The Use of Long Term Agreements to Improve Energy Efficiency in the Industrial Sector: Overview of the European Experiences and Proposal for a Common Framework

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ABSTRACT

In the European Union efficiency improvements in the industrial sector are regarded as a key element of Member States' strategies to meet their Kyoto target. Besides the traditional policy instruments, such as fiscal and financial aids, minimum efficiency standards, R&D and technology programmes, there is an increasing interest by both public authorities and industry for voluntary approaches to improve industrial energy efficiency.

In the European context the term voluntary approach is often used to describe a wide range of industry actions including, inter alia: industry covenants, negotiated agreements, long term agreements, self regulation, codes of conduct, benchmarking and monitoring schemes. These voluntary approaches differ in relation to their form, legal status, provisions and enforceability.

The paper provides an up-to-date overview of the present status of the different voluntary approaches for the industrial sector in several Member States (the Netherlands, Sweden, Germany, Denmark, Finland, Ireland, and the United Kingdom). The paper will focus on the particular type of voluntary approach implemented in the Netherlands and commonly called Long Term Agreements (LTA). The paper analyses the opportunities and advantages for creating a common EU framework for the conclusion and implementation of LTAs, based on the successful Dutch model. In doing so, the paper intends also to contribute to the approximation of the LTA's essential elements throughout the Community in order to reduce possible distortions of the internal market and of the competitive position of national industries, thus enlarging the acceptability of this instrument by public authorities and industry. For some industrial sectors, which are quite homogenous throughout the Community and represent a limited number of companies, the paper analyses the advantages of having European LTAs and recommends their implementation. The paper presents the achievable results at EU level in terms of efficiency improvements and CO2 emission reductions. The paper proposes also a strategy to further promote the use of LTAs in the European Union; this will includes actions to be carried out by the Commission and by Member States.

Introduction

The energy consumption in industry

The energy consumption of the industry in the European Union accounted for 11277.2 GJ in 1994, i.e. about 30% of the total final energy demand and showed a yearly increase of about 0.5% over the period 1985 to 1994. The heavy industry sector consumes about 66% of total industry consumption, in particular six sub-sectors (iron and steel industry, pulp and paper production, petrochemical production, ammonia production, cement production and refineries) of heavy industry consume about three quarters of this, or 15% of total final energy demand. Production growth, structural changes, and technological efficiency improvements combine to lead to significant, but not continuous, energy intensity improvements in some Member States (in particular Germany, Denmark and the Netherlands). Although energy intensity improvements will continue, there is a debate as to the rate of change. It is expected that energy intensity gains will follow the lower trend of about 1% per year, experienced in the last few years. According to the "Conventional Wisdom" scenario of the Commission's European Energy 2020[1] study the yearly increase of consumption in the industrial sector will be of 0.9 % per year for the period between 1995 and 2020. The "Conventional Wisdom" scenario includes an efficiency improvement of 0.7% a year compared to frozen efficiency, leading in 2005 to a total efficiency improvement of 10%.

The energy efficiency potential in industry

There is a considerable economic potential for energy efficiency improvements, (that is, the value of energy saved repays the cost of efficiency within a few years[2]) which would not otherwise be realised in the market. However in today's policy debate, the most important aspect of energy efficiency is the associated reduction in the generation of emissions to the atmosphere of carbon dioxide (CO_2), the major cause of the greenhouse effect.

Energy efficiency of a production plant or industrial process can be expressed in terms of specific energy consumption (SEC). The SEC is defined as energy consumption per unit of product output, i.e. the SEC is given in GJ per tonne of product. Accordingly energy efficiency improvement of an industrial process means a reduction of the specific energy consumption of the process. Different categories of efficiency improvements can be defined: the theoretical potential, the technical potential, the economic potential, and market potential[3].

A practical approach to evaluate the potential energy efficiency improvements in the industrial sector is to determine the average efficiency for a given type of process (or plant)

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(1) European Energy to 2020, A Scenario Approach, European Commission 1996

(2) The study "Policy and Measures to Reduce CO_2 Emissions by Efficiency and Renewables" carried out by the Department of Science, Technology and Society, Utrecht University (NL) 1996 estimated that the potential in industry for profitable energy efficiency improvements (i.e. with a pay back period of 6 years or less) for the period 1990-2005 is about 20%.

