Energy efficiency through Long-term Agreements; Broadening the horizon in the new LTA approach

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ABSTRACT

Long-term agreements (LTAs) are understood to be negotiated agreements, which are achieved through bargaining between a public authority and industry. Such voluntary approaches get more and more attention as being a suitable instrument for achieving energy efficiency in industry. In the Netherlands, the second LTA (2001 to 2012) on energy efficiency in industry was recently put in operation by government, industry and service sectors. It is the successor of the first LTA, which ran from 1992 to 2000 and resulted in 22.3% efficiency improvement in 2000 (compared to 1989).

The new LTA approach differs from its predecessor. The first LTA focused mainly on process efficiency; the new LTA has made a shift towards energy efficiency over the product life cycle and a more integrated policy. This paper describes the experiences with the first LTA on energy efficiency, outlines the unique perspective of the second LTA and gives insights on the initial results.x

Background

For the Dutch government, the main drivers for the participation in LTAs are cost-effective CO_2 reduction on the one hand and the reliability of energy supply on the other. By the end of the 1980s, the world became aware of global climate change, caused by increasing emissions of greenhouse gases such as CO_2. In 1989 the Dutch government formulated its national policy for the reduction of the emission of greenhouse gases in its National Environmental Policy Plan (NEPP 1989). The national target was a reduction of CO_2 emissions by three percent in the year 2000, compared to the 1989 level. The policy goal of the first LTAs was therefore to stimulate energy efficiency beyond existing trends, in a context of low energy prices, without resorting to new regulations. The Dutch goal in relation to the Kyoto Protocol is set at 6% reduction of greenhouse gasses in the period 2008-2012, compared to the 1990 level.(Raamverdrag VN and VROM 1999)

By 2000, with the first LTAs coming to a close, an additional driver for energy efficiency presented itself. The Green Paper on the security of energy supply (EU 2000) was adopted by the European Commission in 2000. It looked ahead to the next twenty to thirty years, and drew attention to the structural weaknesses and geopolitical, social and environmental shortcomings of the European Union's (EU's) energy supply; in particular with regard to the European commitments in the Kyoto Protocol.

The European economy, like the Dutch economy, is essentially based on fossil fuels, which make up four-fifths of its total energy consumption. The EU's own energy supply covers barely half of its needs. If nothing is done by 2030 the share of fossil fuels is going to increase and energy imports may rise to 70% of total needs. The resulting import dependence

and rising import ratios may lead to concern about the risk of interruption to or difficulties in supply. In the Green Paper, the EU puts forward a strategy based on demand management, stressing the need for better energy efficiency by 2010 and rapid adoption of energy taxation proposals. This is the background against which the Dutch government developed the new series of long-term agreements (also referred to as the 'second generation LTAs'), which were established for the period 2001-2012.

Creating 'win-win' scenarios

Before 1990 environmental policy in the Netherlands was mainly based on direct regulation. Standards for harmful activities were set in laws and in orders in council. At the end of the 1980s, around the time of publication of the National Environmental Policy Plan, the government shifted emphasis to a paradigm called the 'win-win scenario': environmental problems should be solved, but not at the expense of the economy. Any solution to improve the environment should also improve the long-term viability of the Dutch economy. Instead of being opponents in the realization of desired environmental results, government and industry sectors were now viewed as co-makers, working jointly towards established pre-set goals, which were negotiated and agreed upon. A large number of environmental covenants have been agreed to date, on a range of subjects, including the properties or composition of products or packaging, to waste disposal, the curbing of emissions, and funding for research or projects.

