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VOLUNTARY AGREEMENTS - IMPLEMENTATION AND EFFICIENCY

The French Country Study:
Case studies in the sectors of Packaging Glass and Aluminium

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March 2000

Preface

This study analyses the French experience with voluntary agreements for the reduction of industrial carbon dioxide emissions. The case studies cover the sectors of packaging glass and aluminium. It is one of several reports from the project Voluntary Agreements, Implementation and Efficiency (VAIE) (more information is provided below in Contents of the VAIE project).

The VAIE project studies the conditions under which voluntary agreements (VAs) can be expected to achieve environmental targets in an efficient way. This has been carried out through developing models 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-à-vis member states regarding execution of voluntary agreements in member states and on EU level.

The Project began in February 1998 and ends by February 2000. Five Institutions co-operate in the project: AKF (Institute for Local Government Studies) from Denmark, Wuppertal Institute from Germany, Utrecht University from the Netherlands, Lund University from Sweden and CERNA (Ecole des Mines de Paris) from France.

The VAIE project is supported by DGXII, Science, Research and Development, through the Joule Programme (Contract No JOS3-CT97-0021). Several national institutions have also supported the project. CERNA's research for this project is also financed by the French Environment and Energy Agency (ADEME). The views expressed in this report are the author's only.

Paris, March 2000

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EXECUTIVE SUMMARY

This study analyses the French experience with voluntary agreements (VAs) for the reduction of industrial CO₂ emissions. It follows the common VAIE Project guidelines with regard to its focus, terminology, analytical framework and assessment criteria (Kraemer & Hansen, 1999). It aims at covering the whole policymaking process (i.e. policy formulation, negotiation and implementation). Three relevant policymaking levels are identified: i) the agreement scheme (AS), setting the policy framework for concluding VAs at branch or firm level, ii) the VAs signed at firm or branch level and iii) the energy conservation projects (ECPs) implemented at firm level, contributing to the achievement of VA objectives. Particular focus is given to the two latter levels (VAs and ECPs) in order to highlight VA effects on firms behaviour and on the relations between the firms and the relevant government bodies.

Two case studies are reported: the VA signed by Pechiney (the main aluminium producer in Europe) and the one signed by the packaging glass industry. Their selection had two main motivations. Firstly, to allow for the comparability among many VAIE case studies for at least one sector (the glass industry). Secondly, capturing the diversity of French VAs for CO₂ emissions reduction, which required to study in addition a firm-level VA.

Context

The French agreement scheme was designed in the framework of Rio (1992) commitments, aimed at stabilising CO₂ emissions at their 1990 level by the year 2000. After approval by Parliament, the French government ratified this commitment in 1994, submitted the first national communication to the UNFCCC and launched the National Programme for the Prevention of Climate Change in February 1995. This programme set the broad policy approaches for different economic activities and it specified that for energy-intensive industry branches a tax approach would be discarded. Instead, a consensus and dialogue approach would be adopted, aiming at the signature of voluntary agreements at firm or branch level. Therefore, the AS mainly aimed at limiting competitive effects of policies to curb CO₂ emissions, in particular for energy-intensive industries.

Relevant actors

The negotiation phase involved mainly the Ministry for the Environment (ME) the energy-intensive industries participating in the energy commission at the 'umbrella' business association (the CNPF),

some Industry Associations (IAs) and the largest energy-intensive firms. Although some representatives from the Ministry for Industry (MI) and the French Environment and Energy Agency (ADEME) joined in the talks, with ADEME as ME's technical advisor, the leading role was kept by the ME not only in negotiations but also in concluding and following-up the VAs signed by individual firms or industry branches.

It is worth noting that neither the Senate nor the National Assembly were involved in the design of the National Programme (and nor were environmental NGOs, endorsing a carbon tax). Nevertheless, a Parliamentary debate on the environmental and economic stakes involved in energy policy was undertaken in November 1994. It was based on a report surveying the concerns of different stakeholders on GHG policies. This procedure comes close to the traditional form of environmental policymaking in France (where laws passed by the Parliament only set general guidelines which are then translated into precise policy targets and instruments and implemented by the ME).

