normal existing regulations. This means that firms must comply with energy requirements in the environmental permit and that firms cannot benefit anymore from advantages of participating in the LTA, like financial support and technical assistance. Less experiences as however been gained with setting energy requirements. Moreover, the licensing authorities have not given large priorities to this issues. This has changed since the recent introduction of the Circular 'Energy in the environmental permit' [VROM/EZ 1999] which sets out in detail how licensing authorities should deal with the issue of energy in environmental permits.

Up till now a total number of about 50 companies were expelled or have left the LTA scheme. The most important reasons to terminate the contract by the industry side were insufficient possibilities for energy improvement and limited advantages of the LTA. A relatively large number of the firms that have left the LTA belongs to the cold storage and surface treatment sector.

Before adopting reduction targets, procedures or investment criteria, an independent estimation of business as usual should be made to give a counterfactual that is a likely outcome in the absence of LTA

The Dutch agreements do not fulfil this requirement. Instead of an estimation of a business as usual scenario prior to the negotiations, inventories of energy conservation options and potentials are conducted on firm and sector level.

Obstacles to restrain free riders should be implemented when the LTA involve a collective of firms

Although the agreements in the Netherlands are collective and firms must 'contribute the best of their ability', the number of free-riders appears to be limited [Glasbergen et al. 1997]. This is due to the fact that most of the firms consider the targets of the agreement as a binding obligation. Firms have several other reasons to achieve the LTA requirements. Social pressure from other member companies stimulates the firms to put efforts in the implementation of the agreement. Firms do not want to lag behind the other companies in the sector and do not want to lose face.

In the course of time the authorities put more attention to the verification of the individual firm results apart from the sector results. The stricter assessment of the individual energy conservation plans and its implementation aimed at restraining the free-riders in the LTA scheme.

3 Evaluation of the Long Term Agreement with paper and board industry

This chapter presents the results of a case study on the implementation of the Long Term Agreement on energy efficiency in the Dutch paper and board industry. This case study focuses on the implementation of the agreement on sector level as well as on firm level.

This chapter follows the structure for the case studies proposed by the AKF, see [Kraemer and Hansen 1999]. The following section introduces the paper and board industry in the Netherlands. Section 3.2 focuses on the environmental and energy policies in the sector. Section 3.3 will describe the Long Term Agreement in more detail. Section 3.4 and section 3.5 respectively analyse the Long Term Agreement and the energy conservation projects according to the framework of AKF. The final section evaluates the LTA on the basis of the hypothesis and according to the assessment criteria developed by AKF, see [Kraemer and Hansen 1999].

The information in this case is based on written documents and papers as well as interviews with 5 firms and the LTA co-ordinator of Novem and the Paper and Board Branch Association.

3.1 The paper and board industry in the Netherlands

In 1993 there were 30 paper and board companies at 32 production sites in the Netherlands [VNP 1995]. Due to the closing-down of two companies this number decreased to 28 in 1994 (see Appendix). Until 1997 three different kinds of companies could be distinguished: first of all the working companies of the Dutch multinational KNP BT, secondly the working companies of foreign multinationals and thirdly independent Dutch paper and paperboard manufacturers. In 1998 the number of people working in the sector decreased to about 6800.

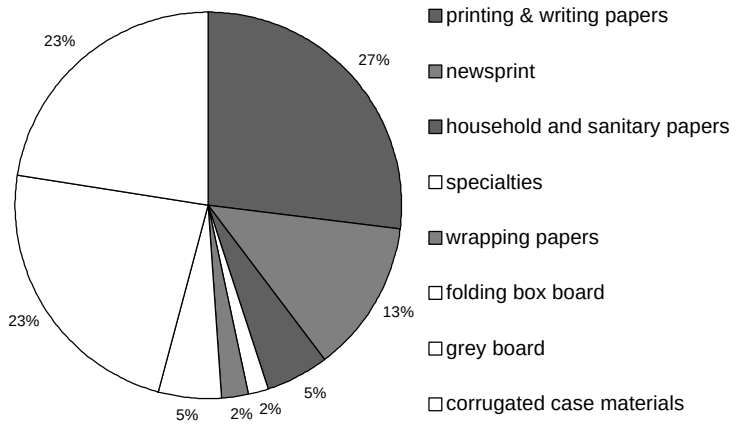
Process description
Paper is produced from fibres. The fibre used to produce paper is supplied by two main sources; virgin fibre from wood and recovered fibre from manufacturing waste paper and discarded paper [Ruth 1998]. A small portion of fibre is derived from other sources, such as cotton fibre. Wood is prepared for pulping by slashing long wood into short wood, debarking and chipping. These steps only require a small amount of energy [WEC 1995]. Wood pulping can be done mechanically, chemically or in an intermediate form. In mechanical pulping the cellulose fibres in wood are most commonly separated by the grinding of wood. Mechanical pulping is a simple and cheap process, but wood fibres are damaged to a large extent. The resulting lower fibre quality limits the use of mechanical pulping mainly to newsprint. In chemical pulping (also called the Kraft process) wood chips are cooked in an aqueous solution of chemicals. The chemical pulping process results in higher paper quality but with a lower yield. After pulping the material may be bleached [Phylipsen et al. 1998]. In the Netherlands only a small amount of pulp is produced. Most of the pulp is imported from abroad.

If paper and board are not manufactured in an integrated pulp and paper plant, pulp is dried and transported to another production location [Farla et al. 1997]. In this case dried pulp is used as feedstock in the paper and board production. The production of paper from pulp involves a series of stages that begins with a stock that is prepared by mixing pulp and water (in case dried pulp is used). The stock is sprayed onto wire mesh to form sheets. Gravitation and suction remove a large part of the water. The sheet of pulp is further de-watered by pressure and heat [Ruth 1998]. Different kind of coatings, depending on the use of the paper, can be put on the dried product. Finally the paper is cut and wound.

Sales and turnover

In 1998 the sales of paper and paperboard amounted to 3180 Mtonnes. In the Netherlands several kinds different product categories are produced. The following figure shows the sectorial sales of different product categories.

Figure 4: Sectorial sales product categories in 1998



Source: [VNP 1999]

The sales in 1998 increased with 0.7% compared to 1997. Growth of sales remained however under the average growth in the EU paper and paperboard industry, which amounted to 2.2%. This is due to the installation of new paper mills in many Western European countries except for the Netherlands [VNP 1998a] in the preceding years. In 1998 about 70% of the paper and board products was exported. The foreign sales of paper and paperboard products have increased steadily this decade. The domestic sales increased in 1998 (+3%), which is against the trend of declining sales during the past decade [VNP 1998a].

In 1998 the total turnover in the paper and paperboard industry increased with 3% compared to 1997 and amounted to 4238 MDfl[8] [VNP 1998a]. Because of the lower increase of sales the average price of paper and paperboard products increased slightly in 1998. The share of the paper and paperboard industry in the total industrial turnover is estimated at 1.4% in 1996. The value added of the production amounted to about 1100 MDfl in 1996 [CBS Annual Publication].

[8] 1 Dfl ≈ 0.45

Energy profile
The level of primary energy requirement in the Dutch pulp and paper sector amounted to 30.2 PJ in 1989 [VNP 1998b]. Although the production of paper and paperboard has increased substantially the total energy consumption in 1996 remained at level of 1989. In 1996 the primary energy requirement in the sector amounted to 30.3 PJ [VNP 1998b]. The share of the energy consumption in the paper & board industry in the total industrial energy consumption can be estimated at 3.1%. Appendix II gives an indication of the level of energy use among the paper and board manufacturers in the Netherlands. The table shows that in 10 firms the level of energy consumption is lower than 0.5 PJ a year and 10 firms consume more than 1.0 PJ a year. In 9 firms the level of energy use amounted to 0.5-1.0 PJ a year.

The drying section in the paper making process is very energy intensive and consumes most of the heat demand in the process. About two thirds of the final energy is used in the drying section of a paper machine to remove the final 1% of the water [Nilsson et al. 1995]. Besides for pulping and the stock preparation, electricity is used to drive the paper machine and to drive the pumps for the transport of water [Farla et al. 1998]. The availability and quality of the recovered paper used as a raw material for paper has also its effect on energy efficiency. In 1985 the share of recovered fibre in the total fibre input amounted to 55% in the Netherlands. In 1997 this share increased to about 75%. Since the preparation of recovered fibres is less energy intensive than the wood pulping process, large amounts of energy savings were achieved [Delemarre and Scheurwater 1998]. However due to the reduced fibre quality of recycled paper new input of wood fibres is necessary to some extent.

3.2 Energy and environmental policies

In recent years the paper and board branch has entered a number of agreements in the field of energy and environment with Dutch authorities. Besides the Long term agreement on energy efficiency the Dutch paper manufacturers have to comply with the packaging agreement and the environmental agreement. Moreover each manufacturer is obliged to have a permit by virtue of the Environmental Management Act. This section gives a short overview of the environmental regulations and the energy policy relevant for the paper manufacturers in the Netherlands.

Long Term Agreements on energy efficiency improvement
Since the introduction of the First Memorandum on Energy Conservation [EZ 1990] the energy conservation policy for the manufacturing industry was stepped up sharply. The energy conservation program in the First Memorandum on Energy Conservation aimed at 20% industrial efficiency improvement excluding feedstocks by the year 2000. LTAs on energy efficiency were considered as a suitable approach to bring about the ‘required and drastic changes in the industry’s [EZ 1990]. In 1993 the first LTA with paper and paperboard industry was concluded and in 1996 the LTA was renewed up to 1 January 2001.

The future energy conservation policies are being prepared. For the bigger companies (energy

consumption >0.5 PJ) *benchmarking* will be introduced in the Dutch paper and board industry in the year 2000, when the LTA will come to an end. The Dutch paper and board manufacturers have committed themselves to belong to the most efficient countries in the world. For the smaller companies (energy consumption <0.5 PJ) new LTAs after the year 2000 are being negotiated.

Environmental agreement
In 1997 much work was done with regard to the implementation of the agreement 'Declaration of Intent on the Implementation of an Environmental Policy for the Paper and Board Industry'. The drafting of Industrial Environmental Plans (BMPs) and its consent by the authorities concerned was settled in the course of the year. The initial BMPs indicate that most targets from the integral environmental task specification (IMT) will be reached before the year 2000. Difficult points are NO_x emissions as well as emissions of sink into water [VNP 1998b].

Packaging agreement
The packaging agreement II [VROM 1997] was signed in 1997, among others by the Foundation Paper Recycling Netherlands (PRB) on behalf of the paper chain. The Paper fibre agreement is an integral part of the packaging agreement II. It covers all paper and board, thus packaging (boxes, wrapping paper) as well as graphic papers (newspaper, magazines, archives, etc.). The main obligations, relevant for the issue regarding energy efficiency, is that in the year 2001 85% of the total amount of paper and board packaging to be newly put on the market (now 66%) will be collected from households and 65% of which will be recycled.

Environmental permit
Since the introduction in the Environmental Management Act on 1 March 1993 it is possible to include energy conservation requirements in corporate environmental permits [VROM 1998]. Most of the firms are obliged to have a permit by virtue of the Environmental Management Act. The procedure for obtaining an environmental permit is simpler for a company, which has signed a LTA. For these companies the licensing authorities are strongly advised to respect the terms of the LTA and to use the environmental permit as a fall back position the company does not comply with the LTA. The Circular 'Energy in the environmental permit' [VROM/EZ 1999] sets out in detail how licensing authorities should deal with the issue of energy in environmental permits.

3.3 Outline of the Long Term Agreement

This section should focuses on the LTA in more detail. The LTA signed by the paper and board branch follows however the general outline of the agreements presented earlier. Therefor we would like to refer to section 2.3. This section describes the major differences.

Signatory Parties
The signatory parties of the LTA are the Minister of Economic Affairs, the Association of Dutch Paper and Paperboard Manufacturers (VNP) and the Association of Provinces (IPO), representing the licensing authority.

Target, time period and coverage
On 11 May 1993 the first LTA with paper and paperboard industry was signed. The agreement aimed at an energy efficiency improvement of 14% in 1995 compared with 1989. On 4 June 1996 the signing parties renewed the LTA up to 1 January 2001. The current target aims at an energy efficiency improvement of 20% in 2000 compared with 1989. This target concerns the use of fossil fuels and external electricity, based on the demand for primary energy. The feedstock energy requirement is not included in the target. The agreement covers pulp, paper and paperboard manufacturers in the Netherlands. This industrial sector is classified with code 21.1 according to the Eurostat nomenclature [Eurostat 1993]. All the Dutch paper and paperboard manufacturers have signed the old and the renewed LTA.

Energy conservation approach
The energy conservation strategy for the implementation of the LTA in the paper and board industry follows the general approach described in section 2.3.1. The members of the Association of Dutch Paper and Paperboard Manufacturers prepare a reference report and a corporate plan instead of Energy Conservation Plans. The corporate plan is for a large part based on the inventory of options for energy conservation on the long and short term in each firm (available in the reference reports). Gasunie, the company supplying natural gas in the Netherlands, and TNO (Netherlands Organisation for Applied Scientific Research) were responsible for this survey. Firms must update their corporate plan regularly on the basis of the monitoring results.

Monitoring
The VNP will yearly calculate the energy-efficiency index, based on the monitoring figures from the individual companies. In contrast with most of the other branches, VNP verifies the individual firm results in stead of Novem. Novem receives the overall results and will annually report the energy-efficiency improvements to the consultative board.

The monitoring system to measure energy efficiency in the paper and board industry (and thus the fulfilment of the targets) can be subject of discussion. First of all a difference between the energy consumption data by the VNP and the CBS can be observed. Secondly, a deviant conversion efficiency for the valuation of electricity is used, which also results in larger differences in the primary energy demand. Finally, the large number of paper and board products considered in the monitoring methodologies makes the system complicated and not very transparent. According to [Glasbergen et al. 1997] only a few people have a complete overview of method.

3.4 Analysis of the Long Term Agreement

The Long Term Agreement with the paper and board industries will be analysed according to framework developed by the AKF, see [Kraemer and Hansen 1999]. The structure of this section follows the outline of the framework. The following sub-sections will consecutively describe the policy-making and implementation process (section 3.4.1), the actors involved in the LTA process (section 3.4.2), stability aspects (section 3.4.3), the knowledge distribution, communication flows and learning experiences in the sector (section 3.4.4) and the effects of the LTA (section 3.4.5).

3.4.1 Policy making and implementation

Policy formulation
The negotiations between the Ministry of Economic Affairs and the chemical industrial association (VNCI) on the development of LTAs resulted into a new approach for energy efficiency improvement for larger industrial sectors in the early nineties. The paper and board industry was also interested in a stabile energy policy and therefor willing to participate in the formulation of a LTA with the branch. During the preparatory talks on the LTA, the paper and board industry doubted however whether an energy efficiency improvement of 20% could be achieved in the specified period, since a lot of energy was already saved before. Therefor the branch wanted to conduct surveys on the energy conservation potential in the branch before concluding a LTA.