The first covenants were mainly related to measures taken in connection with products. In this respect, the Packaging Covenant of 1991 is one of the most well-known agreements. Under this covenant the packaging industry agreed to reduce volume by 10% and achieve a packaging recycling rate of at least 60% by the year 2000. The goals were met much sooner than 2000, resulting in a second packaging covenant in 1997. The third covenant was agreed upon in December 2002 (VROM 2002). Under this new covenant, the packaging chain and local authorities have made a commitment to ambitious new and stricter litter reduction targets, and new recycling and recovery targets for all packaging materials. They are now for instance committed to cutting the amount of littered beverage cans and bottles by two thirds by the end of 2003, from a baseline of 50 million pieces. Failure to meet this target will result in a compulsory deposit scheme, imposing a € 0.25 cent deposit on cans and single use PET and glass bottles, which could be introduced on 1 January 2004

This example shows how covenants and other long-term agreements between government and industry generally work: they are established on a voluntary basis, but failure to meet the agreed-upon targets may lead to serious repercussions for the industry sectors involved.

Dutch industries and the first generation Long-term Agreement

Given this rather 'severe' nature of the covenants and long-term agreements one might wonder why industry is motivated to participate. If a company or sector does not fulfill its LTA obligations or does not show enough effort, the government can exclude it from the LTA. The company will then be subject to normal existing regulations, but it will have to do without the facilities and knowledge available through the LTAs (energy conservation is a relatively non-competitive topic, therefore government actively promotes and facilitates

knowledge exchange among LTA companies and sectors, making it easy for participating companies to learn from each other).

There are several other drivers for participating in LTAs. One is cost benefits. It is an established fact that measures to improve energy efficiency often lead to cost savings as well. An important advantage of the LTAs is that they are self-regulated. This means that the participating companies can decide for themselves how the energy efficiency obligations are met, and they can choose the economically more profitable solutions and timing. The Dutch government is of the opinion that the sectors are themselves best equipped to decide which improvements are the most successful and when they should be implemented. The government provides the participating companies and sectors with different kinds of support and assistance (such as technical assistance, information and training services, financial incentives and support with the development of energy conservation plans). Thus, not only the result of the energy efficiency measures is cost effective, but also the process of getting there.

Another important driver is international competitiveness. Sustainability, social corporate responsibility, good housekeeping: a company operating in international markets has to deal with increasingly more demanding consumers. They need to be able to show they are making progress on these issues. Participation in a LTA can therefore be an attractive option.

And finally the government assures, to those participating, consistency in and protection from new regulations aimed at improving energy efficiency, and a facilitated access to environmental permits.

Results of the first generation LTAs

Some 1250 corporate units and several dozen sectoral organizations took part in the first LTAs, representing approximately 90% of total industrial energy consumption, and responsible for some 30% of total emissions of greenhouse gases in the Netherlands. The Dutch industrial sector is comprised of the energy-intensive industries (chemicals, base metals, glass, paper and cardboard), feedstock industries, refineries and other industries (with on average a lower energy consumption). (EZ 2000)

During the 1989-2000 period, a total energy efficiency improvement of 22.3% was realized. This represents energy savings of 157 PJ (1 Peta = 10^{15}), which means that industry avoided the emission of 9 million tons of CO_2 per year. These figures are the weighted average of the results of 29 LTAs with Dutch industry (EZ 2000).

With the efficiency improvement of 22.3%, the target for the year 2000 (which was 20%) was met, and the first LTA on energy efficiency was considered a success. It should be noted however, that it is hard to establish the exact contribution of the LTAs to the actual efficiency improvements. The Netherlands Bureau for Economic Policy Analysis (CPB 2000) and the University of Utrecht (Utrecht University 1997) estimated that the LTAs had contributed at least one third to half of the improvements. The remainder of the savings were the result of autonomous developments in industry (favorable economic conditions, for instance, lead to more investments in new appliances and equipment that are far more energy-efficient than the existing ones).

The target for the absolute reduction of CO_2 emissions (three percent, as laid down in the National Environmental Policy Plan) was unfortunately not met. However, as industry

managed to avoid the emission of 9 million tons of CO_2 per year, total emissions in industry had in 2000 stabilized at the 1990 level: 68 million tons (EZ 2000). Main reason for not meeting the absolute CO_2 reduction target was a higher volume growth than anticipated. During the negotiations on the LTAs, an agreement on absolute CO_2 emission-reductions had not been reached: industry sectors would have had to forecast their growth over a relatively long period and they were not prepared to restrict production volume in case market demand would grow more than foreseen (Oudshoff 2002).