VA negotiation

VA negotiations started under no clear threat of a fall-back policy instrument in the event of negotiation failure. The French government had stated in a memorandum to the European Commission (21 March 1994) that the use of taxation towards industrial use of fossil fuels was ruled out in view of delocalisation risks (and their potential adverse effects for employment). Nevertheless, despite the failure of the 1992 project for an European carbon tax, many feared that an energy tax debate would be put on the European agenda once again, which was actually the case since 1997 with the ongoing European Parliament debate on the restructuring of the community framework for the taxation of energy products.

After a first scanning of industry views, a standard VA procedure and text were set at the relevant technical level of the ME (i.e. SEI, *Service de l'Environnement Industriel*).

The standard VA procedure involved: i) information on past CO₂ emissions (1990-1994) to be provided by industry; ii) discussion of feasible energy saving or substitution measures; iii) quantitative objectives for CO₂ emissions reduction, set in specific terms (i.e. per unit of production) and, whenever possible, in absolute terms for the period 1990-2000.

The VA text included reference to: i) the policy context and a quote from the French memorandum of March 1994 (stating that no carbon taxation would be applied towards industry in view of Rio commitments); ii) the information on emissions evolution, energy saving or emissions reduction

measures and goals indicated above (nevertheless, VA commitments concerned quantitative objectives rather than specific technologies to be adopted); iii) a regular reporting procedure on progress as regards emissions evolution and implementation of reduction measures was to be clearly stated. It is worth noting that no sanctions and no third party monitoring provisions were included.

Although it was originally envisaged that most agreements would be concluded in 1995, the VA negotiation phase took longer than expected. The first VA was signed in May 1996 and the last one in February 1997. As some interviewees acknowledged, most agreements were finally concluded hastily by the political level at the ME without sticking to the standard VA procedure.

A total of 7 VAs have been concluded for CO₂ reduction. Five of them involve industry GHG emissions: signed by the aluminium (May 1996), steel (December 1996), fat and magnesia lime (July 1996), cement (October 1996) and packaging glass (February 1997) sectors. In addition, two VAs related to transport GHG emissions were concluded: one -product-related VA on car CO₂ emissions- was signed by the automobile industry (Peugeot/Citroën and Renault in the framework of a European level VA) in September 1996, and another one was signed by 3 Suisses, a direct marketing firm, concerning CO₂ emissions from goods transport and delivery (October 1996). Differences in industry and government views and low incentives for VA participation probably explain that many negotiations were unsuccessful. For example, the flat glass industry expected mandatory double-glazing to be included in building regulations which was not granted, and the chemical industry found VA guarantees of an eventual European carbon tax insufficient. In addition, negotiations with the paper, sugar, dairy products, plaster and foundry industries were stalled.

A 1993 study by ADEME/CEREN provided an indication of the energy savings potential in the industries which later on concluded a VA (they covered at most 40% of industrial energy consumption) and showed that the involved sectors showed in 1990 considerable potential for energy savings (at relatively low costs) as compared to industry average and some other energy intensive branches. During VA negotiations, it provided a starting point to the debate on branch-level technical means for energy efficiency improvement, and eventually on best available technologies. Nevertheless, it didn't provide standards against which industry's proposals would be checked.

Motivations for VA participation

Despite a general consensus regarding the potential delocalisation effects of a carbon tax shared by the ME and MI, different views were held at the ME regarding VAs. On the one hand, the political

level preferred VAs due to their consensus-based approach. On the other hand, the technical level was reluctant to adopt VAs, firstly, due to their dependence on industry information and proposals, and secondly due to the difficulties to enforce them under the French Constitution. The final result from the negotiations was apparently that the ME mostly accepted industry self-designed commitments (mainly based on investments and technical improvements largely planned since the late 1980s), but in the negotiation process, information gathering and exchange was quite important and led to some ME learning on industry's situation concerning CO₂ emissions.

As regards the industry perspective, the two case studies indicate that image considerations were nearly as important an incentive for VA participation as the carbon tax exemption. In the packaging glass case, the VA was seen as providing marketing advantages in a context of aggressive campaigns by competing packaging sectors on environmental grounds in the early 1990s. In addition, industry was in a good position to conclude a multi-issue VA showing environmental progress in many fronts (recycling, NO_x abatement, a dramatic reduction in liquid effluents, etc.) and a reduction of absolute CO₂ emissions appeared feasible in view of the restructuring and environmental management efforts under way. An additional driver for participation was provided by ongoing negotiations on air emissions standards. As regards evidence from the aluminium case, a VA on GHG emissions also seemed quite important for Pechiney due to image considerations. In particular, CF₄ emissions had created a bad international image for the aluminium industry and an international pledge to reduce them was initiated. In addition, in view of the restructuring process in the 1990s it was also timely to commit to emissions reductions, since only small changes could be expected over the period 2000-2010.