Policy negotiation
The branch association, VNP, was the major actor in the branch that prepared and negotiated the agreement with the government. Individual companies appeared not to be directly involved in the preparation of the agreements. The firms were informed by the VNP about the progress of the negotiations. The VNP stressed that only the branch as a whole wanted to make an agreement and not the individual companies.

In a letter of intent, signed on 2 May 1991 by the VNP and the Ministry of Economic Affairs, the parties declared to conduct an exploratory survey of the possibilities for energy conservation in each member company, before concluding the LTA. In the framework of the Environmental Plan Industry, GasUnie and TNO conducted surveys between May 1991 and November 1992. The surveys were partly funded by Novem. The surveys resulted in individual firm reference reports and a branch reference reports called ‘Energy-survey, possibilities for the reduction of the specific energy consumption in the Dutch paper and board industry’ (in Dutch). On the basis of the survey results, the firms concluded that an energy efficiency improvement of 14% in 1995 could be achievable given the economic situation. The energy conservation potential up till 2000 had to deal with more uncertainties, but the VNP suggested that a improvement of 20% could be possible. On the basis of these results the target of the first agreement up to 1995 was accepted.

By signing the agreement, the branch wanted to propagate the environmental friendly image of the sector. Moreover, energy conservation would be an issue for the branch and not explicitly for individual firms. The LTA would take into account the economic prospects of the sector and the differences between the firms in the sector, since the firms could contribute to the target to the best of their ability. All the firms in the branch took part in the first agreement and also continued the participation in the new agreement. The firms believed that a co-operative attitude towards the governmental policy, initiated by the LTAs would be more effective and efficient than an opposing attitude. The new available financial means that Novem had in prospect for firms were also an important reason to participate in the LTA. The LTA also offers the firms flexibility regarding the implementation of energy conservation measures. Firms can decide themselves how to contribute to the target, which investments to make at what time and at what place.

Policy implementation
In 1993 and 1995 the firms prepared confidential corporate plans on the basis of the firm reference reports [EZ 1996]. The corporate plans contain the firms individual approach to implement the LTA. The contents of the plans is not officially known by Novem, since the plans are approved by the VNP. Novem has however seen some plans since Novem advises the licensing authorities about the quality of the plans. According to Novem the quality of the plans can differ among firms. The pay-back period of measures in the plans can also be different. On the basis of the corporate plans the branch association drew up the Long Term Plan for energy conservation till 2001 in the sector.

According to Novem all involved parties agree that the implementation of the agreement is very successful. A large part of the target for the year 2000 has already been achieved. According to the Novem al 'certain' energy conservation measures reported in the corporate plans have been implemented. All the firms in the sector fulfil the requirements stated in the LTA. No important bottlenecks were perceived and no sanctions were taken.

3.4.2 Actors involved and their relations

The main actors involved in the voluntary agreement are the branch association, the firms and Novem. Other actors involved are the Ministry of Economic Affairs, the Association of Dutch Provinces, the Consultative Board and the Gasunie. This section will outline their tasks and responsibilities.

Branch Association
The VNP is the contracting party in the LTA that represent the firms in their sector. The VNP has mainly an organising and co-ordinating role in the LTA. The branch association draws the firms' attention to the need for energy conservation in the sector and communicates with and between their members about the LTA. Moreover, the association keeps an eye on the implementation process of the LTA. In close co-operation with the Gasunie, the branch organisation has developed a monitoring system to measure energy efficiency improvement in the sector. In contrast with other branch associations the VNP is responsible for the assessment of the corporate plans for energy conservation as well as the monitoring on sector level and the assessment of individual firm results.

The VNP established an energy board which was responsible for the preparations of the LTA. The Board was split off from the Economic Process Management Board where energy issues were discussed in the past. The firms' energy co-ordinators are member of this board. After the signing of the LTA the Energy Board was dissolved, but re-established since the discussions about the continuations of the LTA and the Benchmarking convenant.

Firms
Firms can join the LTA by signing a Letter of Accession. In all the interviewed firms the board of directors decided about joining the agreement. All firms are obliged to formulate and implement a corporate plan and improve energy efficiency as far as practically and economically achievable, to contribute to the industry target. The LTA also contains a general approach that should be followed, when implementing the LTA (see section 3.3). Furthermore firms must monitor the LTA annually and report the results to the VNP. The monitoring is carried out in close co-operation with the Gasunie.

Netherlands Agency for Energy and the Environment (Novem)
Novem acts as an intermediary between on the one hand the Ministry of Economic Affairs and on the other hand the VNP and the firms. In general Novem is charged with the executive responsibility for preparing and advising the firms and the branche on the LTAs. Novem co-ordinates and provides technical and financial support to firms and branches for energy conservation projects, research and development and demonstration and pilot projects. Novem must check the aggregate monitoring results in the sector and advise the licensing authorities about the Corporate Energy Plans.

Gasunie
In the framework of the Environmental Plan Industry (MPI) the Gasunie (Natural gas supplier) has made an inventory of the energy conservation potential on firm level and in the sector [Valkema 1997]. The Gasunie has played an important role in the development of the monitoring system in the paper and board industry together with the VNP. The Gasunie also assists firms with their annual monitoring and is closely involved in the annual LTA progress report for the sector.

Minster of Economic Affairs
In the LTA the Ministry of Economic Affairs officially agrees to give financial support the LTA program. The Ministry also agrees to maintain the financial assistance within the framework of the LTA, including various subsidy schemes aimed at e.g. research and development, knowledge transfer, demonstration and pilot project investments in energy saving technologies [EZ 1996]. The Ministry is furthermore responsible for the co-ordination of regulatory measures aimed at energy efficiency in industry, including requirements to obtain permits and energy taxes. The Ministry is also responsible for the organisational structure and co-ordination of the LTA process [Nuijen 1998]. The government assures consistency and protection from new regulations aimed at energy efficiency improvement.

Consultative Board
In general the consultative Board, in which the signing parties as well as other directly involved parties are represented, has the task to advise involved parties on the implementation of the LTA [EZ 1993a] and prepare a LTA progress report for the sector and evaluate the results in the sector [EZ 1996]. Furthermore the consultative board discusses the options for the solution of bottlenecks of the LTA [Das 1996]. The Consultative Board is also the forum for discussion of economic, policy and technological developments which have a bearing on energy consumption

[EZ 1998b]. The board meets about twice a year. One of the issues discussed in the board was the effect of liberalisation of the electricity market (and the consequently less favourable investments in CHP) on the energy savings in the sector.

IPO
The IPO signed the new LTA with the paper and board industries. The IPO represents the licensing authorities. They agreed that they will deal with energy consumption in and LTAs in environmental permits as outlined in the Circular [VROM/EZ 1994] published in 1994 by the Ministries of Economic Affairs and Housing, Physical Planning and the Environment [EZ 1996].

3.4.3 Stability

The stability of the LTA network relates to: a) relation of the LTA to previous practice and policy in the field; b) controversies and consensus and c) understanding of the LTA, goals and content. These issues will be discussed below.

Relation to previous practise
The firms consider the LTA as a continuation and a strengthening of the previous practice. Energy conservation has always been of major importance in the sector and the financial schemes already existed before the introduction of the LTA. The LTA is a formalisation of an existing structure and an instrument for the improvement and maintenance of the energy conservation policy.

Understanding of the agreement
Most of the respondents are of the opinion that the LTA is a clear (written) commitment between the involved parties. Commitment among the firm is considered to be strong, since the LTA aims at achieving a win-win situation for both parties. Moreover, the firms certainly do not want to lose face by not meeting the LTA requirements.

Most of the firms agreed with the strong co-ordinating role of the VNP during the preparations and negotiations of the agreement. However, due to not very favourable economic situations in the beginning of the LTA preparations, some firms had to be convinced about the need, the quality and consequences of the LTA as an instrument for energy conservation.

Conflicts
One of the respondents is of the opinion that the authorities are not a real confident actor in the implementation of environmental policies. The confidence is disrupted, since national and regional authorities set different requirements to water conservation in the sector. No problems have occurred regarding energy issues, but the relationship based on mutual trust is slightly damaged due to this ambiguous target-setting. It must be mentioned that the firm is not able to achieve the (more) strict target very easily. One of the other interviewed firms confirms the differences in the target setting but does not consider this as a problem since targets can be easily achieved.

3.4.4 Knowledge distribution

On the one hand a clear and open communication is a key-factor in the LTA-process. On the other hand the branch appeared to be suspicious towards the authorities regarding the confidentiality of firm specific information. This section describes the current communication flows and exchange of knowledge in the sector and discusses the issue of confidentiality. Furthermore this section includes the learning experiences as perceived by the respondents.

Exchange of knowledge
The major channels for communication about the LTA on sector level are the consultative board (see section 3.4.2), the VNP's energy board, meetings organised by Novem or direct (personal) contacts between Novem and the firms. Moreover, the Research Technology Environment Group of the VNP and later on the Knowledge Centre for Paper and Board play(ed) a role in providing of and communication about new technologies in the sector. Several research institutes like TNO and Gasunie play also a role in the development of new options for energy conservation in the sector.

According to the VNP firms are sometimes overloaded with information. The VNP therefor stresses the importance of timing and tuning information flows via common channels. The sector has developed a plan to improve communication flows in the sector. Novem sees no need to re-structure the communication flows.

Recently (1998) the Knowledge Centre for Paper and Board was established. The establishment was initiated by the VNP, the government and several knowledge centres. The Research Technology Environment Group from the VNP partly integrated their activities in the Knowledge Centre. The Knowledge Centre wants to improve the knowledge infrastructure in the sector. The Knowledge Centre aims at collecting and generating (new) knowledge in the sector, the communication of knowledge and the implementation of new knowledge in the sector. The Centre focuses on knowledge about new technologies for paper and board manufacturing in general as well as on energy conservation technologies in specific. Novem has subsidised two major research programmes. Firms participate in the centre by subsidising research and giving financial support.

Confidentiality of firm specific information
The VNP and the members only wanted to sign the agreement under the condition that the VNP would be responsible for the monitoring, the assessment and the evaluation of the LTA. The VNP was very reversed regarding external communication about the LTA. Novem only received aggregated monitoring results of the sector and not the individual firm results. For Novem it was therefor difficult to evaluate the results of the LTA and give feedback to the firms.

According to the VNP a stabile and continuous relationship with the institution verifying the LTA results is essential. Moreover, the VNP is of the opinion that the assessment of the LTA results requires detailed knowledge about the branch. This opinion is supported by Novem; energy issues should be considered in the broad context of the firm's management. Furthermore, Novem is of the opinion that the LTA can not be a successful instrument without mutual trust between the

involved actors, especially between Novem on the one hand and the branch and firms on the other hand. Novem is fully aware of its difficult position as regulating organisation and stimulator of energy efficient technologies; Novem must on the one hand safeguard firm specific information and on the other hand stimulate energy efficiency improvement among the other firms in the sector.

According to Novem significant changes in the communication processes have occurred. Especially the VNP has become less reversed regarding the external communication. The VNP has become convinced about Novem's merits and the confidential treatment of firm specific information. Recently, Novem also receives the individual firm results.

Learning experiences
All involved actors consider the LTAs as a good instrument to achieve a win-win situation, which can satisfy everyone. The LTAs are considered as an effective and efficient instrument to achieve the specified targets.

Novem says to have obtained better and detailed knowledge about the sector and the technology used in the branch. Together with the firm specific information, recently available, Novem is now able to assess the individual results and give feedback to the firms. Secondly Novem thinks that more uniformity among the implemented LTAs would have increased the possibility to make better use of the learning experiences in other sectors. Thirdly, new themes like de-materialisation and the use of renewable resources must be included in the new LTAs that are being prepared to maintain the current rate of energy saving

According to the VNP the success of improved communication processes is one of the important learning experiences. Secondly the mutual trust and co-operation between involved parties has appeared to be an essential element in the LTA. Thirdly, VNP is of the opinion that all actors must keep on putting attention to the so-called 'learning effects' (i.e. monitoring) of the firms. Finally, the VNP stresses that economic performance of the firms is still more important than the environmental issues.

The firms get better knowledge about there production processes and possibilities to save energy through the LTAs. The monitoring of the energy consumption has provided the possibility to search for new possibilities for energy conservation on firm level. Some firms are of the opinion that also the energy conservation plans are a useful instrument for the systematic implementation of energy conservation measures. For other firms the development of the plan is only considered as a mass of paperwork.

3.4.5 Effects

Here, we would like to refer to section 3.6.3 which points out the organisational changes, new energy practices and the energy efficiency improvement on sector level.

3.5 Analysis of the energy conservation projects

The implementation of the energy conservation projects in the firms will be analysed according to framework developed by the AKF, see [Kraemer and Hansen 1999]. The structure of this section follows the outline of the framework. The following sub-sections will consecutively describe the policy-making and implementation process (section 3.5.1) and the actors involved in the LTA process (section 3.5.2) and knowledge distribution and communication flows in the sector (section 3.5.3).

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3.5.1 Policy making and implementation

Formulation

The reduction of energy costs and the improvement of production processes appeared to be of major importance to start feasibility studies on energy conservation projects in the firms. For example, due to some major changes in the electricity law in the late eighties investments in *CHP installations* were very favourable for two of the interviewed firms. Moreover, the firms could earn a lot of money with the delivery of electricity to the public grid. Several colleagues and the energy distribution sector drew the firms' attention to the interesting possibilities of investing in CHP. In another company energy consumption and thus costs could be reduced significantly by changes in the *stock preparation* process. The formulation of the above mentioned energy conservation projects had already started before the agreement was signed. Although the average target of the agreement could easily be reached with the implementation of only these projects, the firms have implemented additional energy conservation projects as well.

In one of the bigger interviewed firms a special project group has been established that has the task to study the feasibility of new energy conservation projects. The project group is steered by the management board of the firm. The project group has for example studied the possibility to reduce the number of *vacuum pumps* for the paper mill. In the past there was always a large over capacity of vacuum pumps. The firm was informed by Novem about the new pumps and the possibilities to measure the required capacity and thus save energy. The primary reason to start this project was the possibility the cut down on energy costs.

In the same firm the environmental image of the multinational appears to influence the attention for energy conservation. Environmental regulations have large effects on the formulation of new projects, which save energy at the same time, as well.