Lessons learned from the first generation LTAs

The implementation of the LTAs on energy efficiency appeared to work out well. In general, the industry sectors demonstrated a positive perception of the LTAs (Oudshoff 2002):

- Participation generated more management attention for the energy situation in a company.
- Participating companies became more aware of existing opportunities for energy savings.
- Consequently, the exploration of the existing potential was accelerated.

Naturally there were various options for improvements. The target of 22.3% was reached mainly because of the involvement of the chemical industry, which accounts for 35% of the industrial energy use. The chemical industry achieved a relatively large energy efficiency improvement of 25%. Many smaller sectors (13 out of 24) did not achieve their targets (Booij 2002).

Most of the measures for energy efficiency were focused on the production processes. Other possibilities for energy efficiency, like energy efficient product development or the deployment of renewable energy, had not been taken into account in the LTA. It was expected that such new themes might account for substantial additional energy savings.

In the course of the LTA, several non-industrial sectors (the agrarian sector, commercial services and non-profit sectors) signed on. A further involvement of non-industrial sectors was considered desirable.

Based upon the positive assessment of the LTAs, most parties expressed the desire to continue with the framework of LTAs, taking into account that new elements were to be added and some (mainly procedural) improvements needed to be implemented.

The second generation Long-term Agreements and the Benchmarking Covenant

The next phase of LTAs will span the period 2001 to 2012. An important difference with the first LTA is the distinction between the energy-intensive industries and the others (with an energy consumption of less than 0.5 PJ per year per plant). The Dutch government concluded the Energy Efficiency Benchmarking Covenant with the energy-intensive industry in 1999. For the other industries, a new long-term agreement was developed, referred to as the second generation LTAs.

Energy Efficiency Benchmarking Covenant

In the benchmarking covenant, the energy-intensive industry pledges to be among the world leaders in terms of energy efficiency for processing installations by no later than 2012. In exchange for this undertaking, the government has agreed not to impose any extra specific national measures governing energy conservation or CO_2 reduction on the participating companies. The benchmarking covenant was originally proposed by the energy-intensive industries. They felt there was little point in imposing heavy restrictive measures that would make them more energy efficient than their best global competitors. This would compromise their international competitiveness and reduce their ability to continue producing in the Netherlands. In the covenant, the level is set by the companies themselves, by means of an international benchmark.

The high degree of participation in the covenant has shown that this approach has met with acclaim in the industrial sector, with virtually all companies qualifying for participation joining, i.e. a total of 97 industrial and six power generating companies representing a total of 232 plants with an aggregate energy consumption in the amount of 1,060 PJ implying a participation ratio of 84% of potential benchmark companies. In terms of energy consumption, this is 94% for the industrial sector almost 100% for the power-generating sector, warranting the conclusion that the number of participants has more than lived up to expectation. The first step is for the companies to identify the Top Global Performers (i.e. the top ten percent worldwide) for their processes. Once a business has identified its Top Global Performers, it has to prepare an Energy Efficiency Plan (EEP) setting out, per individual plant, the concrete measures to be adopted. (Commission Benchmarking 2002)

It can be deduced from the EEPs filed to date that these plans will enable a reduction in CO_2 emissions ("CO_2 emission prevention") by the industrial sector in the amount of 4.6 million tons by the year 2012. This calculation has been based on 81% of energy consumption and on measures some of which are definite while others are less certain. Extrapolated into 100%, this would yield a CO_2 reduction by 2012 in the amount of approximately 5.7 million tons. Just before the covenant kicked off, Utrecht University prepared an estimate of the covenant's potential CO_2 reduction by 2012. (Utrecht University 1999) Restated for the period from 2000 to 2012, this reduction would work out at 3.2 to 4.0 million tons of CO_2 for the industrial sector, which implies that with the situation as it stands, the energy-intensive branch of industry is more than complying with standards.