(3) For industrial processes thermodynamic principles are used to calculate the theoretical efficiency and hence the maximum potential. The technical potential is defined as the achievable energy savings resulting from the most effective combination of efficiency improvements; the economic potential is defined as the potential savings that can be achieved at a net positive economic effect, i.e. the benefits of the measure are higher than the costs (including interest, depreciation, and operation and maintenance costs); the market potential is defined as the potential savings that can be expected to be realised in practice.

in the reference year and the best existing practice, where the best existing practice is the efficiency of the most efficient process (or plant) in the reference year (e.g. 1990). The best existing practice differs from the technical potential, which in this case would be a process (or plant) including all the new and most efficient technologies that are commercially available on the market.

Measures to improve energy efficiency in industry

Several options are available to industry to improve efficiency including both "soft" measures such as energy management, monitoring and targeting, etc., and adoption of more efficient technologies. Some technologies are specific for the type of industry (for instance for the iron and steel industry: dry coke quenching, top gas power recovery at the blast furnace, continuous casting, etc.). Other technologies are widely used across several industrial branches and are responsible for a large share of energy consumption.

One most important areas of application of these "horizontal" technologies is waste heat recovery, which is one of the most important ways to improve energy efficiency in industry, since about 30% of the energy consumed ends as waste heat through gas and water streams. The three main technological solutions to recover heat are co-generation/combined heat and power, heat pumps and heat exchangers. In particular co-generation is a well-known technology which offers potential energy savings in the industry in the Community of about 15%[4].

Other technologies can contribute to the efficiency improvements of the combustion process, which consumes about 70% of total energy consumption of industry; the separation processes, mainly though the adoption of membranes; electricity end-use, through the wide spread use of high efficiency electric motors, which account for about 70% of electricity use in industry, and adjustable speed drives.

The policy instruments to promote energy efficiency

Energy efficiency improvement in industry and the tertiary (commercial and public) sector is a rather complex phenomenon, which is affected by the decisions of different actors: public authorities, industry, utilities, professional consultants, etc. Although measures to improve energy efficiency are theoretically profitable in that investments are repaid in a few years, the measures actually taken are far less than being justified from an economic point of view: this is because there are several barriers to the penetration of energy efficient measures in industry (and the tertiary sector) such as: lack of available and accessible information, willingness to invest [5] and profitability barriers[6], institutional barriers (for

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(4) The energy savings potential for CHP is discussed in the study "Saving Energy with Combined Heat and Power (CHP): Feasible, not Self-evident" by A. Martens, VITO (BE), September 1996.

(5) Major investments in equipment (e.g. new process plant) are only carried out when the old equipment is fully amortised; moreover this is without taking into account the all life cycle cost of the equipment.

(6) Energy efficiency improvements as a means to reduce production cost are not a high priority in several firms, as energy is not their core business; moreover in several industrial and commercial companies energy cost are less than 1% of the company turn-over. Accordingly, companies substantially underinvest in energy efficiency. In addition, when companies decide to invest in energy efficiency normally they request a very high rate (above 50%) of return for energy efficiency investments.

example toward co-generation), equipment owners not paying for running costs, "split incentives", etc. As a result of market failure to achieve the "economic optimal" efficiency improvements, public authorities have implemented policies and programmes to overcome barriers to energy efficiency.

The range of policy instruments commonly used to overcome these barriers includes: price-based and fiscal instruments (i.e. taxes, subsidies, depreciation rules), regulation, voluntary approaches, information programmes, public aid for research, development and demonstration.

As indicated in several studies, policies aimed at improving energy efficiency could include a combination of the above instruments. Regulatory approaches have proven effective in improving energy efficiency. Examples of regulatory approaches include efficiency requirements for appliances (e.g. electric motors for the industrial sector), where public authorities require all products to meet some minimum efficiency levels. Other instruments have been generally defined as "economic instruments"; these instrument include taxes, tradable emission permits, etc. At European Union level, the Commission has, for instance, recently proposed a re-structuring of the taxation of energy products. The proposal increases the minimum levels of taxation on hydrocarbon oils, and extends the scope of excise duties to other energy products (coal, natural gas, electricity).

European Union Member States' Experience in Voluntary Agreements with Industry Branches

Although voluntary approaches are not "economic instruments" because they do not create economic incentives, they depend on market decisions on the demand side for their effectiveness. Therefore voluntary approaches have been defined "market oriented" instruments. Voluntary approaches have been effective in removing barriers, for instance, in overcoming profitability barriers and in making participants aware of profitable energy savings. In some cases voluntary approaches are aimed to achieve results similar to regulatory programmes without a "command and control" approach.

The results achieved in the past through the use of voluntary approaches varied, due to the different type of goal (performance based, target based), the nature of the participant commitment, the degree of regulatory threat, etc.. In addition, it is worth noting that voluntary approaches have seldom operated in isolation as policy instruments. They have been combined with other measures such as regulatory approaches, or fiscal instruments.