Negotiation

For the investment in the CHP plant a subsidy was definitely a pre-condition for one of the companies. The subsidy scheme obviously played an important role in the decision-making process. For the other company, who invested in a CHP, a subsidy was not a precondition. The subsidy was relatively small compared with the total investment. The board of directors made the final decision about the CHP investments. The improved co-operation and contact between firms and energy distribution companies was essential in the formulation and decision-making process

about investments in CHP.

In the other firm some people initially doubted whether a changed stock preparation process would maintain the same paper quality. A pilot project was therefor started to test the effects on paper quality and energy consumption. The pilot project was subsidised by Novem. Foreign partners, providing the required technological equipment also participated in the pilot project. On the basis of the results of the pilot project the R&D department of the firm advised the Management board in the decision-making about investments required for the changes in the stock preparation process.

The special project group (mentioned in the section about the formulation of energy conservation projects) presents the results of their study in forum, containing all interested parties, from operators to the management team. In this forum all involved people can criticise the plans. The new projects, including a financial assessment, are sent to the management board, who takes the final decision.

Among the interviewed firms, some energy conservation projects were cancelled because the projects did not meet the required pay-back period or because of technological barriers. According to Novem the firms use a maximum pay-back period of 2-4 years. For more strategic investments longer pay-back periods are more common. The maximum pay-back period can however differ among firms and in time. Besides the pay-back criteria, the uncertainties in the energy prices, uncertainties in the maintenance costs and the size of the investments can be an important element in the decision-making process.

Implementation
No problems were observed during the implementation of the projects in general. The firms did not regret the investment, although the energy prices have declined in the nineties. In one of the firms an energy conservation project was not implemented due to changes in the package of produced products. One of the respondents thinks that the required changes in the attitude of the process operators can be an important barrier for the implementation of energy conservation measures on firm level.

The building of the CHP plants started around 1992. Since 1995 both CHP plants are in operation. The CHP gives the highest contribution to the total energy savings in both the companies. In one of the companies some problems with the CHP occurred during the maintenance of the installation last year.

The changes in the stock preparation process required a modification of the paper mill. These modifications were also partly subsidised by Novem. The modifications also resulted in an increased production capacity of the mill (+25%).

3.5.2 Actors involved and their relations

In the several stages of the policy-making and implementation of energy conservation project different actors are involved, ranging from Novem, foreign partners, energy distribution companies and colleagues. For a more precise interaction of the involved actors in the different stages we refer to section 3.5.1

3.5.3 Knowledge

Firms mainly obtain their knowledge about energy conservation projects from existing networks. The major channels are Novem, various publications, meetings and colleagues. The VNP has a co-ordinating and stimulating role in these communication processes. The VNP often brings all interested parties together, but is not a source of knowledge itself. Firms also develop new energy conservation projects themselves, since process technology and the strongly related energy technology have always been of important interest in the sector. The role of external consultancies in the formulation of new projects is limited according to one of the respondents. Novem draws the firms' attention to the existing subsidy schemes and possibilities for tax reduction. Moreover Novem assists firms with applying for subsidies.

3.6 Assessment of the Long Term Agreement and the energy conservation projects

In this section the implementation of the LTA with the paper and board sector will evaluated on the basis the hypothesis and several assessment criteria, see [Kraemer and Hansen 1999].

3.6.1 Hypotheses for the Long Term Agreement

Firms have a big room for interpretation within the different LTA

This hypothesis can be partly confirmed in this case study. On the one hand there is no room for interpretation with respect to the overall target on sector level. On the other hand firms do have room for interpretation with respect to their individual approach towards energy conservation; firms can decide themselves how they contribute to the target of the branch, at what time and at what place. Firms must however contribute to the best of their ability. This means that already efficient companies do not necessarily have to meet the average target. At the same time less efficient companies are stimulated to improve their energy efficiency. The agreement also takes into account the economic situation and performance of the individual firms. In this way each firm develops its own individual approach and strategy for energy conservation.

The paper and board industry has room for interpretation regarding the procedures for calculating the Energy Efficiency Index. A deviant conversion efficiency of 38.1% (in stead of the prescribed 40%) is used to calculate the primary energy requirement of the electricity consumption. According to [Farla and Blok forthcoming] the use of this lower conversion efficiency may overestimate the savings from CHP installations by as much as 10%.

Authorities seldom use sanctions if the firms do not keep a LTA

The paper and board industry performs very well regarding energy efficiency improvement. All the firms fulfil there procedural obligations (delivering monitoring figures and energy conservation plans). There was no need to use sanctions in the sector. Consequently this hypothesis can not be evaluated in this case study.

(Adapted) LTAs have a different impact on large firms as compared to SMEs

In this case study differences in the impacts of the LTAs on the interviewed firms could not be observed.

In the short run the agreement does not improve the level of energy efficiency considerably above the non-intervention level, but in the long run new procedures and a higher level of information regarding energy efficiency will lead to considerable energy savings

Comparing the achieved energy efficiency improvement in the paper and board industry during the agreement with the results in the preceding period learns that the rate of improvement has not changed significantly. The previous decade was however characterised by high energy prices and large subsidies for all investments aimed at energy efficiency improvement.

The target of the current long term agreement will probably be reached in the year 2000. For a large part the energy savings have however been achieved by the installation of CHP plants. The recent introduction of energy management systems and the more and more implemented environmental management systems are often considered as promising instruments to improve energy efficiency in the long term. The second generation Long term agreements as well as the benchmarking initiatives must show whether the rate of energy efficiency improvement can be maintained in the long run, by implementing additional energy conservation measures.

To sum up, this case study supports the hypothesis that (apart from the energy savings by CHP) the agreement does not improve the level of energy efficiency considerably in the short run There is no strong empirical evidence that in the long run new procedures and a higher level of information regarding energy efficiency will lead to considerable energy savings.

Firms get more information through LTA networks on energy efficiency from other firms within or without the industrial sector, which reduces the transaction cost of energy saving projects

All firms support the hypothesis that the agreement has enhanced communication flows through the LTA network and in the branch. The agreement has improved firms' technological knowledge about energy conservation options as well as access to several schemes providing financial support. It could not be assessed whether transaction costs of energy saving project are indeed reduced.

Authorities get a deeper knowledge of the specific production processes through LTA (LTA decrease the asymmetric information problem)

This hypothesis is supported in this case study. Novem confirms that through the agreement a deeper and more specific technological knowledge of the sector has been developed. Here it must be mentioned that this is also due to Novem's new energy conservation approach and not only because of the agreement. Since 1985 a sector approach replaced a technological based approach for energy conservation.

3.6.2 Hypothesis for the energy conservation projects

Energy conservation projects are more often a minor appendix to the everyday life of the firms, therefore they will often be related to other issues, which the firm finds more important, e.g. environmental considerations

The reduction of energy costs and the improvement of production processes appeared to be the most important reasons to study the feasibility of energy conservation projects. Energy conservation is therefor not an issue on itself. At the same time it can however not be considered as a minor appendix, since energy conservation is closely related to the production process. Energy conservation projects where not carried out because of environmental considerations in the first place. Consequently, we suggest that this hypothesis is only partly supported by this case study.

Most energy conservation projects are implemented by a top-down approach from management

This case study shows that the energy conservation projects can be formulated and negotiated with either a bottom-up or top-down strategy. Energy conservation projects can be initiated by shop-floor workers, technical staff or by the management (section 3.5.1). Most of the final investment decisions are however taken by the top management, since the studied conservation projects require large investments. The implementation strategy of energy conservation projects, after investment decisions were made, could not be revealed.

Energy conservation projects are often rather technical, and therefore involve the technical staff rather than ordinary employees

Energy conservation projects are often closely related to the production process and are therefor rather technical. As far as can be investigated, all relevant actors in the firms are involved in the discussions about the energy conservation projects. Since they are rather technical, ordinary employees are indeed less involved.

Energy conservation projects do not relate to the PR strategy of the firm

$_2$ emissions)

rather than the energy conservation projects itself relate the PR strategy of the firm. The environmental image of the firms seems to be more often considered as an important element of the PR strategy, especially in large firms and member companies of large multinationals. Energy conservation projects are carried out because of process improvement and cost reduction and not because of a PR strategy. So, in general this hypothesis is supported by our findings.

3.6.3 Assessment criteria

Organisational changes
Energy conservation has always been important an important issue in the paper and board industry. The implementation of the LTA has resulted in some organisational changes in branch:

1. The VNP deliberately has appointed a secretary to put more attention to for environmental affairs and energy issues in the sector;
2. The VNP energy board was established to prepare the LTA and communicate with the members of the VNP;
3. The Knowledge Centre for Paper and Board has recently been established;
4. Recently new energy management system have been introduced in the firms;
5. Within firms (new) co-ordinators for energy issues were appointed or tasks and responsibilities were re-defined.

Here we must also point at the Novem's new energy conservation approach which started in 1985. In 1985 a sector approach replaced a technological based approach for energy conservation. The LTAs have obviously benefited from this new organisational approach.

Technical changes
The energy conservation measures taken in the paper and board industry are divided in the five following categories:

1. Good housekeeping/energy management. The category 'good housekeeping' concerns energy saving measures that have a relatively short pay back period and do not require large investment. Energy saving measures in this category concern new procedures, implementation of environmental quality systems, simple adaptations and improved maintenance, as well as projects aimed at the improvement of energy management.

2. Combined heat and power generation (CHP) and energy conversion. Projects in this category are aimed at the improvement of the conversion efficiency. The contribution of CHP to the energy savings is the highest in this category.

3. Energy-saving investments (retrofit). Energy conservation, related to these investments, has often a process integrated character. 'Energy-saving investments' concern projects aimed at the improvement of energy efficiency. Hence, the profitability of these investment depend largely on the conservation potential of the energy saving measure. Examples of such investments are

insulation, adjustable speed drives and heat recovery.

4. Projects with a strategic character or replacement of equipment. This category concerns investments aimed at the replacement, maintenance or extension of industrial equipment. These investment are primarily made for strategic reasons. The profitability of these investments does in general not depend on the energy conservation potential. Changes in raw material input are also included in this category

5. Product efficiency improvement. Projects in the category product efficiency improvement are aimed at for example reducing waste, equipment failures etc.

Table 2 gives an overview of the energy savings in the paper and board industry divided into the five conservation categories mentioned above. The total energy savings in 1997 compared to a frozen efficiency situation in 1989 amounted to about 7.2 PJ. This corresponds to about 470.000 tons of avoided CO_2 emissions [VNP 1998b].

Table 2: Energy savings in paper and board industry 1989-1997

Conservation category	Energy saving 1989-1997 (TJ)		
	Increase	Decrease	Net
Good-housekeeping/energy management	+10	-140	-130
CHP/Energy conversion	+3	-3527	-3524
Energy saving investments	0	-417	-417
Strategic/replacement investments	+72	-2081	-2009
Product efficiency	+242	-1588	-1346
Not identified	+400	-220	+180
Total	+727	-7973	-7246

Source: [VNP 1998b]

According to Table 2 most of the energy savings were achieved by the increased CHP capacity in the paper and board industry. Until 1996 a number of large CHP plants (ca. 60 MWe) were installed. The share of the CHP in the total energy savings is about 49%. According to the paper manufacturers this was for an important part due to an agreement between the SEP and EnergieNed on the limited growth of installed electric power, changes in rate structures and the liberalisation of the electricity market. The energy efficiency still improved due to the introduction of an energy management system and improvements of process efficiency [Delemarre and Scheurwater 1998]. According to Novem the less efficient companies show better energy efficiency improvements than the firms that were already more efficient.

Effects on energy practice

An important question is to what degree the agreements really have led to new practices regarding energy conservation in the sector.

Firms say that the LTA has increased the attention for energy conservation in the sector and that the energy efficiency improvement would not have been as high in case no agreement was concluded. The additional savings of the agreement are however expected to be low. The firms confirm the stimulating role of the branch association during the implementation of the LTA. The respondents confirm that the LTA has enhanced their technical knowledge about energy conservation options and possibilities to apply for subsidy schemes or tax reduction.

On the other hand the firms indicate that all the investments in energy conservation projects would also have been taken anyway, also without the agreement. For significant energy savings often large investments are required, which are assessed on the basis of normal investment criteria if no additional obligations exists. Most of the investments are made because of process technological reasons. Mainly proven technology is applied.

The changed view of the branch association on Novem's participating can be considered as an important new practise. Together with the (re-)structuring of the monitoring and the energy management system this is considered as a key-element in the feedback mechanism of the LTA.

Relation to supporting initiatives
The subsidy schemes and tax reduction are often considered as an important element in the LTA. About 1 MDfl is yearly spent on program funds (BSE subsidies) for the paper and board industry. The budget is divided among about 10 projects a year. Besides this subsidy scheme firms apply for tax reduction (like VAMIL and EIA) and other funds, not directly aimed at LTA companies (e.g. TIEB/Tendem and SPIRIT) as well, see section 2.3.4.

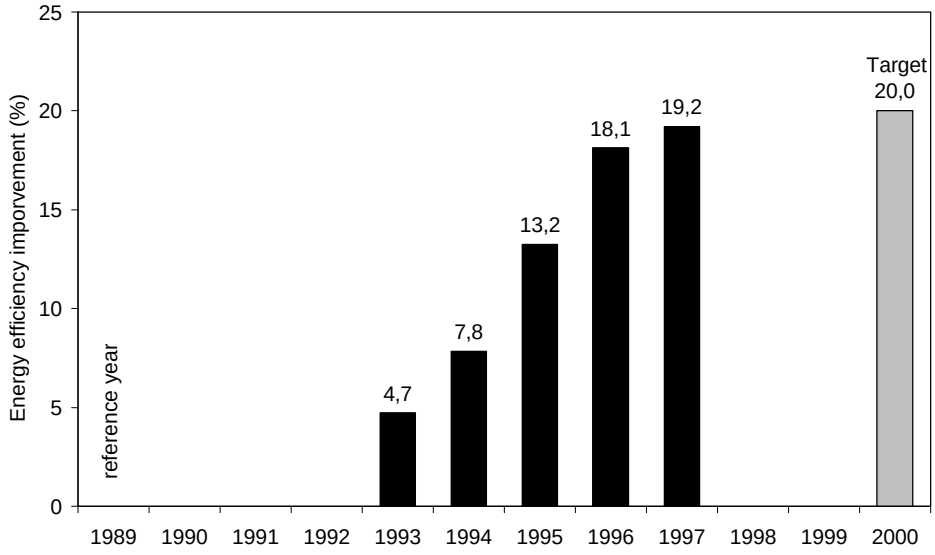
Our interview results show that some firms obviously benefit from Novem's financial assistance. Other firms do not profit from those subsidies, since the subsidies are primarily aimed at the introduction or demonstration of new, innovative technologies. In some energy conservation projects subsidies were only of minor importance or did not play any role in the decision making. According to Novem the subsidy schemes play not a leading but still important role in the LTA. One of the firms indicate that nowadays it is more difficult to receive a subsidy. In the early days of the LTA the firms did not very often make use of the subsidies, since large firm investments were required as well. Due to the LTA and the Target Group Approach the contact between firms and authorities have been improved. Consequently firms make more use of the subsidy schemes.