Second generation LTAs

At the beginning of 2003, 17 sectors (both industrial and non-industrial) had signed up for a second LTA (representing approximately 90% of the industrial energy consumption of the energy-extensive industries). Some sectors still have an ongoing 'first generation LTA', which will be continued in a second LTA once the first has expired.

The most important differences between the first and the second long-term agreements are discussed here (Novem 2002).

- Instead of a pre-set target, the companies in the second long-term agreement are given the opportunity to formulate their own targets. The move away from a pre-set target was motivated by the government's desire to make the companies more responsible for their own energy efficiency behavior. The target setting is done in the following way: each company taking part in the second LTA must draw up an Energy Conservation Plan (ECP). It describes measures for improving energy efficiency in the company's

production processes. The energy conservation plans of individual companies form the basis for setting targets at the sectoral level. The energy efficiency improvement target for a sector is at least equal to the weighted sum of the targets of its member companies. This may seem like a good opportunity for companies to lie back and formulate modest targets, but each company is screened and needs to comply with the ALARA principle (their energy consumption should be As Low As Reasonably Achievable).

- In line with the ALARA principle, two new compulsory elements were introduced. These are the obligation for companies to introduce all suitable process efficiency measures with a pay back time of five years or less; and the introduction of an energy management system in line with ISO 14001 within two years after signing the LTA. The obligation to introduce efficiency measures with a pay back time of five years or less applies to non-LTA companies as well, however they'll have to do without all kinds of government support like knowledge exchange in workshops.
- The Ministry of Economic Affairs started a facilitating program, carried out by the Netherlands agency for energy and the environment, Novem, which operates as an independent expert. The sectors and companies are approached by Novem to familiarize themselves with the LTA and to join the LTA. When they join, Novem supports them by performing a scan of the sector and individual companies to determine the energy saving options and formulate an energy conservation plan. Also there are several other instruments to stimulate and facilitate the sectors and companies.
- The LTA2 assigns an important role to provincial and municipal authorities, as the Competent Authorities for the Environmental Management Act. Municipal and provincial authorities deal with the energy consumption of companies within their boundaries through licensing and license enforcement procedures. Under the Environmental Management Act, energy efficiency requirements are imposed when environmental licenses are granted. Each company that takes part in the LTA2 must draw up an Energy Conservation Plan (ECP) within a particular period. An ECP covers the energy paragraph of an environmental license. Many municipal authorities pursue an active climate policy, which is also directed at local businesses - by promoting the development of sustainable industrial estates, for example, or by promoting the use of renewable energy. The LTA2 makes it easy to call companies to account for these possibilities.

Introduction of new energy efficiency themes in LTA2

The most notable difference between the first and second LTA, however, is the introduction of the so-called 'expansion themes' of renewable energy and energy-efficient product development, which put the second LTA in a broader perspective. It is a unique approach in Europe. The major new challenge is to save more than just the energy consumed to manufacture products. The possibilities for attaining this goal are often surprising in their nature and scope. Concrete measures for achieving energy efficient product development include sustainable products, sustainable industrial estates and the optimization of transport, logistics and product chains.

These non-process efficiency measures are optional (they are not obligatory under the Environmental Management Act, but are given credit for in the LTA monitoring), but each sector is challenged to investigate which themes it is willing and able to address. In the

period 2001-2004 this occurs on a voluntary basis. This voluntary period gives the opportunity to develop and test methods to support the participating companies. One method is Lifecycle Energy System Scan (LESS), a software tool developed by Novem to calculate the fossil energy savings of the new LTA themes (Avest & Vuyk 2003).

Renewable energy

For participating companies, the use of renewable energy widens the scope for achieving fossil fuel savings and curtailing climate change. Switching from fossil to renewable energy sources counts as a saving option, even if the actual energy efficiency of the processes in the plant is not changed. The non-fossil energy sources included are: wind energy; thermal, photovoltaic and passive solar energy; geothermal energy; hydro-electric power; heat/cold storage; heat pumps using ambient heat; energy generated from waste or biomass.