The Netherlands

In the Netherlands, 31 agreements have been concluded between the government and industry branches. The annual budget for this programme is about 100 MEURO. NOVEM (the national energy agency) is, on behalf of the government, charged with the industrial energy conservation programme including supporting of the national agreement scheme. NOVEM is acting in the market as an independent intermediate body, having close contact (advising, monitoring etc.) with the sector and individual companies. Each agreement is a contract under civil law signed by the government, individual companies and the trade association. The latest report from the Dutch Ministry of Economic Affairs indicates that the Dutch agreements are on target to deliver 2 % per annum efficiency improvement in the period 1990-2000. Moreover, the Dutch authorities are discussing at

the moment with industry the next phase (period 2000-2010) where an efficiency improvement target of 2.2 % per annum is under discussion.

Germany

In March 1996, The Federal association of German Industry (BD) published a "Joint Declaration of the German Industry on Climate Protection" together with five other trade and industry associations, stating their intention to reduce specific CO_2 emissions or their specific energy consumption by 20% in the period up to 2005, taking as base year 1990. The agreements cover over 71% of industrial energy consumption in Germany and more than 99% of public power generation. The declaration also announced a transparent and verifiable monitoring process and fixed the date for the first monitoring report for autumn 1997. This is however linked to a postponement of the introduction of any energy tax by the German government. The first report was issued in 1997, this report indicated that the industry was delivering what offered. However, there is some controversy on the real "extra" efforts by German industry.

Finland

The Ministry of Trade and Industry and the Confederation of Finnish Industry and Employers concluded a voluntary Agreement on the Promotion of Energy Conservation in Industry in November 1997. The aim of the agreement is to reduce the specific consumption of energy and to develop and introduce actions which would allow energy efficiency to become an integral part of companies' operations. The Ministry agrees to finance the activities within the limits of appropriations made. The agreement was well received by industry and to date the system covered over 70 % of all energy used in Finnish industry.

Ireland

In Ireland the voluntary approach covers essentially the obligation of regular energy audits without any specific efficiency targets. The Irish Energy Centre's (in charge of this scheme) mission is to promote the development of a sustainable national energy economy. It does this by devising and implementing programmes to stimulate and maintain demand for energy efficiency products and services and to generate long term behavioural change in industry. The Irish Energy Centre in 1994 developed and implemented a pilot long term agreement scheme under the title of "Annual Self Audit and Statement of Energy Accounts Scheme". This scheme targeted large companies (with an annual energy bill of more than 640kEURO per annum), which are profitable and have a quality profile.

Sweden

The Swedish voluntary agreement program for efficient energy use in industrial companies is called the EKO Energy scheme. The Swedish National Energy Administration (STEM) provides participating company with specified, comprehensive list of key data on their production. These data focus mainly on energy consumption, but also cover material flow and company environmental issues according to ISO 14001. In addition, the companies get expert advice on what measures to take in order to reduce energy consumption and cost. In exchange for this knowledge, the company agrees to

establish energy efficiency goals and to add a plan for actions. The company also agrees to establish a company policy according to EMAS scheme and ISO 14001.

Denmark

In Denmark the voluntary agreements with industry branches can be characterised as non-binding gentlemen's agreements. Voluntary agreements in Denmark serve to motivate industry to negotiate and commit to environmental targets in exchange for public authorities holding back legislation. Since 1987, 16 legally non binding agreements have been concluded relating to energy and environmental issues. Agreements on energy focused on energy supply and were concluded between government and power companies. In the framework of the "Follow-up of Energy 2000" (1993) part of the initiatives consisted in getting agreements on energy efficiency with sectors from industry. The agreements are valid for three years. Companies operating heavy processes commit themselves to energy-saving investments in return for a reduced tax rate. Also other companies with an energy tax liability of more than 3% of the added value may enter into this kind of agreement. Heavy-process companies joining are required to undertake any investment with a payback period of less than 4 years (for other companies even 6 years or less).

United Kingdom

In 1997 the United Kingdom Government reached an agreement with the chemical industry. In this voluntary pact the Chemical Industry Association committed the sector to a 20% CO2 emission reduction by year 2005 compared to 1990 level.

The Long Term Agreement (LTA) Instrument

In this paper the LTA is a specific type of environmental agreement, which is concluded between public authorities and industry. The essential characteristic of an LTA is that the industry trade association and its members have to commit themselves to a quantified target for energy efficiency improvement by a specific year (e.g. 2005) relative to a reference year (e.g. 1990). According to this definition not all the voluntary agreements described in the previous session can be classified as LTA (as an example the Irish agreement are not LTAs). The targets for energy efficiency improvement of the industrial process include individual components of the production process (e.g. use of variable speed drives, etc.), but exclude the efficiency of the final product (e.g. domestic appliances, etc.).