According to the firms the energy issues in the environmental permit and the environmental agreement are fully covered by the LTA. No tuning problems were observed although in some companies different people are responsible for the LTA and the environmental convenant. Among the firms in the sector the implementation of an environmental management system seems to become a standard.

Fulfilment of agreements' target
Figure 5 shows the energy efficiency improvement in the paper and board industry in the period 1989-1997. The target of the first LTA, aiming at an energy efficiency improvement of 14% in

1996, was not completely achieved, due to a delayed start of some CHPs. Up till 1997 the energy efficiency improvement amounted to 19.2% compared with 1989.

Figure 5: Energy efficiency improvement in paper and board industry



Source: [VNP 1998b]

The sector is consequently somewhat ahead on schedule to realise its target. The paper manufacturers expect that the LTA target can be achieved if the utilisation rate of CHP does not further decrease.

4 Evaluation of the Long Term Agreement with glass industry

This chapter presents the results of the case study on the implementation of the Long Term Agreement on energy efficiency in the Dutch glass industry. The chapter is structured according to the framework developed by [Kraemer and Hansen 1999]. Section 4.1 gives a (short) description of the Dutch glass sector including its energy profile. Section 4.2 goes into the energy and environmental policies. Section 4.3 outlines the contents of the Long Term Agreement, whereas section 4.4 and section 4.5 respectively analyse the Long Term Agreement and the energy conservation projects according to the framework of the AKF. The final section evaluates the LTA on the basis of the hypothesis and according to the assessment criteria developed by AKF, see [Kraemer and Hansen 1999]. This chapter is based on several documents (like the LTA contract and monitoring reports), other research reports and several interviews with representatives of three glass manufacturers, Novem and the VNG, the association of Netherlands' glass manufacturers.

4.1 The glass sector

The glass industry is a relatively small and stable sector with regard to the number of companies. In 1980 only 7 large manufacturers, running in total 10 glass works, produced glass. This did not change until 1998. All of them (except Akzo Nobel) are joined in the branch association VNG (Vereniging voor Nederlandse Glasfabrikanten). Only very recently one more (foreign) company entered the glass sector [EZ 1992c]. All of VNG members (except Phillips) have joined the agreement. Philips did not join because the company has its own LTA. Philips agrees however with the contents of the agreement and will also take part in joint projects and VNG meetings.

In 1989/1990, the sector employed about 5980 people, in 1997 this number was reduced to 3600 people. The production stayed more stabile. In 1989/1990, the sector produced 1113 kton glass, in 1997 it produced 1108 kton glass [EZ 1998b], [Novem 1994]. Both the size and the products of the companies are very diverse as is shown in Table 3. Except for the largest glass manufacturer (Vereenigde Glasfabrieken), most manufacturers are at this moment part of a large multinational company.

Table 3: Glass manufacturers in the Netherlands

Manufacturer and location	Product	Employees	Production (t/day)
NV Vereenigde Glasfabrieken (Leerdam, Schiedam, Maastricht)	Container glass	2000	(3 sites) 1600
PLM (Dongen)	Container glass	550	700
Maasglas (Tiel)	Flat glass	500	450
PPG (Hoogezand)	Glass fibre	800	130
Isover (Etten-Leur)	Glass wool/film	330	170
Philips (Roosendaal, Winschoten)	Speciality glass	1800	50

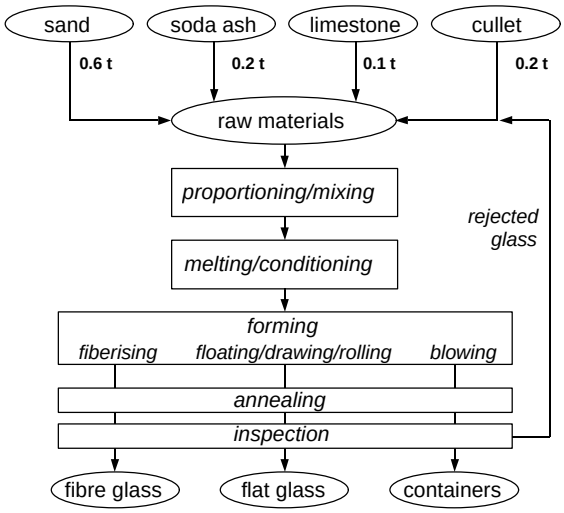
Source: [Novem 1994]

Technology and production process

Figure 6 gives a schematic representation of the glass producing process (indicating the amount of each of the raw materials for producing 1 ton of glass). The raw materials for the bulk of the glass are sand, lime salts and soda salts. Some other materials might be added in small quantities to give different characteristics to the glass. These quantities add up to only 1 to 2% of the total.

The melting process is done in a tank with refractory walls. In the Netherlands the furnaces are fired with natural gas or oil. All furnaces are regenerating furnaces, except for the two oxy-fuel furnaces at Vereenigde Glasfabrieken, Leerdam and Philips Lightening, Roosendaal. The regenerating furnaces are equipped with two regenerating chambers in which the combustion air is preheated to raise the temperature to the required temperature of approximately 1500°C. After melting and reaction of the materials, the glass is formed. In the annealing step the glass is cooled down evenly to make it tension free. In the inspection step the product quality is assessed. The main part of the products with a poor quality are recycled (90%) [Farla et al. 1998].

Figure 6: Main steps in the process



Source: [Farla et al. 1998]

Energy profile

The energy intensity of the glass sector is rather high. About 8-10% of the production-costs consists of energy costs. In 1997 the energy-consumption amounted to about 12 PJ, corresponding to 1.6% of the total energy-consumption of the Dutch industry [Philippens 1998].

The bulk of energy is used for the melting process, accounting for a share of 50 to 90% of the total consumption for the glass manufacturing, depending on the glass product that is made. For the total glass manufacturing industry, the energy consumption in the furnaces is of the order of 75% of the total energy consumption in the sector [Farla et al. 1998]. In 1992 the absolute (averaged) energy consumption for the melting oven is 6.9 MJ per kg net marketable glass. The total (average) energy consumption is 9.3 MJ per kg marketable glass [EZ 1992c].

Table 4 gives the energy consumption for the different types of glass in the year 1983. The table shows large differences in energy consumption. This can be partly explained by the size of the furnaces. Glass fibre, glass wool and the speciality glass products are manufactured in relatively small furnaces, in which the heat losses per unit of product are relatively high. Also, the percentage of the gross glass production that is rejected tends to be quite high.

Besides a high energy intensity, the use of big amounts of recycled glass is characteristic for the glass sector. With regard to this, one needs to take into account that not all recycled glass can be used for the production of high quality glass [EZ 1998b].

Table 4: Overview of the (net) specific energy consumption for the different glass products in 1983

Product	Rejected Glass (%)	Fuel (GJ/ton)	Electricity (GJ_e/ton)	Primary (GJ/ton)
Container glass	20	8.5	1.4	12.1
Flat glass	34	22.3	0.5	23.6
Glass fibre	35	28.9	4.3	39.6
Glass wool	n.a.[1]	37.4	4.3	48.3
Speciality glass	35	10.7	1.5	14.5
Weighted average	23*	12.6	1.7	16.8

[1] The amount of rejected glasswool is not available; the weighted average is calculated without glass wool. Assuming that the rejected glass wool will be 35%, the weighted average will increase to 25%.
Source: [Farla et al. 1998]

4.2 Energy and environmental policies

Besides the Long Term Agreement on energy efficiency, the glass sector also has to deal with other environmental policies, like the packaging agreement and the environmental permit. The glass sector did not enter other environmental agreements because the sector is too small for the target group approach. This section will describe the current and future energy and environmental policies.

Long Term Agreement on energy efficiency improvement
Since the introduction of the First Memorandum on Energy Conservation [EZ 1990] the energy conservation policy for the manufacturing industry was stepped up sharply. The energy conservation program in the First Memorandum on Energy Conservation aimed at 20% industrial efficiency improvement excluding feedstocks by the year 2000. LTAs on energy efficiency were considered as a suitable approach to bring about the required and drastic changes in the industry's consuming behaviour. In 1992 the LTA with the glass producing industry was concluded.

The future energy conservation policies are being prepared. For companies consuming 0.5 PJ per year or more, *benchmarking* is introduced. Some sectors already signed the benchmarking convenant, committing to belong to the most efficient countries in the world. All firms of the glass sector consume more than 0.5 PJ a year. After the LTA has ended (January 2000) the glass sector will probably also enter the benchmarking convenant. This has not happened so far.

Environmental permit
Since the introduction in the Environmental Management Act [VROM 1998] on 1 March 1993 it is possible to include energy conservation requirements in corporate environmental permits. All firms in the glass sector are obliged to have a permit by virtue of the Environmental Management Act. The procedure for obtaining an environmental permit is simpler for a company, which has signed a LTA. For these companies the licensing authorities are advised to respect the terms of the LTA and to use the environmental permit as a fall back position the company does not comply with the LTA. The Circular 'Energy in the environmental permit' [VROM/EZ 1994] sets out in detail how licensing authorities should deal with the issue of energy in environmental permits.

Packaging Agreement
In 1997, the second packaging agreement glass was conducted between the Department of Housing, Physical Planning and Environment, the Association of Municipalities and the Foundation for Recycling Glass [VROM 1997]. The latter signed on behalf of its members: the glass producing industry, the glass processing industry and the glass collecting industry. In this agreement, the glass industry commits itself to recycling 90% of the absolute weight quantity of the glass packages in 2001 (under the pre-condition that recycled glass is sufficiently available). The government commits itself to organising and paying for the costs of collecting the glass.

4.3 Outline of the Long Term Agreement

The LTA document signed by the parties starts with the recognition of the greenhouse issue and of the national objective of CO_2 emission stabilisation in 1995 at the 1989 level and a reduction of 3-5% in the year 2000. Also acknowledged is that energy efficiency is one of the important ways to achieve this target and a reference is made to the memorandum on Energy Conservation. The LTA specifies the commitments of both the government and industry, including objectives and targets. The government agrees that when in the future other instruments are introduced (like an energy tax) it will consider seriously whether such instruments conflict with the VA or damage the international position of the sector. The LTA also signalises that the glass industry also needs to fulfil certain environmental requirements. Measures to decrease pollution might increase energy consumption. This section will systematically introduce the major elements of the LTA of the glass sector. The emphasis will be on aspects that differ from the description of a LTA in section 2.3.1.

Signatory Parties
The signatory parties of the LTA are the Minister of Economic Affairs, the branch association for glass manufacturers VNG (Vereniging van Nederlandse Glasfabrikanten) and Novem (Netherlands Agency for Energy and Environment). The branch association signed on behalf of its members, the individual firms. One of the members (Philips) is not considered as one of the parties, because it has its own LTA (see section 4.4.2).

Target & Time period
The LTA of the glass sector is signed on 17th of July 1992. The target for this LTA is equal to the average target of all LTAs: a 20% increase in energy efficiency in the year 2000, from 1989 levels. This target does not concern non-energetic energy. In contrast to some other agreements, this LTA was concluded for the whole period 1992-2000 in once.

Energy Conservation Strategy
The target in the agreement is set on branch level. The firms, participating in the LTA must contribute to the achievement of this target to the best of their ability. The measurements to achieve this target are laid down in the technological Long Term Energy Program. With respect to the energy conservation strategy, the emphasis is put on improving energy efficiency in a process-integrated manner, stimulating joint-research projects and development and transfer of knowledge. The LTA of the glass sector does not oblige the individual firms to draw up a Corporate Energy Plan.

Bilateral Agreements
When perceived necessary, Novem and individual companies can conclude additional bilateral agreements in the framework of the LTA concerning: 1) energy efficiency targets; 2) possible measures to reach this target; 3) time scale of activities; 4) method for determining the energy efficiency index (EEI) and 5) method of reporting.

Monitoring and Reporting
Individual firms must annually report the LTA results to the Novem. The annual monitoring report must include the energy efficiency index. Yearly, the individual firms need to report on the EEI, the total energy consumption and the energy projects. When necessary, Novem is allowed to discuss energy data of the individual firms and projects.

The EEI is determined on the basis of the energy consumption per ton product for the most important phases of the production process. For container glass, an additional EEI is determined, based on the energy consumption per litre of containment of the product. The reference year for the EEI is 1989, which is put on 100. The EEI can be corrected for the following factors: 1) energy consumption due to implementation of environmental measures; 2) increased or decreased energy consumption due to changed product specifications and 3) projects that cannot be implemented completely due to changed investment priorities with respect to environmental measures.

4.4 Analysis of the Long Term Agreement

This section will go into the Long Term Agreement in more detail. The process of the LTA will be described and analysed using the format developed by [Kraemer and Hansen 1999]. First we will go into different phases of the LTA (section 4.4.1). Section 4.4.2 gives an overview of the actors involved. Next, the stability of the network (section 4.4.3) and aspects of knowledge distribution (section 4.4.4) are discussed.

4.4.1 Policy making and implementation

Policy formulation and negotiation
Parties that were involved in the phases of policy formulation and negotiation are the Ministry of Economic Affairs, Novem and the VNG who represented the companies. The individual firms were not (directly) involved during the policy formulation. However, the managing directors of all individual companies are members of the board of the VNG. This means that companies have indirect influence. The same is valid for the negotiation phase. Of course the board of directors of all companies also had to decide individually whether or not to join the agreement.

Around 1990 a lot of branches concluded Long Term Agreements on energy efficiency with the Ministry of Economic Affairs. Long Term Agreements were part of energy policies of this department. The agreement did not have major disadvantages for the sector. In order to stimulate energy efficiency, the sector already tried participating with the 'target group approach' of the government. However, the sector was too small for this approach. The Long Term Agreement was a good alternative for stimulating energy efficiency measures in the glass sector.

Before the MJA was concluded most companies had conducted an energy scan or a study to the possible environmental measures. VNG and TNO (Netherlands Organisation for Applied Scientific Research) also carried out a survey to the energy savings potentials. The results of this study were put down in the TMP 1990-2010 (Technological Long Term Energy Programm 1990-2010) which showed that an energy efficiency improvement of 20% in 2000 (compared to 1989) was possible. This TMP served as the basis for the agreement. The parties came to an agreement easy and fast, partly because the sector is relatively small. No major controversies between the parties occurred during the negotiations. Two issues might have influenced the negotiation phase. First, The VNG was primarily interested in energy efficiency measure integrated with the whole process instead of end-of pipe technologies. Secondly, it took some time before the sector was willing to give the Ministry of Economic Affairs and Novem all information they needed.