VAs vs. traditional policymaking

So far, no specific regulations concern CO₂ emissions. A 1977 regulation imposed mandatory energy audits but its relevance was minor in the early 1990s due to low compliance (it was finally scrapped in 1998). In parallel, energy efficiency and conservation programmes and information and training campaigns are run by ADEME, set up in 1991, bringing together the old agencies for energy conservation, the agency for management of waste and the agency for air quality.

The SEI (the concerned body at the ME, traditionally in charge of environmental policymaking towards industry) became the relevant actor on the public side to discuss CO₂ reductions. In contrast, ADEME, traditionally active in energy efficiency promotion had in general a minor participation in VA negotiation and formulation. As a matter of fact, the areas of competence of ADEME and the SEI remained separate, which indicates a lack of co-ordination in policies towards the related goals

of GHG abatement and energy efficiency promotion, in the sense of little transfer of information and lack of «carrot-like» incentives to improve energy efficiency under the VAs for CO₂ reduction.

Policy Perspectives

Under the Kyoto commitments (in particular, under the internal burden-sharing agreement for the European «bubble») France is expected to maintain its average GHG emissions at their 1990 levels over the period 2008-2012. Although government officials don't see much challenge in keeping Rio commitments, they find it far more difficult to comply with the Kyoto-related objectives.

The new National Programme for the Prevention of Climate Change (issued in January 2000) has not completely defined the full policy-mix towards Kyoto commitments, but it has already specified that it will include an energy tax towards industry (starting at 150F/ton -23 EURO/ton- CO₂ in 2001 and reaching 500F/ton -76 EURO- in 2010). Also, being this move highly controversial due to its negative distributive effects within industry, energy-intensive industries will be either exempted or granted a tax reduction. The new programme defines neither the industries which will benefit from the exemptions, nor the mechanisms through which these exemptions would be granted. In this last regard, it opens the door for both VAs and (grandfathered) tradeable permits (in order to guarantee a ceiling on absolute GHG emissions). For its part, industry is proposing a policy-mix including an emissions quota (set through VAs) and credits for early action (to be used as tradeable permits once the international GHG permit market is established).

The packaging glass case study

The agreement signed in February 1997 concerns most aspects of environmental management: solid waste, liquid effluents and air emissions (CO₂, SO_x, NO_x, particles) over the period 1990-2005. It also includes firms' commitment to obtain ISO 14001 certification by 2002. It was signed by the container glass IA (CSVMF) and the ME. Overall, 8 firms (and 21 production sites) are covered by the agreement.

As regards the CO₂ reduction objectives, a 10% reduction in absolute emissions (given a hypothesis of 13% increase in production) and a 27% reduction in specific emissions were committed for the period 1990-2005. The VA text includes some indication of the technical means for achieving CO₂ emission reductions: a) Recycling and lighter bottles -the particular way of measuring specific

emissions adopted (gCO₂ per hl content of glass containers) indicate a considerable reliance on these improvements to achieve VA objectives-, b) energy savings, through the replacement of old furnaces and the technical improvement of modern ones, c) rational use of different energy sources: namely, increasing the use of dual energy systems and increasing the natural gas share in the fuel-mix.

Negotiations over CO₂ reductions were framed by those initiated after a 1993 regulation specifying stringent air pollution standards. Industry was in particular pushing for a reduction of the tight limits set for particle emissions, which couldn't be met with available technologies at a reasonable cost. In return, industry was prepared to increase their NO_x abatement over and above the 1993 regulation standards. In this context, the ME introduced CO₂ concerns to the negotiations, and asked for a 10% reduction in absolute emissions which seemed feasible in the framework of the packaging glass industry restructuration.

Reporting of progress towards VA objectives basically relies on industry's self-reporting to the ME. Although it was planned that each site would create in co-operation with the ME annual reports on their environmental management which would start at the beginning of 1998, this requirement has not been fulfilled to date.