Given the great variety of voluntary approaches used in the Member States to promote energy efficiency in industry it is important to create a common framework for the LTA approach. The internal market requires industry and commerce to be operating under similar conditions across the Community as far as practicable, thus reinforcing the need for comparable efforts between Member States on energy and associated environmental initiatives. The precise framing of measures to improve energy efficiency however, will often need to take account of differing national circumstances and opportunities and, where there is no overriding need for action at Community level, may be left to national competence, in line with the principle of subsidiarity. The Commission has been working on the promotion of the LTA instrument and in the creation of a possible harmonised framework for the LTA approach. The Commission work is based on the checklist presented in the Commission Communication on Environmental Agreements. It retains the essential

elements of the above mentioned checklist: the objectives, the quantified targets, the monitoring and reporting mechanisms, and the obligations of the parties. It adds some new requirements specific to LTAs such as the energy conservation plan, and the communication plan. The most important attribute of LTAs which makes them particularly suited for "common" implementation in several Member States is their flexibility. They can be designed to follow a common framework and yet allow for specifics to differ according to national industrial situations and energy/environmental approaches. The proposed framework is designed to contribute to the creation of a level playing field among the same industrial sectors in different Member States, which are competitors in the internal market. In addition, the minimum requirements will help to assure that LTAs are effective, transparent and open to public scrutiny. In the Commission's view, Member States could, in line with their own national programmes for the reduction of CO_2 and efficiency improvements, and within national legislative frameworks, use the "common" LTA approach to achieve their goals.

The Advantages and Disadvantages of a Unified LTA Instrument

When considering the energy consumption of the industrial sector, each sector (chemical, steel, dairies, etc.) has its own specific production processes and patterns of energy consumption. Given the complexity of the individual production processes and of the solutions to improve energy efficiency, it could be difficult to have regulation flexible enough to adapt to the different and specific characteristic of each sector. By using an LTA approach there will be more degrees of freedom in adapting the targets and methodology to each industrial sector. By designing tailor-made solutions both for the specific industrial sector, for which collective targets are set, and for individual companies within the sector, LTAs allow for a different timing of energy saving investments for individual companies[7].

Since industry has the best knowledge of the production processes, it is clear that co-operation between public authorities and industry can facilitate the establishment of ambitious energy efficiency targets. In addition, through co-operation on energy efficiency improvements, public authorities and industry could share responsibility in setting ambitious targets[8], which are at the same time realistic and achievable. Thus, taking into account both the different circumstances and position of each sector and of each individual participating company in an LTA approach, industry can decide by itself how best to achieve the target. Industry would be, in partnership with public authorities, responsible for introducing feasible energy conservation measures based on an energy efficiency programme and ambitious targets.

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(7) For instance, in the Netherlands LTAs energy efficiency improvements do not have to be distributed equally among a company's various sites, but the company has to carry out the measures indicated in the energy efficiency plan and has to contribute to meet the sector's target.

(8) The level of "ambition" should be set by public authorities based on an independent assessment of the efficiency potential, as described later on in this section. The fact that the target is subject to negotiation with the industry branch does not weaken it, but on the contrary can make more effective than legislation as industry shares it. As indicated an independent assessment and openness to the public comments and scrutiny will assure that the target is beyond the BaU.

The effectiveness of the LTA instrument

There is substantial economic potential for energy efficiency. The difference between the level of energy efficiency that can be expected to be realised in practice (the market potential) and the level that is economic profitable is often described as the "efficiency gap". The existence of this efficiency gap has also been described in terms of "no-regret" potential whose exploitation should be a policy priority. The LTA approach can be instrumental in overcoming the efficiency gap, as it will make companies aware of profitable efficiency investment opportunities and convince them to make a (quantified) corporate commitment to carry out those investments. These investments should be made in addition to the planned investment to replace stock, since the goal is to accelerate the replacement of old and inefficient plants, processes or technologies. As any other policy measure, the LTA would be designed to achieve the efficiency improvement in a cost-effective manner. In doing so it is important that, besides the energy/environmental (and economic) benefits, all the costs involved both to industry and public authorities are evaluated beforehand and compared with other possible instruments to achieve the same goals. In particular public authorities should evaluate carefully the transaction costs, which could be considerable especially in industry sectors with several actors or with poorly organised trade associations.