Implementation
At this moment all companies have a draft energy conservation plan. In 1997 Novem ordered TNO to draw up these individual plans together with the companies. Novem has not checked these plans yet. The interviewed companies only included profitable measures in their energy plans. The studied firms employ payback periods between 1.5 to three years. Partly depending on the specific products, some firms have more investment money available than others.

For VNG it is not completely clear what is the objective of the energy conservation plans. The sector already has its TMP, which is updated regularly. This TMP is based on individual plans. The following measures are put down in the last TMP (2000-2010):

- Profitable (and autonomous) measures like replacements of furnaces;
- Measures that are profitable only when subsidised;
- Measures with uncertain profitability that are proved technically possible by TNO.

All interviewees seem to perceive the agreement as rather successful, even though not all companies individually achieve an energy efficiency improvement of 20%. This is not considered to be a problem. All respondents of the companies stress that the aim of the agreement is a *collective* improvement of 20%. Most of the interviewees do not consider this as a very ambitious target. In terms of the target, the agreement indeed is successful. At sector-level, the energy efficiency improvement is almost according to plan.

4.4.2 Actors involved and their relations

The number of actors involved in the LTA is limited. These are the branch association VNG, the individual firms, Novem and the Consultative Board. Less important actors are the Ministry of Economic Affairs and TNO. The Association of Dutch Provinces, which is concerned with other agreements (for example of the pulp and paper sector) is not involved. This section discusses the tasks and motives of, and relations between the actors involved.

The individual firms and the branch association
In short, the LTA compels the individual companies to take necessary measures, in order to achieve the best results. They should improve energy efficiency preferably in a process integrated manner (by integrating energy-efficiency measures with revision of the furnaces). A general obligation for every individual firm to draw up an energy conservation plan does not exist in the framework of the LTA. On the other hand, formally a firm should have a less detailed corporate energy plan in the framework of the environmental permit. In 1997 Novem asked all companies to draw up a energy conservation plan.

The main responsibility of VNG is drawing up a monitoring report for Novem every year. The actual monitoring is done by TNO, which is considered as an independent party by all others. The VNG also raised an energy commission, consisting of the LTA co-ordinators of all firms. They come together regularly, discuss plans and exchange ideas. All respondents consider these meetings as stimulating.

VNG and the companies are together responsible for individual and joint research projects and development of energy efficiency techniques. For development and transfer of knowledge in general, VNG raised the National Committee of Dutch Glass manufacturers (NCNG). However, this was not as a part of the LTA and this committee does not only pay attention to energy efficiency technologies. The NCNG plays a role with respect to for example research projects and courses that can be beneficial to all firms. One of the problems is that the glass sector is rather diverse which makes new technologies or knowledge hardly ever generally applicable.

The motives of the sector for joining the agreement are clear. The most important is reduction of the cost price of their products by energy savings. The major concern for most companies in the glass sector is the quality of the glass. However, competition is hard and profit margins are small. This makes (even small) savings in costs important for the industry [Philippens 1998]. This means

that all incentives to encourage structural energy efficiency improvement are beneficial for the sector. Besides this, interviewees of the glass manufacturers mentioned two advantages of the LTA in comparison with other incentives for reducing energy use:

- The glass industry can avoid (stricter) regulations when signing the LTA. In this way, companies can make their own choices with respect to the questions which measures to implement and at what time. This is especially important since the duration of this agreement is rather long (8 years). This long time scale leaves companies the opportunity for example for research in order to be able to implement the most effective and efficient measures.

- In contrast to other instruments, the LTA directs the sector as a whole. Individual arrangements would not lead to the same results. The LTA stimulates the companies to join forces with respect to for example research and development.

Netherlands Agency for Energy and the Environment (Novem)
In short, Novem has three tasks. First, it reports yearly to the Consultative Board (see next) on the energy efficiency improvement. For this purpose, Novem checks the monitoring data of the VNG. Secondly, it supports the process of the LTA. Novem advises companies (amongst others with respect to the energy conservation plans) and it is concerned with diffusion of knowledge. Thirdly, Novem is administrator of several subsidies programs. It co-ordinates and subsidises research and development projects of firms. This was also a task of Novem before the LTA.

Consultative Board
In the framework of the LTA, a consultative board has been raised. Seated in this board are the VNG, the Ministry of Economic Affairs and Novem. Usually this board comes together once a year and its main task is to evaluate the progress of the LTA process. The board also initiated a study to the possibilities for energy savings in the glass sector. Low improvements of individual companies are discussed. When these firms do not have reasons for this and do not improve after a warning, they can be expelled from the agreement. However, in the glass sector these situations did not take place. Other tasks of the consultative board are amongst others advising parties on the implementation of the energy policies that are relevant for the glass industry and provide CO_2 emission data for the Ministry of Economic Affairs.

Ministry of Economic Affairs
As one of the parties of the agreement the Ministry of Economic Affairs has the following [EZ 1992c] duties. It should support the agreement with financial policy instruments including subsidising R&D programs, market introduction and transfer of knowledge. It should make the Novem program ‘industry’ primarily available for firms and branches that are willing to conclude a LTA as well. The same accounts for other subsidies. Furthermore the department agrees to try to retain a stimulating program of which the glass industry can make use as well. The motives of the Ministry of Economic Affairs for conducting the LTA are described in chapter 3.

Netherlands Organisation for Applied Scientific Research (TNO)

TNO is an important research institute for the glass sector. Of course companies have also other source of knowledge, but TNO is the most important one. Before the LTA, the sector already trusted this institute and the co-operation between the sector and TNO was good. As mentioned before, TNO is put in charge of the actual monitoring of the results and it is seen as an independent party.

Relations
The glass sector itself is rather tight, with good connections between the individual firms. This was already the case before the LTA started. Reasons for this might be that the sector is relatively small, and that most companies are not direct competitors because they produce different products (e.g. fibre, container glass, etc.). As mentioned before, the firms hold close contact with TNO and joint research projects are quite normal. The VNG is considered as an active branch association. Respondents argue that these have all been stimulating factors for the success of the LTA. The companies trust each other, which means that they accept lower EEI improvements of other firms as the best achievable.

The relation between the sector and Novem is more ambivalent. The interviewees of the firms state that their companies do not have frequent (personal) contact with Novem. Sometimes companies use (research) reports of Novem. The interviewees of the VNG consider the contact with Novem as good, but not frequent. This did not change much after the LTA. According to interviewees of Novem, the work relation between Novem and the sector is very good. This made it easy for Novem to motivate the sector for the LTA.

The LTA is considered as an important factor with respect to the contacts between the sector (VNG) and the Ministry of Economic Affairs. Before the LTA, no direct contacts between these two actors existed. Now both meet in the framework of the Consultative Board. This gives the VNG an opportunity to discuss energy policies with the national government.

4.4.3 Stability

According to the research framework by [Kraemer and Hansen 1999] the stability of the LTA network relates to: a) relation of the LTA to previous practice and policy in the field; b) controversies and consensus and c) understanding of the LTA, goals and content. These issues will be discussed below.

Relation to previous practice and policy
Most respondents consider the LTA as a good supplement to previous policies. Before the LTA, energy efficiency was primarily stimulated by subsidies. The LTA improved the understanding of Novem of the sector. This led to subsidising programs better tuned to the demands of the sector.

Also, the LTA can be seen as a continuation and strengthening of the previous practice with respect to joint research projects. As mentioned in section 4.4.2, already before the LTA, a good infrastructure for joint research and development existed. The actors also make use of this

structure in the framework of the LTA. More attention is now paid to energy efficiency technologies. The LTA also strengthened the infrastructure by putting more emphasis on the diffusion of knowledge.

Besides relations to previous practice, two remarks with respect to other policies can be made. First, none of the respondents signalise any problems with respect to tuning the LTA and the energy conservation plans to the provincial environmental permit. Formally, one of the requirements of the environmental permit for firms is a corporate energy plan. The (provincial) authorities usually leave this to the LTA and the authorities dealing with the energy conservation plan. In other words, provincial permit authorities are not very concerned with energy issues, even when the running time of the LTA is shorter than that of the permit. Secondly, 2 of the 3 firms studied do not integrate their corporate environmental care system with their energy plans.

Controversies and consensus
Not many controversies between the different actors of the network exist. The interviews suggest some (minor) disagreements between the sector and Novem. Interviewees of Novem mention that especially in the beginning, the sector was reluctant to supply detailed information. The sector itself suggests that Novem should not be focussed on details and the development of knowledge, but more on the management of the process.

Understanding of the LTA
All parties emphasise that the target of the LTA is a collective goal and not an individual one. However, interviewees of Novem state that during the process of the LTA, the emphasis changed from evaluating the common progress to evaluating individual firms. Interviewees of the companies do not seem to agree with this. This might indicate a minor disagreement on the understanding of the LTA.

All parties agree on the degree of commitment. The firms have an obligation to do whatever is (economically) possible to achieve an efficiency improvement of 20% in 2000. However, when this is not possible for valid reasons, Novem and the Ministry of Economic Affairs will accept this. This is very important for the firms. However, the situation will not be the case in the glass sector. Most likely, the sector will achieve its target.

4.4.4 Knowledge

One of the hypotheses of the VAIE project is that agreements result in a redistribution of knowledge. This section goes into the issues of knowledge distribution and learning experiences.

Development and diffusion of knowledge
Before the LTA, the sector already co-operated in the field of research and development (see also section 4.4.2). TNO plays an important role in this. Most firms also develop their own technologies, especially the companies that are part of a large international corporation. During the LTA, the exchange of knowledge between the firms improved. The NCNG (part of VNG)

raised a communication group consisting of representatives of all firms. This group organised amongst others workshops and introduced energy efficiency as a theme in courses for students. One of the problems with respect to knowledge transfer is that most companies need and develop rather specific knowledge that is not useful for other firms.

The interviews showed no signs of drastic changes of the knowledge distribution between Novem and the sector. Novem does not have a lot of technical know how. However, according to the respondents this is not necessary. Novem is not a knowledge centre and it should concentrate on the (financial) support of the firms and the management of the process. With respect to other issues, knowledge distribution did change. During the process of the LTA, Novem got more insight into the energy data of the individual firms.

Learning experiences
A better feeling of the sector and more insights in what is really important for the firms, is for Novem the most important learning experience. This makes it easier for Novem to support firms with respect to energy efficiency. Research programs and subsidies can be better tuned to the wishes of the sector. Both interviewees of the sector as well as respondents of Novem agree that the support of Novem is more professional than before.

The LTA stimulated the firms to develop a more structured and systematic way of dealing with energy efficiency. The respondents of the companies indicate that their firms already took energy efficiency measures before the LTA. Isover for example had a (simple) energy monitoring system. However, these activities were not very structured and well organised. This has changed. Firms also acknowledge the importance of a structured monitoring system that can help to detect possibilities for energy efficiency.

However, it is not sure that these changes are all caused by the agreement. One of the respondents points out that at the same time the LTA was concluded, his company was taken over by an American multi-national. Nowadays the firm has a more systematic approach to energy efficiency than in 1992. However, according to the respondent this is more a result of the new 'American' culture than of the LTA. The American parent company was already used to a more structured monitoring system and a more systematic approach of energy efficiency.

4.4.5 Effects

Here, we would like to refer to section 4.6.3 which points out the organisational changes, new energy practices and the energy efficiency improvement on sector level.

4.5 Analysis of the energy conservation projects

This section will analyse the implementation of the LTA on the level of energy conservation projects (ECPs). Both the analyses and assessment of the energy conservation projects are based on the framework developed by [Kraemer and Hansen 1999]. Section 4.5.1 describes the policy

making and implementation of ECPs. This section will also discuss the actors involved in all phases. Section 4.5.2 goes into the issues of stability and knowledge.

4.5.1 Policy making and implementation

Policy formulation
Those actors that are responsible for energy efficiency within a firm usually bring up ideas for new conservation projects. As mentioned in section 4.4, these can be energy co-ordinators or technical people that are also responsible for the maintenance of the machinery. This has been the case with for example the computerisation of the burners of the fibre producing machinery and with some relatively simple conservation projects like the introduction of frequency control for the cooling fans of the machinery.

With respect to bigger and more complex projects, other actors also play a role. For example the replacement of a conventional furnace by an oxy-fuel furnace in one of the firms was brought up by the parent company of the firm.

Some of the energy conservation projects are not actually put on the agenda by one or more particular actors. This is the case when a project concerns the revision or replacement of a furnace. Usually it is perfectly clear when revisions or replacements are necessary, and improving energy efficiency in such cases is the accepted method.

None of the respondents mentioned Novem as an actor playing a role in the policy formulation phase. Novem only points out successful conservation projects to other companies.

Some of the energy conservation projects are also related to other issues than energy efficiency. One of the examples is the oxy-fuel furnace. The main reason for introducing this furnace is the reduction of NO_X emissions. The firm considered the improvement of energy efficiency as one of the positive side effects. An energy conservation project can also have a negative side effect. This is the case with the adaptation of the process of refinement of the glass. Glass can be refined with sulphate or nitrate. The latter improves the transfer of energy, but increases the emission of NO_x. Only one of the firms changed from sulphate to nitrate.

Conservation projects can also have other advantages or disadvantages for the production process. The computerisation of the burners in one of the firms led to a reduction of the number of people needed to run the process. However, the disadvantage of computerisation is that the process became more sensitive for failures. In addition these failures are also more difficult to detect and to straighten out.

Negotiation and implementation
Which actors are involved in the negotiation phase of the energy conservation project often depends on the (investment) costs involved with the project. Actors that are always involved are the employees of the firms responsible of energy efficiency (called the energy-working group in

one of the firms). In one of the firms, the Board of Directors is only involved when payback time of a project is longer than 1 year. In that case, the Board decides. In other cases the decision is made on a lower level in the frim. In another firm the energy-working group decides which projects are possible in principal. Sometimes the Board is involved in case of large investments and high pay back periods.

Several factors are important with respect to the negotiation phase. First, the investment costs and the payback time. The acceptable payback time differs among the firms. Of course subsidies also play a role in this, because they reduce payback times. Secondly, some projects are held back (usually by the Board) because they create too much risks for the production process. For example, in one of the firms the idea of using waste heat for producing electricity was not implemented because it would cause too many breakdowns of the furnaces. None of the respondents signalised any conflicts in the negotiation (decision) phase between the different parties. Even the computerisation project that decreased the number of necessary people did not, because the firm had a shortage of employees.

Novem plays a role in the negotiation phase because it provides subsidies for EBPs and for research preceding the projects.

With respect to the implementation of the discussed energy conservation projects, none of the respondents have mentioned problems.