Evidence of VA impact stresses the synergy between the actions to achieve the VA objectives concerning CO₂ reduction and other developments (such as restructuring and investment efforts, negotiations over environmental regulations concerning air emissions, ISO 14000 certification, etc.). Nevertheless, it also appears that the VA played only a minor role as compared to other motives for improving energy efficiency, and most CO₂ reductions stem from activities undertaken to achieve other goals (cost reduction, modernisation, compliance with other environmental regulations or other VA goals, etc.). Similarly, the VA didn't lead to a change in firms' energy management practice nor its organisation. These organisational aspects don't seem to have changed much over the last few years, partly because energy management has always been a core issue for the sector. The only exceptions are given by a higher priority of energy issues since the early 1990s (due to the threat of a carbon tax) and the organisational change brought about by ISO 14001 certification, major investment programmes and cost reducing efforts. In this context, the VA didn't pose additional challenges or efforts, but seems to play a role in making both firms and the IA measure CO₂ emissions, which is not spurred by other firms initiatives.

As regards progress towards the CO₂ goals, the industry is confident to keep its specific emissions objective. Nevertheless, some problems may be encountered to comply with the absolute emissions

objective due to higher than expected production levels (at the time the VA was signed a 8% increase in production was predicted for the period 1990-99, while the actual production increase amounted to 16% for the period 1990-98).

The aluminium case study

The VA signed in May 1996 by ME and Pechiney (the main French and European producer of primary aluminium and aluminium products) only concerns GHGs, focusing on CO₂ and CF₄ emissions reductions and specific energy consumption for the period 1990-2000. The agreement covers Pechiney's production of alumina (basic raw material), and both primary and secondary aluminium production, and concerns 8 production sites

The VA targets refer to the period 1990-2000 and they were set for absolute and specific emissions: for absolute CO₂ emissions an increase of 2% was set as objective, while for specific emissions, a reduction of 19% was committed. As regards CF₄ emissions, stemming from (primary) electrolytic aluminium production, the committed reductions for absolute and specific emissions were, respectively, 63% and 73%. To summarise the VA expected effects regarding GHGs, CF₄ emissions are translated into tons of CO₂ equivalent, yielding an overall reduction of the firm's «potential for global warming » of 33%.

Negotiation: The group-level Energy Director (who usually negotiates energy supply conditions) was in charge of negotiating the with the ME (SEI). The agreement was originally aimed at energy consumption and then turned into a GHG emissions agreement. Apparently, no real negotiations were involved. The firm conducted an energy audit and analysed the possibilities for improving energy efficiency and GHG emissions and set a BaU objective for the year 2000, which was proposed to and accepted by the ME. The trade-off involved was that the firm would considerably reduce specific emissions but slightly increase absolute emissions of CO₂.

Evidence on VA impact: The following actions undertaken to achieve energy efficiency improvements and CO₂ reduction were identified: 1) heavy investments (mainly concentrated in technical improvements of the electrolysis process), 2) small improvements in energy efficiency (due to better metering equipment and performance of burner jets, process optimisation in primary production and in remelting processes and increase of production capacity -which reduces specific emissions-) and 3) training programmes.

Most of these initiatives appear to be very closely related to developments other than the VA, as the early 1990s was a period of deep restructuring for the company (technology updating, the opening of new plants and the shut-down of the ones with poor productivity). Furthermore, in parallel to the VA negotiation Pechiney was launching a cost-reduction initiative, called the Challenge Programme.

Image considerations also played a role: the investments towards the reduction of GHG emissions were not only spurred by technology updating and cost reduction (lower CF₄ emissions also meant lower energy loss and hence amounted to cutting energy costs) but also by the international pledge by the aluminium industry to reduce CF₄ emissions.

Nevertheless, it is important to note that the investment phase was well under way by the time the agreement was signed and hence most of the specific emissions objectives were nearly achieved by then.

Overall, the VA meant no additional pressure as regards the firm's practice on energy and raw material consumption: in general the efforts linked to either the cost-reduction programme or to modernisation were enough to attain VA objectives (probably save for the CF₄ reduction objectives). Therefore, most efforts were undertaken due to their economic return, which is consistent with the interpretation of VA objectives as being no more than BaU. To some extent, environmental benefits have been considered by the firm as « zero cost benefits » derived from investments worth undertaking due to their economic return.