Energy-efficient product development

Energy -efficient product development comprises the creative process of adapting an old product or designing a new product with the aim of reducing energy consumption throughout the product life cycle (see also Avest & Vuyk 2003). This implies a wider scope for achieving energy savings in the product life cycle, via sustainable products, optimization of transport and logistics in the chain and sustainable industrial estates (see also Table 1).

Table 1. Expansion themes
Improvement options within energy efficient product development

Energy efficient product development entails the themes 'sustainable products', 'optimization of transport and logistics in the chain' and 'sustainable industrial estates'. This innovation contributes to an improved indirect energy efficiency in eight different ways:

Optimal functionality: Map out the functional consumer demand (need) that a product provides for and design a more energy efficient implementation that satisfies the same function, need, and product service or demand.

Material saving: Lower indirect energy use per unit product by decreasing the consumption of raw materials or switching to less energy-intensive materials.

Improved process energy efficiency: Lower direct energy use per unit product by lowering energy use in heating or cooling processes and/or driving of pumps, compressors or other process units.

Optimal distribution: Lower energy use per unit product in transport and storage.

Decreased energy consumption during product application: Lower direct and indirect energy use per unit product, during the actual life span of the product, due to innovative design or implementation changes.

Optimal life span: Lower direct and indirect energy use per unit product due to optimal choice of product life span. One can choose to design the product so that the actual life span will be close to the technical life span or to discontinue the life of a product prematurely when launching a less energy-consuming product.

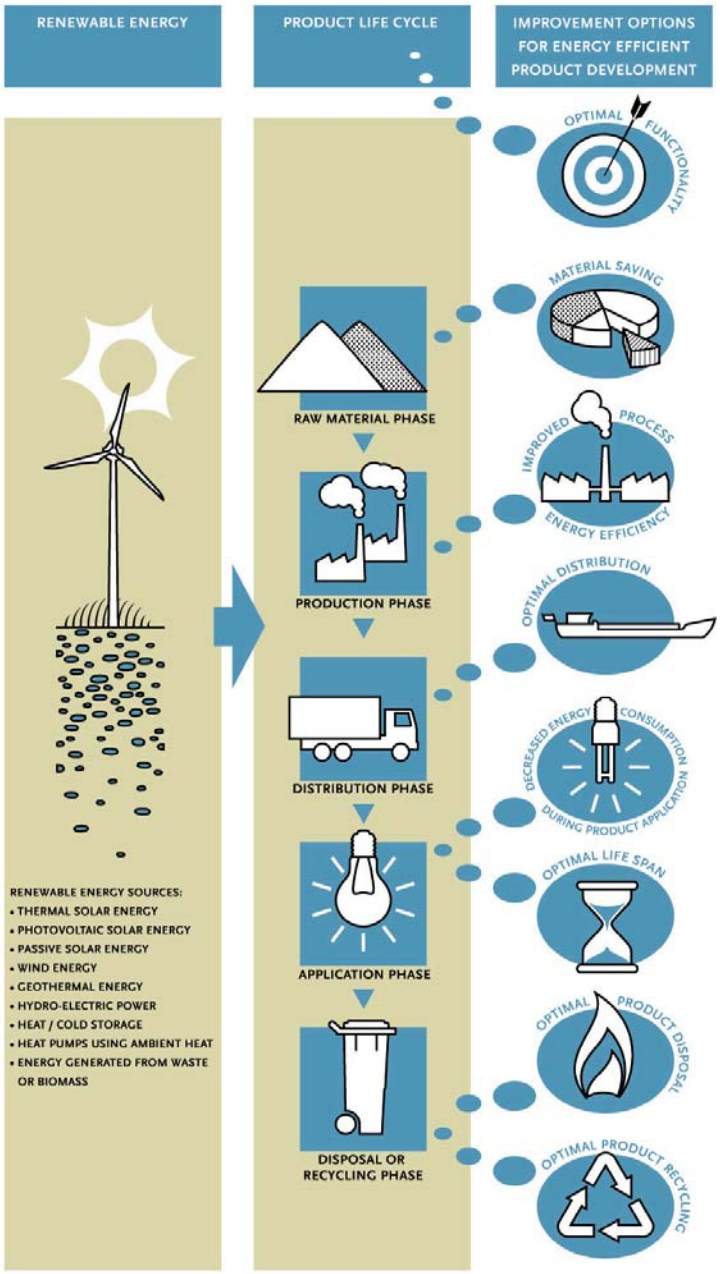
Optimal product disposal: Measures taken to minimize energy consumption, per unit product, for the sub-cycle of treatment of the discarded product: collection, transport, incineration, gasification or landfill.