4.5.2 Stability and knowledge

The framework of the AKF suggests that the network around the energy conservation project is highly stable when many activity links and many different kinds of actors (management, employees, consultants, etc) are centrally placed in the network. The interviews do not indicate that many actors are involved, neither that these frequent activity links exist. However, the interviews do not indicate either that the network is unstable in the sense that a lot of controversies and different understandings of energy conservation projects exist.

With respect to knowledge, the following remarks can be made. For some projects (for example the replacement of conventional water pumps by pumps that only use 100% of their capacity when necessary) no knowledge was needed. It was just a matter of placing them. For other projects, technical knowledge was needed. Knowledge sources named are: the parent company, suppliers and own research and development.

4.6 Assessment of the Long Term Agreement and the energy conservation projects

In this section the implementation of the Long Term Agreement of the glass sector will be assessed. First, the hypothesis developed by the [Kraemer and Hansen 1999] are discussed. Next, we will go into the other assessment criteria.

4.6.1 Hypothesis for the Long Term Agreement

Firms have a big room for interpretation within the different Long Term Agreements.

The case study of the glass sector can not reject this hypothesis. Firms decide which measures are taken at what time. This is very important for the sector. In order to implement most of the measures the firm has to stop the production process. Companies do not want to do this for reasons of energy efficiency only. The sector can also decide by itself which firms are taking the measures. For example, one of the companies studied already implemented some energy efficiency measures before the LTA. The respondent of this firm stated that for this reason it was acceptable that the EEI improvement of this firm was lower than 20%.

The target of the LTA, 20% energy efficiency improvement in 2000 also leaves room for interpretation. The firms only have an obligation to try and reach this target. Not reaching this target does not necessarily mean sanctions from the government. On the other hand, firms do feel committed to the LTA. However, most respondents also felt that the target is not very ambitious. It is not clear how committed the firms would have been when it was very hard to achieve the target.

The glass industry has also some freedom with respect to the design of the monitoring methodology. The production of packaging glass is measured in terms of volume, whereas flat glass is measured in square meters and other glass products in tons.

Authorities seldom use sanctions if the firms do not keep a LTA.

It is very hard to reject or accept this hypothesis on the basis of the case study of the glass sector. Using sanctions was never an issue because the energy efficiency of the sector and the firms improved according to plan. There were no reasons for the authorities to use sanctions.

Industrial sectors with many big firms are easier in relation to LTAs than industrial sectors with many small and medium enterprises.

The progress of the implementation of the LTA depends partly on the degree of professionalism of the firms. For example, with regard to the energy conservation plan, smaller enterprises need more help from Novem. This is not the case in the glass sector. The relatively big glass firms all have one or more employees primarily concerned with energy (and environmental) issues. In smaller firms these issues might be one of the many topics an employee needs to deal with.

Besides professionalism, the number of firms might also relate to the process of a LTA. Mutual contacts between the firms and the contacts between the firms and the VNG are frequent and good. One of the respondents suggests that the reason for this is the fact that the glass sector is small, consisting of only 7 firms. For the implementation of a LTA, good relations are essential,

because companies need to trust each other and co-corporate. However, relations within the sector might also be good because only two of the firms are direct competitors.

In the short run the LTA does not improve the level of energy efficiency considerably above the non-intervention level, but in the long run new procedures and a higher level of information regarding energy efficiency will lead to considerable energy savings.

The development of the EEI shows that after the conclusion of the LTA the EEI improved only slightly faster than the three years before [EZ 1998b]. The exception is 1994 (2 years after the LTA was signed). In this year an energy efficiency improvement of 5% was achieved (whereas usually each year the EEI improves 1 to 2 %). In other words, on the basis of these data this hypothesis can not be confirmed.

On the other hand, the LTA indeed led to organisational changes within the sector and to a better diffusion of knowledge. All respondents indicate that the most important 'effect' of the LTA is that it forces the companies to meet regularly, discuss energy efficiency and join forces with respect to research and development. However, the magnitude of these advantages on energy efficiency improvement in the short and long term remains unclear.

In short, the case study of the glass sector does not show any evidence to subscribe this hypothesis.

Firms get more information through LTA networks on energy efficiency from other firms within or without the industrial sector, which reduces the transaction cost of energy saving projects.

The firms studied indeed obtain more knowledge on energy efficiency from other firms within the sector. Novem subsidises research for particular projects and distributes the results amongst all participants of the LTA. However, not for all energy saving projects transaction costs are reduced. As mentioned in section 4.1, the products of the different firms are divers. The production processes for these different products are very different. This means that the technologies and possibilities for improving energy efficiency differ as well. In other words only some of the knowledge developed during the LTA is useful for all companies. A lot of specific knowledge is developed by the companies self. The transaction costs are not reduced for all energy saving projects.

Authorities get a deeper knowledge of the specific production processes through LTAs (LTAs decrease asymmetric information problem).

This case study does not show that the asymmetric information problem with respect to specific knowledge of production processes has decreased. However, the actors do not perceive this as a problem. Novem is not considered as a knowledge centre. On the other hand, Novem now knows better what are the important issues for the companies. This means that Novem can tune the subsidising programs better to the sector.

4.6.2 Hypothesis for the energy conservation projects

Energy conservation projects are often a minor appendix to the everyday life of the firm, therefore they will often relate to other issues the firms find more important

Some of the energy conservation projects are indeed related to environmental considerations. Others (replacement and revisions of furnaces) are related to the technical demands made to the furnaces. At some points, furnaces just need to be revised or replaced for reasons other than energy efficiency (quality of the glass, risk for breakdowns). Meanwhile, energy efficiency is also improved. However, this does not mean that energy conservation projects are just a minor appendix to every day life. Other projects are only related to energy efficiency.

In general one can say that for the firms the improvement of the quality of the glass is the most important. However, competition is hard and energy costs are high. This makes energy efficiency important for the firms [Philippens 1998].

Most energy conservation projects are implemented by a top-down approach from the management

On the basis of the interviews, this hypothesis can be rejected. In most cases, the energy conservation projects are put on the agenda and implemented by a 'energy management team' or an energy co-ordinator and some technical staff. In one firm, one of the managers was part of the energy management team. However, especially with big projects, the Board of Directors indeed has a big say in the approval of potential projects.

Energy conservation projects are often rather technical and therefore involve the technical staff rather than the ordinary employees

This hypothesis cannot be accepted totally on the basis of the results of the interviews. Most of the projects discussed only involve technical staff or an energy co-ordinator. On the other hand, one of the interviewees mentioned that the sales department was also involved when it came to replacements and revisions of furnaces and all other projects that required stopping the production process. This way the sales department and the technical staff can tune the production to the fluctuations in the demand of glass.

Energy conservation projects do not relate to the PR strategy of the firm

On the basis of this study we cannot reject or accept this hypothesis, because the interview results do not supply enough data. It seems that PR strategies are not related to energy conservation projects. None of the respondents mentioned PR advantages (or demands of customers) as one of the motives for entering the LTA or for concrete energy conservation projects.

4.6.3 Other assessment criteria

Organisational changes
Organisational changes took place, both at sector level and the level of the individual firms. Most of the changes at sector level are already discussed in former sections of this chapter, and will be mentioned briefly here. First, the Consultative Board has been established. Secondly, the VNG and NCNG raised an energy commission and a communication group. Thirdly, the LTA created more possibilities for the sector for contacts with the Ministry of Economic Affairs and Novem. Firms now have direct and indirect via the VNG contact with Novem.

Also at the level of the individual firms, some things changed. In the case of the studied firms the number of employees responsible for energy issues increased. One of the firms raised a energy management team consisting of technical and financial people that meet regularly.

Technological changes
Lots of minor and big technological innovations took place in the glass sector during the LTA. Table 5 provides an overview of the effect of technical and other measures on energy conservation in the glass industry in the period 1994-1997. The total energy savings in that period compared to a frozen efficiency situation in 1989 amounted to about 1.9 PJ. Below, the technical measures are explained in more detail.

Table 5: Effect of technical and other measures on energy conservation in the glass industry

Measure	Sub-total 1994-1997 (TJ)	Total 1994-1997 (TJ)
Use of flue heat		109
Improved melting process		373
Optimisation	495	
Increased production volume	211	
Oxy fuel furnace	226	
Other	15	
Ageing of the furnaces	*-483*	
Decrease of melting efficiency	-3	
Commissioning of new furnace	-88	
Improved process quality (excl. melting)		503
Lightweight packaging glass	161	
Pumps/compressed air treatment	71	
Design	169	
Other	102	
Increased use of cullets		68
Energy efficient oven design		60
Low-NO_x burners		109
Good housekeeping		26
Environmental measures		-126
Quality requirements		-40
Other		-13
More complex products		-69
Total		1876

Source: [Novem 1995b; Novem 1996; Novem 1997; Novem 1998].

Pre-heating raw materials

More energy-efficiency is achieved using flue gasses for pre-heating the raw materials. For example, PLM Dongen makes use of this system which decreased the energy-consumption for the melting furnace with 15% [Philippens 1998].

Improve melting process

As mentioned in section 4.1, most of the energy consumption is used for melting the raw materials. Improving the melting process is a good starting point for improving the EEI. This is done by several adjustments. One of the main technical improvements are the oxy-fuel furnaces. Several of these furnaces that use pure oxygen instead of pre-heated air have been taken in operation. This innovation improved energy-efficiency up to 20% (including the amount of energy needed to split the oxygen and the nitrogen). Oxy-fuel furnaces are more efficient because they produce less flue gasses than conventional furnaces. This means that less heat is lost [Philippens 1998].

Revisions and replacements of furnaces also improve the energy efficiency of the melting process. Glass furnaces have a lifetime of approximately 12 years. After approximately 6 years a major revision of the furnace is necessary. During a revision the refractory materials of the glass furnace are replaced. After revision, heat losses through the walls are temporarily diminished because of the new refractory material. During the use of the furnace, the refractory material will slowly dissolve in the molten glass, and the heat losses will gradually increase. The energy required for melting the glass may increase with as much as 25% between start and stop of a furnace as a result of the consumption of refractory material [Farla et al. 1998]. Replacing old furnaces by new furnaces also improves efficiency. Heat loss through the walls of a furnace decreases when a larger one is used. Between 1980 and 1994 the average capacity of the glass furnaces has doubled. Assuming that the furnaces are cube-shaped, this has led to a 20% decrease of the heat losses through the walls per ton of glass produced [Farla et al. 1998].

Furthermore some research has been done in order to improve the melting process. For example, transfer of heat between the burners and the melting materials have been studied. Low-NO_x burners have replaced some of the burners.

Improved process quality

Also attention is paid to other parts of the process control. The quality of the glass is improved, as a result of which less glass is rejected. This improved energy efficiency of the net marketable glass. Furthermore glass weight per unit (container) glass has decreased. Changing the design of table glass and glass wool decreased energy consumption with 62 TJ over 1997 [Novem 1998].

Increased use of cullets

Nowadays approximately 80% of the glass for onetime use is collected via bottle containers. The re-use of the glass (cullets) in the glass furnace lowers the energy demand because no reaction energy is required for this part of the input.

Good housekeeping

Measurements that are not subsidised by Novem fall in this category. Most of the projects are concerned with improvement of lighting, heating and insulation of the buildings. Although the companies intend to do so, they did not set up energy management systems yet.

Effects on energy practice

The LTA structured and strengthened the activities of the firms with respect to energy efficiency. Since the oil crises in the seventies the companies are already implementing energy efficiency instruments. Energy efficiency is very important for the glass sector, because the costs for producing glass are for a large part determined by energy costs. However, improving energy efficiency is costly and often energy efficiency measures can only be taken every 6 or 12 years. The LTA has served as an incentive for the firms to approach energy efficiency in a more structured and systematic manner.

Monitoring of energy consumption has become more important. At least one of the studied firms

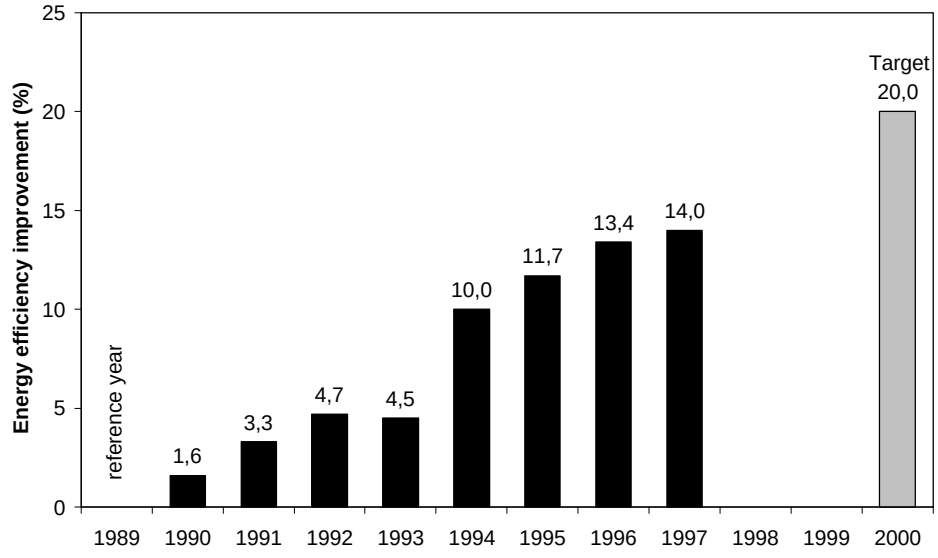
attempts to refine it's monitoring system more and more. Most of the measures that realise major improvements of energy efficiency have been implemented now. Companies now need to focus on the details, which requires more detailed monitoring.

Relations to other initiatives
Before the parties signed the LTA, Novem already stimulated the sector with subsidies. All firms agree that subsidies are still very important. Between 1990 and 1998 Novem subsidised energy efficiency programs for more than 18 Mfl (TIEB and BSE programs). One of the respondents states that subsidies are the most important incentive. Due to the MJA Novem can now better assess and understand the sector, which makes it easier to support it.

Furthermore two remarks can be made with respect to other policies (also discussed in section 4.4.3). First, none of the respondents signalise any problems with respect to tuning the LTA and the energy conservation plans to the provincial environmental permit. Formally, one of the requirements of the environmental permit for firms is a corporate energy plan. The (provincial) authorities usually leave this to the LTA and the authorities dealing with the energy conservation plan. In other words, provincial permit authorities are not very concerned with energy issues, even when the running time of the LTA is shorter than that of the permit. One of the reasons for this is that the permit authorities do not have insight in all the information with regard to the LTA. Secondly, 2 of the 3 firms studied do not integrate their corporate environmental care system with the LTA.

Fulfilment of agreements' target
Figure 7.shows the energy efficiency improvement in the glass industry in the period 1989-1997. Up till 1997 the energy efficiency improvement amounted to 14% compared with 1989.