Given that modernisation and technology acquisition was important over the period 1990-2000, only small changes at the margin could be expected for the period 2000-2010. In this industry it is apparently very difficult to drastically reduce energy consumption without a major technological improvement. Furthermore the firm expects production levels to remain nearly constant towards 2010.

From the 1997 progress report issued by Pechiney, it is clear that most of the objectives have already been achieved (in particular specific emissions reduction of CO₂ and CF₄ of 19% and 73%). Nevertheless, the attainment of absolute emissions objectives remains highly uncertain. In 1997, absolute CF₄ emissions were in line with the VA objectives, and overall emissions were lower than the VA predictions. This was due to an unexpectedly low aluminium production (which resulted in an overall GHG reduction of 40% from 1990 levels). New production forecasts for 2000 suggest that the absolute emissions commitments won't be kept and that CO₂ emissions will be higher than originally expected in the VA.

Main results and concluding remarks

The French VAs for industrial CO₂ emissions reduction were mainly motivated by political

considerations regarding the distributive and delocalisation effects of a carbon tax. Overall, VA policymaking didn't imply a major departure from traditional policymaking regarding neither interest group and parliamentary involvement nor the logic of previous energy policy towards industry.

As regards VA impact, it is important to discriminate between VA *target ambitiousness* and *target achievement*. Regarding the former, VA objectives appear quite modest as they mostly comprise CO₂ emissions reductions economically interesting to firms (which appears to be very close to business-as-usual performance). In order to understand this outcome, it is important to underline many hindering factors. Firstly, the lack of co-ordination between the Ministry for the Environment (in charge of VA negotiation and GHG policy) and the Environment and Energy Agency (in charge of energy efficiency promotion) limited the potential for synergy in a well-articulated policy-mix. Secondly, the internal conflicts at the Ministry for the Environment (where only top officials were in favour of the VA approach), jeopardised VA design. Thirdly, firms faced no clear threat of alternative instruments of GHG policy, as a national carbon tax had been discarded as a policy option by the time the VAs were negotiated (only a somewhat vague threat remained in terms of an eventual European carbon tax).

Even if close to business-as-usual, the quantitative reductions involved in the two studied VAs appear quite impressive. This is mostly explained by the ongoing restructuring and investment efforts in these industries (which suggests that the timing for VA negotiation was good for the achievement of substantive specific emissions reductions).

As regards VA target achievement, it appears that, in spite of the lack of enforcement or sanction mechanisms, most industry branches appear to keep their VA commitments regarding specific emissions. Furthermore, the packaging glass case shows that even if the VA objectives for specific emissions were close to BaU ex-ante, they turned out to imply some additional efforts by the firms ex-post, in view of the low energy prices of the late 1990s. In contrast, the two case studies suggest that absolute emissions commitments are unlikely to be kept if production levels turn out to be higher than expected. From this perspective, the VAs may have provided some sort of an insurance to guarantee minimum improvements on specific emissions, but not so much for absolute emissions.

Finally, as regards VA impact on firms' energy practice, our case studies couldn't identify energy efficiency improvements (or CO₂ reduction efforts) which were mainly fostered by the VAs. Keeping in mind that VA objectives did not require much effort over and above what appeared profitable to firms, other drivers gained higher priority (concerns spurred by environmental regulations,

restructuring and cost-cutting efforts, etc.).

I. INTRODUCTION

This study analyses the French experience with voluntary agreements (VAs) for the reduction of industrial CO₂ emissions, according to the common guidelines of the VAIE project with regard to its focus, terminology, analytical framework and assessment criteria (Kraemer & Hansen, 1999). It covers the whole VA policymaking process (policy formulation, negotiation and implementation) for which three relevant levels are identified: i) the agreement scheme (AS), setting the policy framework for concluding branch-or firm-level VAs; ii) the VAs signed at firm or branch level and iii) the energy conservation projects (ECPs) implemented at firm level, and contributing to the achievement of VA objectives. The analysis focuses particularly on the last two levels to better understand what difference VAs make as policy instruments, and their effects on firms behaviour and on the relations between the relevant actors. To this aim, two case studies are reported: the VAs signed by Pechiney (the main aluminium producer in France) and the packaging glass industry. They were selected in order to study one of the common sectors as set in the VAIE guidelines to guarantee comparability of the case studies (the glass industry), and also to capture the diversity of French VAs for CO₂ emissions reduction, which required to study in addition a firm-level VA.