Optimal product recycling: Measures that involve recycling and thus allow reusing the energy content of materials in the discarded product, with relatively little extra energy use.

Table 1 Article 4 of the 'Protocol Expansion Themes' describes the scope of energy-efficient product development (MJA2 2001).

Figure 1 summarizes the new energy efficiency themes in graphics. The first column shows the 'renewable energy' theme. The second column is about energy-efficient product development. The five steps in a product's life cycle are shown: from the production of raw materials to the disposal or reuse of the discarded product. The third column shows the eight options for environmental improvement that are also listed in table 1.

Figure 1. New energy efficiency themes



In a preliminary study, Novem estimated that the savings of Dutch industry (both energy-intensive and energy-extensive sectors) through energy-efficient product development could amount to roughly 100 PJ in 2010 (Avest & Veen 2001).

Apart from the energy savings, participating companies stand to gain much more out of the development and implementation of plans for the expansion themes. Other attractive prospects include:

- Direct gains: lower production costs, wider margins, more marketable products.
- New opportunities: ideas for new products and new markets, improved cooperation with suppliers and customers.
- Corporate social responsibility: the deliberate application of environmental criteria to corporate policy, in addition to social and economic criteria: people – planet – profit.

For government, the expansion themes are important because of the potential energy efficiency gains, but also because of the strategic implications of these themes. By incorporating new concepts such as life cycle thinking and by finding new ways of collaborating with suppliers and customers across the product chain, the participating companies may broaden their horizons and gain strategic advantage over their competitors and over non-LTA companies.

Novem and the expansion themes

Novem is a government agency commissioned to facilitate the second generation of long-term agreements. One of Novem's tasks is monitoring the progress of LTA2. Companies taking part in the second long-term agreement are required to report each year on progress with their activities relating to the long-term agreement. Each company or institution taking part in an LTA records its energy efficiency target in an Energy Conservation Plan (ECP), together with concrete measures and a schedule for achieving the target. Novem assesses these energy conservation plans. Apart from monitoring, Novem also gives advice and support, for instance with the writing of the energy conservation plan, the introduction of an energy management system and with the choice for a particular (set of) expansion themes. Novem also gives information on relevant subsidy schemes and is active in the field of knowledge transfer (through working groups and handbooks).

The expansion themes, being such a new area, were particularly challenging for Novem. In 2000 Novem started informing potential LTA2 companies about the new long-term agreement and the expansion themes. Although most companies signed up for LTA2, only few showed interest in working with the expansion themes. This was probably due to these themes being rather new and ambitious in character; they require a certain amount of risk-taking and collaboration with new partners. As a response to the poor interest in the expansion themes, Novem developed several tools and instruments to help companies understand what the expansion themes are about and how they can be of benefit (these consisted of scans, a handbook and the software program LESS). Also, Novem stepped up its communication efforts: it actively approached sectoral organizations and individual companies, and organized many information meetings and workshops. Early 2002, Novem concluded that the participating companies were now better aware of the expansion themes, but still hesitant to actually start working with them (Swets & Velde 2003).

This led to the development of the 'feasibility study': a short inventory of potential ideas for energy efficient product development, done for a specific company. The inventory is the

result of a brainstorming session with the company, and includes an estimate of potential energy savings of the idea(s) and of their economic feasibility. The feasibility study is done in a very short time span (approximately one month), with minimal financial effort for the company in question. The feasibility studies are supposed to lower the threshold for a real pilot project. By actively involving the company in the idea generation, and showing (in hard figures) what the benefits of the new ideas can be, it is expected that the company management will commit itself to an ongoing (energy efficient) product development.