Figure 7: Energy efficiency improvement in the glass sector



Source: [Novem 1998]

The rate of energy efficiency improvement was somewhat less than planned in 1997, due to the construction and commissioning of a number of new furnaces. Optimization was expected to lead to an additional energy-efficiency improvement in 1998. On the basis of the measures still to be realised, a 20% improvement is feasible. The conversion of recuperative furnaces to oxy-fuel and further increase in the use of recycled glass will contribute towards this [EZ Annual].

5 Assessment of the country study

The assessment of the country study primarily assesses the agreement scheme on the basis of the experiences gained through the analysis of the sector agreements and the energy conservation projects. The assessment of the agreement scheme relates to the hypothesis for the agreement scheme and the criteria for discussing the agreement scheme.

5.1 Hypothesis for the agreement scheme

The hypothesis presented below are tools for the analytical part of the country study. For the agreement scheme the hypothesis basically relate to the motives for employing the agreements, the exclusion of actors, the relation to previous energy and environmental policy and also the expected results.

Industrial organisations basically support agreements in order to avoid stricter regulation in the future, e.g. emission standards

In the Dutch case the avoidance of stricter regulations was certainly one of the major reasons for firms and industrial organisations to support the agreements. The threat of the proposed introduction of an energy tax forced the industry to take part in the debate about the agreements. By concluding LTAs the firms are relatively certain about the government's energy policy in the long term. Moreover, the LTA-procedure gives firms better possibilities to exert influence on energy requirements in the environmental permit, which most of the institutions in the manufacturing industry are obliged to have by virtue of the Environmental Management Act.

Politicians primarily support agreements to actively work for environmental protection without overburdening the firms

Since the Second Memorandum on Energy Conservation, the LTAs have become the real crux of the Dutch energy policy. Much support to the LTAs was given since the LTAs were seen as the most suitable instrument for the energy policy in that time. The LTAs could bring about the behavioural changes required to reach the goals of the energy policy. Moreover, because of several reasons the politicians were of the opinion that (investments in) energy conservation could be best co-ordinated by the industry themselves. An active role of the industry in the LTA was considered as a much better guaranty than regulation, that the efficiency targets would be met.

Agreements as a policy instrument exclude the influence of parties not directly involved in the process, e.g. environmental organisations

The involvement of environmental interests groups has not been studied in such a detail that we were able to verify whether the influence of parties not directly involved in the process, e.g. environmental organisations has been excluded. According to Novem the interest groups have however had the possibility to influence the design of LTA framework in the early beginning. The

influence of such parties during the negotiations and further implementation and evaluation of the LTA is limited as far as we know. On this basis, we assume that this hypothesis is supported by the Dutch country study.

Agreements are a continuation of the logic of previous energy policy towards industry

The LTA approach emerged as a response to new ideas on co-operative environmental management during the last decade. The increased use of convenants seemed to be the result of the 'shared responsibility' and 'internalisation' that marked the environmental policy as outlined in the National Environmental Policy Plan [VROM 1989]. Moreover, a general development in the use of convenants, contracts and voluntary agreements in a broad spectrum of policy fields could also be observed [Klok 1989]. This can mainly be attributed to a changed view on the role of the government in policy issues and the related trend towards deregulation.

Because of positive experiences with environmental convenants gained by the Ministry of Housing, Physical planning and the Environment as well as due to the huge resistance against the energy tax, the government decided to introduce LTAs as an instrument for energy conservation in the industry. Furthermore, regulation was considered as an unsuitable strategy to stimulate industrial energy conservation.

The Ministry of Economic Affairs had practical reasons for the implementation of the LTA. The subsidy schemes for the stimulation of energy conservation that were developed over long period had become very fragmented. The introduction of the LTAs was an excellent chance to re-structure and co-ordinate the subsidy schemes.

The effects of agreements in terms of energy savings are very close to the base line scenario

According to the official monitoring results the total energy efficiency improvement in all the participating industrial sectors amounted to 14.5% in the period 1989-1997 [EZ 1998b]. This corresponds to an annual average improvement of about 1.9% a year. The detailed monitoring results show however a large number of sectors that are relatively far behind on schedule.

A comparison of the official monitoring results with the energy efficiency improvement in the preceding decade shows that the effects of the agreements are very close to the baseline scenario. The annual average energy efficiency improvement in the manufacturing industry in the preceding years (1980-1988) amounted to 1.8% [EZ 1990]. However in that period large subsidy schemes for the investments in energy efficiency existed. Moreover the energy prices were very high until 1986. In view of both facts it might be expected that the rate of energy efficiency improvement has declined substantially since then. The effects of the agreements in terms of energy efficiency improvement are therefor expected to go beyond the baseline scenario.

5.2 Criteria for discussing the agreement scheme

To give a more many faceted picture of the advantages and drawbacks of the different agreements described in the VAIE project, the following five criteria have been suggested as themes of discussion of practical considerations of instruments in environmental policy [Russell and Powell 1999].

5.2.1 Static concerns

The main question under the heading of the static concerns is whether the environmental target is reached with least costs, i.e. the sum of the investment cost, information and search costs (energy audit, special investigations, verification) and administrative costs. In this section we will mainly look at the efficiency of the agreements from the government point of view. In general efficiency is considered from the point of view of society as a whole. However, we will show that in this case this is less relevant as industrial investments were relatively small and highly cost-effective.

Industrial investments and monitoring costs
In [Glasbergen et al. 1997] an estimation of the total industrial investments in the period 1989-1995 was made. In the period 1989-1995 energy conservation investments in the Netherlands saved about 20 PJ in the total industrial sector. From the evaluation of LTAs by [Glasbergen et al. 1997] and from other sources including the previous sector studies it is clear that the pay-back time of most energy conservation measures is short. Assuming an energy price of 6-8 Dfl/GJ and an average pay-back period of 2-3 years, the total investments in end-use energy efficiency in the period 1989-1995 are estimated at 240-480 MDfl. According to [Senter 1996] the costs of the installed CHP plants amount to 1343 MDfl. In addition, the energy distribution sector spent 800 MDfl on CHP plants [Senter 1996]. An average monitoring cycle per industrial sector costs about Dfl 100,000 a year for the participating sector [EU 1997]. On the basis of these figures it can be concluded that industry has not been put to great expense as a result of the LTAs in the Netherlands.

Government costs
This section focuses on the costs of the LTA policy from a governmental point of view. The major costs for the preparation and implementation of the LTA policy can be allocated to the TIEB and EMA schemes in the framework of the 'Industry Sector Programs' and the BSE and LTA subsidies. Furthermore the government has spent money on the Novem-personnel. In the framework of the BSE and NEWS scheme incentives has been given to the CHP-generation[9]. The total costs for preparation and implementation of the industrial energy conservation policy from the government point of view is estimated at 1301 MDfl in the period 1989-1999. Table 6 shows a breakdown of the financial incentives aimed at industrial energy conservation provided by the government. The figures concern the sum of the yearly committed budget.

[9] See section 2.3.4 for details on TIEB, EMA, BSE and NEWS schemes.

Table 6: Breakdown of financial incentives aimed at industrial energy conservation 1989-1999

Incentive	MDfl[1] (1989-1999)
Industry Sectors (TIEB, EMA)[2]	261
Subsidy Schemes (BSE, MJA)[3]	227
Novem-Personnel[4]	64
CHP-subsidies (BSE, NEWS)[5]	212
Tax schemes (EIA)[6]	537
Total	1301

[1] 1 Dfl ≈ 0.45
[2] Source: [Nuijen 1999].
[3] Approx. two-third of the total input can be attributed to BSE. MJA covers spendings on external consultancy. Source: [Nuijen 1999].
[4] Input of Novem-personnel for Industry Programs and Subsidy Schemes only. Source: [Nuijen 1999].
[5] The BSE subsidies for CHP (in total 202 MDfl) covers the period 1989-1995. The amount of NEWS subsidies (1996-1999) covers projects in LTA companies only. Source: [Senter 1996], [Senter 1997], [Senter 1998], [Senter 1999a].
[6] Source: [Senter 1999b]. The government spending on VAMIL scheme and green taxes is considered to be very low.

The government spending on the MINT program is not included, since no results are expected in the short-term. The total government spending on industrial energy conservation is therefore underestimated. The total amount spend on the MINT program including Novem personnel is estimated at 86 MDfl till 1999 [Nuijen 1999].

Table 7 gives an overview of the specific CO_2 emission reduction costs and the specific costs for energy savings in the industrial sector. These costs are based on the CO_2 emissions avoided as a result of the industrial energy conservation policy in the Netherlands and government spending in the period 1989-1995. We have assumed a discount rate of 4% and a amortisation period of 10 years.

Table 7: Overview of specific energy saving and CO_2 emission reduction costs

		Total policy	Industrial LTAs	CHP policy
Spec. energy saving costs	Dfl/GJ	1.8-2.6	1.5-2.3	3.6
Spec. CO_2 emission reduction costs	Dfl/ton CO_2	23.4-33.2	19.7-32.0	35.7

The cost-efficiency of LTAs can be compared with specific CO_2 emission reduction costs of other policy instruments, like for instance the ‘energy bonus’, a large-scale subsidy scheme that existed between 1980 and 1988 for stimulating investments in energy efficiency improvement. [Farla et al. 1998] estimated the specific CO_2 emission reduction costs to be 67.7 Dfl/ton CO_2, that is 4.9 Dfl/GJ. Here it should be noted that only direct effects of the energy bonus were taken into account; indirect impacts of this subsidy were not included. These figures suggest that from the government point of view, the LTAs are a cost-efficient policy instrument for the improvement of energy efficiency, at least compared to a subsidy instrument.

5.2.2 Dynamic considerations

The two basic questions in relation to the dynamic consideration are whether the policy instrument is flexible over time and whether the policy instrument stimulates the development of new energy efficient technologies.

Flexibility of the instrument
Although the agreements have a long term character in the Netherlands and the formal design has not been changed dramatically, flexibility of the agreements can be perceived. In the early beginning the LTAs had only an experimental character and were only concluded with leading industrial branches. In the course of time certain organisational conditions were set to select branches for the LTAs. Furthermore stricter requirements were set to the preparation of Energy Conservation Plans and a clause to exclude firms from the LTA were included in the newer agreements. Obligations of the LTAs can even be renegotiated in case drastic changes occur in policy insights, legislation, competitive position of firms or due to the introduction of new policy instruments.

As a result of the evaluation of the LTAs by [Glasbergen et al. 1997] the Ministry of Economic Affairs investigates the possibilities to improve and include new themes in the second generation LTAs after 2000.

Stimulation of new energy efficient technologies
The LTAs offers great flexibility to sectors and individual companies regarding the implementation of energy conservation measures. The energy efficiency targets are set on branch level and no individual targets are set. Firms can decide themselves how to contribute to the energy efficiency target, which investments to make and at what time and place. The case study on the paper and board industry shows however that mainly proven technology and CHP is applied and the development of new energy efficient technologies is limited. Up till now mainly the cheaper and high profitable technological options for energy conservation have been implemented. Energy management and the communication and diffusion of knowledge have certainly become a more and more important element in the general management of firms as well as in the industrial sectors, but the future must show whether the dynamic effects of the LTA also include the development of new energy efficient technologies.

5.2.3 Institutional demands on regulator and regulated part

The implementation of the LTAs require certain institutional demands on regulator as well on the regulated. The regulator needs the necessary professional and technical expertise, whereas the regulated must be able to handle the instrument as well.

Regulator
The LTAs in the Netherlands are not simple to administer. The implementation of the LTAs requires relatively high institutional demands to the regulator; Novem being in charge with the

executive responsibility of the LTAs needs specific technological knowledge about the individual sectors for preparing, advising and verifying the LTAs. No drastic new institutional demands were however necessary in this respect. Novem was considered as a independent organization with already some expert knowledge in the field of energy conservation, contrary to the licensing authorities. Moreover the LTAs were embedded in the sector approach for energy conservation. By involving Novem in the LTA process, knowledge and information could be transferred directly to firms and branches.

One of the reasons to choose for LTAs above further regulation to stimulate industrial energy conservation was that licensing authorities did not have any experience with energy requirements in the environmental permits. Setting energy efficiency requirements in the environmental permit would require an individual approach of the firms and create a burden of checks and balances. Within the LTAs the licensing authorities have the task to assess the environmental permit (see section 2.4). According to [Glasbergen et al. 1997] a structured approach with regard to energy conservation in environmental permits is still lacking within those authorities.

Regulated
The increased attention to communication and distribution of knowledge in LTAs required higher than previous institutional demands to the individual branches. Existing networks and commissions appeared to fulfil part of the necessary demands, but also new ones were created. Monitoring of the LTAs on sector level is usually delegated to external consultancies.

The communication between the different LTA branches have become institutionalised during the years. The branches that are member of the VNO-NCW (employers' association) meet twice a year to discuss general issues concerning the LTAs not particular for specific branches.

The preparation, implementation and monitoring of the agreements require high institutional demands to the firms. The environmental or energy co-ordinator as well as process engineers mainly provide the internal expertise necessary for the preparation, implementation and monitoring. However, the firms often use external consultants or Novem to lower institutional demands, e.g. with respect to the inventory of energy conservation options.

5.2.4 Political considerations

The political considerations to choose agreements as a policy instrument towards energy intensive industry were mainly based in the government's aim for deregulation of environmental policies in the late eighties. The government was developing a target group approach to increase the firms' interest in and commitment for the implementation of environmental polices. The target group approach was expected to enhance the implementation of environmental policies in the specific sectors. By involving the industry on a voluntary basis, through the LTA approach, the industry would take its own responsibility for reaching the targets.

The Ministry of Economic Affairs considered that an acceptable and realistic energy policy

towards the energy intensive industry was essential in this respect. The strong opposition towards the introduction of an energy tax as proposed by the Ministry of Housing, Physical Planning and the Environment was therefor another political consideration to choose agreements to stimulate energy efficiency improvement among the energy intensive industry. The agreements (with a relative target-setting) would take into account the competitive position of firms and were therefor supported by industry.

Moreover, the Ministry of Economic Affairs considered that further regulation instead of the agreements was an unsuitable strategy to stimulate energy efficiency among the energy intensive industry: Because of the following reasons the Ministry of Economic Affairs was of the opinion that energy conservation could be best co-ordinated by industry and firms themselves: 1) Considering the energy conservation of the individual sector, each sector has its own specific production processes and patterns of energy consumption. The individual production processes can be rather complex, which means that setting standards of performance for energy conservation through regulation would be rather difficult; 2) Energy saving investments require an accurate timing since these investments depend for an important part on the total investment budget available; 3) The licensing authorities did not have any experience with energy requirements in the environmental permits.