To evaluate the effectiveness of the LTA instrument in improving energy efficiency, it is important to determine the level of the quantified target compared to the efficiency improvement that would in any case have taken place, the so-called "Business as Usual" (BaU) scenario. It is worth noting that the definition of the BaU might be complex and sometimes controversial, and in some cases it might be more appropriate to compare the energy efficiency target (e.g. 20% improvement in 10 years) with the historical trend.

The main characteristic of the LTA is that is a target-based instrument. An effective should LTA should promote energy efficiency beyond the BaU scenario and should aim at least at the economic potential, which, because of the market barriers, does not coincide with the BaU scenario. In-depth analysis (i.e. the energy efficiency inventory) of the possible efficiency measures allows public authorities to negotiate targets with industry that are ambitious and go beyond the BaU scenario. For example, a commonly used criterion for establishing the efficiency targets is to identify all opportunities for efficiency improvements with an acceptable pay-back period (PBP), the establishment of the "acceptable" varies from sector to sector and from Member State to Member State.

The possibility to have targets which go beyond the "no regret" (economic) potential depends on the degree of the threat of introducing stringent regulatory measures and on the policy mix adopted, e.g. regulation, financial and fiscal instruments: for instance an LTA linked to energy tax exemptions could be more effective in persuading companies to go beyond the economic potential.

In any case the adoption of the LTA instrument will start a process to raise industry's awareness of the profitable energy efficiency potentials and to offer industry the possibility to share the responsibilities for achieving ambitious energy efficiency targets.

However, as it has been clearly indicated in the Communication on Environmental Agreements, besides the above indicated advantages of the LTA approach (and of environmental agreements in general), there are also certain risks associated. In particular there is the risk that the negotiated energy efficiency targets "reflect little more than "business as usual"". To avoid this "it is certainly helpful to set general targets (e.g. CO_2 emissions reduction targets) through legislation". A high public awareness for CO_2 emissions reduction would also help as well as a negotiation process open to public scrutiny. Moreover the "risk of free-riding", i.e. a number of companies belonging to the sector and

not committing themselves to make the efficiency improvements, increases the more demanding the targets are; this risk must be clearly assessed by public authorities when setting the target.

Potential Results

In evaluating the potential results we assumed that each LTA implemented aims at least at the economic potential for efficiency improvements (the minimum goal for LTAs). In addition, as already indicated, it has been established that in the heavy industry sector the economic potential for efficiency improvements for the period 1990 to 2005 is at least 20%[9]. Therefore, in the optimistic assumptions that LTAs are implemented in all Member States and in all the heavy industry sectors and that LTAs are leading to a 20% efficiency improvement both for fuel and electricity compared to a frozen efficiency scenario, this would result in fuel savings of 660 GJ and for electricity of 308 GJ per year. This would be equivalent to a total reduction of CO_2 emission of 90 Mtonnes. For the light industry sector the economic potential for efficiency improvements for the period 1990 to 2005 is estimated to be at least 20%; accordingly assuming that LTAs are also implemented in about 70 % of the firms in the light industry sector this would add final energy savings of 440 GJ and an additional reduction of CO_2 emissions of 53 Mtonnes. In addition, LTAs can be used in the service and commercial sectors[10] thus contributing to further CO_2 emissions reductions. Preliminary results from the PRIMES model, developed under the European Union Joule II Programme, suggest that energy efficiency improvements could result in a reduction of CO_2 emissions of 105 Mtonnes CO_2 in 2010 compared to a business-as usual-scenario.

Conclusions

A common European LTA, constructed according to the guidelines of the proposed by the European Commission may a suitable instrument to improve the energy efficiency of industrial processes to meet at least the economic potential. In the industrial sector the LTA could be a cost-effective solution, where industry will gain considerable economic benefits and Member States could achieve substantial reductions of CO_2 emissions. Accordingly, Member States in designing policy measures to improve energy efficiency in the industry sector should consider the use of the LTA as a viable policy instrument and evaluate its effectiveness in achieving the efficiency targets.

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(9) The assumptions is on the conservative side. It is based on the Dutch experience of an average target of the 2% efficiency improvement per year. Recently the European Chemical Sector Association (CEFIC) offered a voluntary commitment of 20% efficiency improvement in the period 1990 to 2005. Moreover the BaU scenario is estimated to have an energy efficiency improvements of about 1% per annum.

(10) In these two sectors the LTA approach shall complement other policy measures such as minimum efficiency standards (for appliances and buildings) and technology procurement. Therefore the single contribution of LTAs to efficiency improvements would be difficult to assess.

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