This new approach worked very well. By the end of 2002, twenty feasibility studies were concluded or underway. Several of these will continue as pilot projects in 2003. Novem will use the results of these pilot projects to convince more LTA companies to start their own projects. Getting the most out of the expansion themes will be, for the next few years, an interesting challenge for both the participating companies and Novem as their facilitator.

9. Case study: C-Fix carbon glue in construction materials

The case of 'carbon glue in construction materials' is an excellent example of an energy efficient product development project. The development of the carbon glue (C-Fix) was done by a consortium of Shell Global Solutions International, the University of Technology in Eindhoven (the Netherlands), and two Dutch construction industries: HBG and Den Boer Beton.

Description of C-Fix

C-Fix is a construction material based on a carbon-rich adhesive that is produced from petroleum refining. In term of its properties, the material lies somewhere between cement concrete and asphalt and provides opportunities for alternative construction solutions. The use of the carbon-rich binding agent in this composite material creates a sustainable application for petroleum fractions that would otherwise generate CO_2 emissions during incineration. Almost 100 percent of the material can be re-used without loss of quality.
The advantages of C-Fix:

- Heavy petroleum products that are utilized in C-Fix products are no longer incinerated but are processed into a product; thereby limiting CO_2 emissions.
- The product is an alternative to other products in the construction industry whose production generates CO_2 emissions.
- C-Fix products are fully recyclable, so that at the end of the product life span, CO_2 emissions through incineration can be prevented.

Energy savings

If C-Fix would take a five percent share in the production of street cobbles in the Netherlands, the energy savings could amount to 50 TJ (= 0.05 PJ). This was calculated in the following manner (broad calculation by Novem). Based on so-called CO_2 accounting, some 100-200 kg of CO_2 per kilogram product can be stored, depending on the application and the amount of C-Fix composite required. In the case of street cobbles (4 kg per cobble), approximately 1 kg of CO_2 can be stored in this way. Based on the annual quantity of street cobbles produced in the Netherlands alone (approximately 200 kilotons) and a proportion of

C-Fix of 5 percent (10 kilotons), this represents a total of around 2.5 kilotons of CO_2. This is equivalent to the CO_2 reduction achieved by saving approximately 50 TJ of energy (based on natural gas). One point of attention in the further development of the project is that the CO_2 remains stored in the product and is not released by e.g. combustion. The results of a life cycle analysis show that CO_2 storage is the main environmental gain of this product. Moreover, the production of C-Fix releases less CO_2 than comparable cement products.

Next step

A separate company will be commercializing the products during 2002 and 2003, in close collaboration with Shell and construction firms. C-Fix will initially be used in specially selected applications, but will need to be developed into a bulk product. The supply of heavy carbon-rich petroleum products is not a limiting factor in this application. Not until C-Fix becomes economically viable for mass production will it start making a significant contribution to the reduction in CO_2 emissions.

Conclusions

- Covenants have over the years proven to be useful and successful instruments, enabling companies to balance environmental and economic constraints and choosing the most profitable solutions and timing while doing so. The first long-term agreement on energy efficiency was a success, and the prospects for the second long-term agreement and the benchmarking covenant are positive.
- Through the new long-term agreements, an integrated life cycle approach will be made visible and put into action. Also, policy on energy efficiency and environmental issues will be more integrated, because of the involvement of national, provincial and municipal authorities in LTA2.
- The expansion themes of renewable energy and energy-efficiency product development offer more opportunities for realizing energy efficiency, but at the same time this broad perspective on the second LTA makes it hard for companies to commit to these new themes, as they are rather ambitious and not without risk.
- Compared to the LTA1, the impact of the second generation of LTAs will be less, as these do not include the majority of industrial energy consumption. Through the integrated life cycle approach, however, companies will be involved in exploiting the new themes.

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