5.2.5 Risk

The basic question here is which understanding the regulator and the regulated have concerning the risk related to different policy instruments; there will always be a risk related to different instruments, among others whether the political targets will be reached. Another issue concerning risk is the robustness of agreements, e.g. towards shocks like drastic declines in energy prices.

The risks for the regulated seem to be very low. The 20% target of most of the agreement must finally be reached by the end of 2000. In case of non-compliance the authorities do not impose serious sanctions to the regulated firms. Expelled firms must comply with regulations in the environmental permit and they loose Novem's assistance and possibilities to apply for subsidies. Therefor the regulating authorities seem to run high risk in this respect.

According to the regulating authorities as well the regulated firms success of the LTAs is for a large part based on the mutual trust between the involved actors. This mutual trust and strong commitment can change the actors' perception of risks.

The agreements are robust towards shocks in a way that in case of drastic changes beyond the firms' control, like new policy insights, legislation, changed competitive position of firms, the LTA can be discussed or terminated.

6 Concluding remarks

In the 1992 Long Term Agreements were introduced as a policy instrument to improve energy efficiency in the Dutch manufacturing industry. The LTAs were considered as the main policy instrument to contribute to the industrial CO_2 emission reduction. Currently the LTAs cover about 90% of the industrial energy consumption. On average the agreements aim at 20% energy efficiency improvement in the year 2000 compared to 1989. On the basis of the results in 1997 it may be concluded that the average target is likely to be reached. The CO_2 emission reduction target as outlined in the National Environmental Policy Plan will not be reached by far. A large increase of absolute CO_2 emission could even be observed due to a higher volume growth. This can be considered as a serious weakness of the Dutch LTAs.

The Long Term Agreement in the Netherlands must be considered as a mix of several policy instruments. The agreements' regulatory measures are supported by several subsidies scheme and information services. The structured nature of the agreement scheme looks impressive from the outside. The LTAs are however for a large part a formalisation of existing structure of policy instruments and measures aimed at industrial energy conservation. In the whole process of preparing, implementing and evaluating the LTAs, Novem plays a stimulating, advising, facilitating and verifying role, which is considered as one of the success keys of the Dutch agreements.

In the course of time the LTAs showed several weaknesses. For example, the obligatory commitments of the LTA appeared to limited. Among others, this was due the insufficient attention paid to the role of the individual energy conservation plans. Due to some weaknesses in the monitoring and limited access to data, verification of individual firm results appeared to be a problem as well. Moreover, an effective mechanism for imposing sanctions in case of non-compliance is lacking. Sanctions are limited to warnings to be expelled from the LTA, including the risk to loose financial support and technical assistance. The limited obligatory commitments and the lack of a sanction mechanism have however only led to a weak performance of the LTA with sectors in the light industry and can therefor not be considered as serious shortcomings. Up till now about 50 companies have left or were expelled from the LTA.

In the sector case studies the impact of the agreements on the implementation of energy conservation projects on firm level has been studied. The case studies showed that the LTAs have increased awareness for energy and climate issue and moreover motivation to improve energy efficiency among industrial sectors. In the paper and board industry investments in CHP and replacement investments have increased energy efficiency in the sector to a large extent. In the glass sector replacement investments and a higher rate of glass recycling have considerably improved energy efficiency. The sector case studies show that the LTA is an effective instrument to stimulate communication and knowledge transfer about (new) energy conservation options on the sector level. Moreover the LTAs have improved the firms' access to several schemes providing financial support. Apart from investments in CHP the LTAs have however mainly enhanced investments with low pay back periods. Firms indicate that most of the investments would also

have been without the agreement. Cost-reduction and process efficiency appeared to be the most important reasons to implement energy conservation projects. Except from the introduction of energy management system, monitoring and the more systematic search for options for energy efficiency improvements, no further, serious empirical evidence for long term impacts of the LTA could be observed. The effects of the LTAs on technological innovation seem therefor to be negligible.

Most of the LTAs will come to an end in the year 2000. A benchmarking tool for energy intensive industries will become the core of the new energy conservation policy. According to the Benchmarking protocol, signed in July 1999, Dutch energy-intensive companies commit to joining the world leaders in the field of energy efficiency. In return the government agrees not to impose additional CO_2 policy measures. The underlying idea of benchmarking is to give energy conservation policy additional stimuli taking into account the international context [EZ 1998a]. In contrast with the first generation LTAs, the benchmark convenant will have an individual character. The LTA approach will also be pursued after 2000 on a more individual basis with less energy consuming firms.

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Appendix I: Acronyms

BSE	= Funds from industry programmes
CEP	= Corporate Energy Plan
CHP	= Combined Heat and Power
ECP	= Energy Conservation Plan
EEI	= Energy Efficiency Index
EIA	= Energy Investment Tax facility
EMA	= Energy and Environmental Advisory Support
EZ	= Ministry of Economic Affairs
IMT	= Integrated Environmental Target Plan
IPO	= Association of Provinces
LTA	= Long Term Agreement
MINT	= Inter-sectoral Technologies for Manufacturing Industry
NCNG	= National Committee of Dutch Glass manufacturers
NEWS	= New Energy-Efficient Combinations of Combined Heat and Power Systems
NMP	= National Environmental Policy Plan
NMP+	= National Environmental Policy Plan Plus
Novem	= Netherlands Agency for Energy and Environment
TIEB	= Tenders for Industrial Energy Conservation Support
TNO	= Netherlands Organisation for Applied Scientific Research
VAMIL	= Accelerated Depreciation of Environmental Investments
VNG	= Netherlands' Association of Glass Manufacturers
VNP	= Netherlands' Paper and Board Association
VROM	= Ministry Of Housing, Physical Planning and the Environment

Appendix II: Paper and board manufacturers in the Netherlands

No.	Company [1]	Owner	Location [1]	Product range [1]	Energy consumption [2] PJ/year
1	Berghuizer Papierfabriek NV	Enso (FI)	Wapenveld	Graphic, wrapping	>1.0
2	Coldenhove Papier BV	Independent	Eerbeek	Graphic	<0.5
3	Crown van Gelder Papier-fabrieken BV	Independent	Velsen	Graphic	>1.0
4	Papierfabriek Doetinchem BV	Independent	Doetinchem	Corrugated, wrapping	<1.0
5	De Eendracht Karton	BPB (UK)	Appingedam	Grey, folding	>1.0
6	Fort James Nederland BV	Jamond (USA/FA)	Cuyk	Household & sanitary	<1.0
7	Van Houtum Papier BV	Independent	Swalmen	Household & sanitary	<0.5
8	Papierfabrieken Van Houtum & Palm BV	GP	Apeldoorn	Graphic	<1.0
9	Kappa Attica BV	Kappa Packaging	Oude Pekela	Grey	<0.5 (Attica KM1)
	(Ceres + de Kroon)				<0.5 (Attica KM4)
10	Kappa Graphic Board BV	Kappa Packaging	Hoogezand	Grey	>1.0
11	Kappa Graphic Board BV	Kappa Packaging	Sappemeer	Grey	<1.0
12	Kimberly-Clark BV	KC (USA)	Ede	Household & sanitary	<1.0
13	Kappa Triton BV	Kappa Packaging	Coevorden	Grey	<0.5
14	Kappa Trinton BV	Kappa Packaging	Nieuweschans	Grey	<1.0
15	Leopack BV	Van Leer (BE?)	Franeker	Grey	<0.5
16	Mayr-Melnhof Eerbeek BV	MM (AUS)	Eerbeek	Folding	>1.0
17	Meersen Papier BV	GP	Meersen	Graphic	<1.0
18	Parenco BV	Haindl (Dsl)	Renkum	Graphic	>1.0
19	Recycled Paper Europe / Roermond Papier	Kappa Packaging	Roermond	Corrugated, grey	>1.0
20	Sappi Maastricht BV	Sappi (ZA)	Maastricht	Graphic	>1.0
21	Sappi Nijmegen BV	Sappi (ZA)	Nijmegen	Graphic	>1.0
22	SCA Hygiene Paper Papierfabriek-Friesland BV	SCA	Bergum	Household & sanitary	<0.5
23	SCA Hygiene Paper Edet Nederland BV	SCA	Tilburg	Household & sanitary	<1.0
24	SCA Packaging De Hoop BV	SCA	Eerbeek	Corrugated	>1.0
25	Papierfabriek Schut BV	Claier Fonaine (Fr)	Heelsum	Graphic	<0.5
26	Smurfit De Halm Karton BV	Smurfit (Ir)	Groningen	Grey	<1.0
27	Smurfit Solidpack BV	Smurfit (Ir)	Loenen	Grey	<0.5
28	VHP Veiligheidspapierfabriek Ugchelen BV	GP	Apeldoorn	Graphic	<0.5

[1] [VNP 1998b]
[2] [KCPK 1998]

Appendix III: Long Term Agreements contracted with industry

LTA	Contracting date DD-MM-YY	Duration DD-MM-YY	Primary Energy consumption in 1997 (PJ)	EEI Improvement 1989-1997 (%)	Target for 2000
Food an Drink Industries					
Potato	17-06-1996	01-01-2001	8.2	10	20
Beer	10-03-1998	01-01-2001	3.8	25	27
Cacao	07-11-1998	01-01-2006	2.2	No data	18[1]
Soft Drinks	11-07-1996	01-01-2001	0.8	16	21
Fruit and Vegetables	17-12-1997	31-12-2000	2.5	10	16.5
Coffee Roasting	26-11-1996	01-01-2001	0.7	18	19
Margarine/Fats/Oils	02-04-1996	01-01-2001	8.6	16	22
Sugar	03-09-1993	01-01-2001	6.9	18	20
Meat Processing	08-09-1993	01-01-2000	4.4	12	20
Dairy	17-04-1998	01-01-2001	17.4	9	20
Building Materials Industry					
Asphalt	06-11-1995	01-01-2001	2.5	10	20
Cement	01-03-1998	01-01-2001	4	11	20
Fine Ceramics	26-04-1994	01-01-2000	2.3	8	20
Glass	17-07-1992	01-01-2000	12	14	20
Brick	13-10-1993	01-01-2000	8.8	9	20
Sandlime Brick	27-02-1997	01-01-2001	1.2	16	23
Chemical Industries					
Chemical	24-11-1993	01-01-2001	324	15	20
Other Industries					
Plastic Processing	14-12-1994	01-01-2001	7.8	12	20
Paper and Board	04-06-1996	01-01-2001	31.7	19	20
Philips	00-05-1993	01-01-2000	14	32	25
Rubber	22-11-1994	01-01-2001	2	15	20
Textile	08-03-1996	01-01-2001	3.5	14	20
Base Metals Industry					
Non-ferrous	02-12-1996	01-01-2001	9.2	10	15
Iron and Steel	21-12-1995	01-01-2001	64.2	15	20
Light Industries					
Cold Storage	15-03-1996	01-01-2001	1.7	12	28
Industrial Laundries	16-06-1994	01-01-2001	1.4	15	20
Surface Treatment	14-03-1996	01-01-2001	2.1	10	20
Carpet	26-06-1996	01-01-2001	1	11	20
Iron Foundry	23-06-1995	01-01-2001	2.6	3	16
Other Industry	24-06-1996	01-01-2001	13.3	9	20

[1] validity 1998-2005
Source: [EZ 1998b]

Contents of the VAIE Project

The VAIE project has been organised in different tasks, which followed quite different approaches to the analysis of voluntary agreements, *ref.:* the web-site of the project: www. akf.dk/vaie.

- Task A: Theoretic model and meta-analysis followed an approach from economics and here three theoretic models on voluntary agreements are presented. The models are confronted with a meta-analysis based on existing investigations of agreements. The goal is to point to central actors in the policy-making and implementation processes, and to discuss ways of distributing knowledge and information among the actors. Given the simplifying assumptions, the analysis derives the welfare implications of agreements.

  Ref.: Chidiak, M., M. Glachant, and L.G. Hansen (1999): VAIE Project Task A Final Report. Theoretical Perspectives on the Efficiency of Voluntary Approaches to Promote Energy Efficiency, Cerna, Paris.

- Task B: Framework for country studies describes the methodological framework for the country studies undertaken.

  Ref.*: Krmer, T.P. & K. Hansen (1999): Task B Framework for the Country Studies. AKF Forlaget, Copenhagen.*

- Task C: Country case studies. The five country studies in Denmark, France, Germany, the Netherlands, and Sweden are based on case studies of agreement schemes and voluntary agreements. The objective primarily is to identify impact mechanisms at firm level in relation to the implementation process of agreement schemes respectively the voluntary agreement.

  Ref.: Chidiak, M. (1999): Voluntary Agreements Implementation and Efficiency. The French Country Study. Case studies in the sectors of packaging glass and aluminium. Cerna, Paris.

  Ref.: Johannsen, K.S. and A. Larsen (2000): Voluntary Agreements Implementation and Efficiency. The Danish Country Study. Case studies in the sectors of paper and milk condensing. AKF Forlaget, Copenhagen.

  Ref.: Kågström, J., P. Helby and K. Åstrand (1999): Voluntary Agreements Implementation and Efficiency. The Swedish Country Study. Case study in the sector of paper and pulp. Lunds University, Lund.

  Ref.: Ramesohl, S. & K. Kristof (1999): Voluntary Agreements Implementation and Efficiency. The German Country Study. Case studies in the sectors of cement and glass. Wuppertal.

  Ref.: Rietbergen, M.G., M. Breukels & K. Blok (1999): Voluntary Agreements Implementa-

tion and Efficiency. The Netherlands Country Study. Case studies in the sectors of paper and glass manufacturing. Utrecht University, Utrecht.

- Task D: Actual outcome - the nonintervention case. Three methods: monitoring of the historical development, the actual change in energy-efficiency investment behaviour and simulation of energy-efficiency investment behaviour are described. The methods are used on data mainly from the Netherlands and the actual outcome of voluntary agreements is assessed.

  Ref.: Rietbergen, M.G. & K. Blok (1999): The Environmental performance of Voluntary Agreements on Industrial Energy Efficiency Improvement. The Task D report from the VAIE project. Utrecht University, Utrecht.

- Task E: Voluntary Agreements in an EU-perspective The other tasks in the project, especially the country studies and task A, are discussed in task E from an EU perspective, focussing on the question of implementing agreement schemes at the EU level.

  Ref.: Helby, P. (1999): Voluntary Agreements Implementation and Efficiency. Task E. Transferability of case study lessons to voluntary agreement schemes at the European level. Task E report from the VAIE project. Lunds University, Lund.

- Task F & G: Conclusions and policy recommendation summarizes the findings in the project and gives policy recommendation concerning voluntary agreements.

  Ref.: Krarup, S. and S. Ramesohl (2000): Voluntary agreements - Hot air or a key to higher efficiency? AKF Forlaget, Copenhagen.