A number of representatives from government, research bodies and industry were interviewed during the field work. Their willingness to participate is gratefully acknowledged. Evidence from three firms was gathered: Pechiney (the first European and fourth world-wide producer of basic aluminium), Saint Gobain (SG) (the packaging glass sector leader, a highly diversified firm participating in all segments of the glass industry) and Tourres et Cie, the third firm in the packaging glass sub-sector (a specialised medium-sized enterprise). Access to quantitative data has proved very difficult and, due to a high personnel turnover, so it was to contact representatives from firms and government involved in VA negotiation or implementation (with only a few exceptions). For these reasons, most of the information on historical developments and VA performance rely on available documents and our account of the interviewees appreciations. In this last regard, the usual disclaimer applies.

The report follows with the context, formulation and characteristics of the policy framework for the use of voluntary agreements for CO₂ reduction (chapter II). Subsequently, the two case studies are presented, where the negotiation, formulation and implementation of the VAs concluded by the packaging glass and aluminium sectors are covered (chapter III). Chapter IV presents a qualitative assessment of the French experience with VAs for industrial CO₂ reduction and chapter V concludes. Appendix 1 contains the acronyms used throughout the report, Appendix 2 the list of interviewees

and Appendix 3 the assessment of the case studies and the French agreement scheme according to the VAIE criteria (Kraemer & Hansen, 1999).

II. THE AGREEMENT SCHEME

a. Context

France signed the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. This implied a commitment to stabilise CO₂ emissions at 1990 levels by 2000, which was ratified after approval by the Parliament, on 25 March 1994. In this context, the government submitted the first national communication to the UNFCCC and launched the National Programme for the Prevention of Climate Change in February 1995. This programme may be seen as setting the agreement scheme (AS) as among the policy approaches directed at different economic activities, it specified that for energy-intensive industry branches, a consensus and dialogue approach would be followed.

b. The Policymaking and implementation process

Policy formulation

The policy formulation phase may be assimilated to the process leading to the National Programme for the Prevention of Climate Change, which set the basis for agreements as the policy approach to be adopted.

The National Programme specified that although the use of an energy tax would not be rejected for transport, residential, services, and non-energy-intensive industries, France wouldn't adopt a tax approach for energy use in production by energy-intensive industries (nevertheless such an approach could be used for non-productive energy use by industry). For energy-intensive industry branches, voluntary agreements for CO₂ emissions reduction would be promoted either on a branch-by-branch basis or at the firm level.

Not even the threat of an European carbon or energy tax to French industry was apparent, after the « French memorandum on tax approaches to the prevention of greenhouse effect » issued on 21 March 1994 by the government and presented to the European Commission. It ruled out the use of

taxation towards industrial use of fossil fuels, in view of delocalisation risks (and its adverse effects concerning employment). Nevertheless, there remained some uncertainty in this regard, as many feared that, despite the failure of the 1992 project for an European carbon tax, an energy tax debate would be put on the European agenda once again. This was actually the case since 1997 with the European Parliament debate on the restructuration of the community framework for the taxation of energy products.

The National Programme was the result of a long debate on policy instruments for CO₂ reduction that since the early 1990s had focused on the potential competitive impact of a CO₂ tax and an analysis of policy alternatives. It was informed by a series of studies financed by the Ministry for the Environment (ME), the National Agency for the Environment and Energy Management (ADEME) and also the inter-ministerial task-force on the Greenhouse Effect (MIES), which acts since the early 1990s as advisor to the Prime Minister on these issues.

It is worth noting that neither the Senate nor the National Assembly were involved in the design of the National Programme. Similarly, environmental groups (endorsing a carbon tax approach) were excluded from VA policymaking debate. Nevertheless, it is worth pointing out that in November 1994, before the National Programme was issued, a Parliamentary debate was launched by the government on the more general topic of the environmental and economic stakes involved in energy policy. This provided the government with a clear idea of the concerns of different stakeholders on GHG policies. This procedure comes close to the traditional form of environmental policymaking in France (where laws passed by the Parliament only set general guidelines which are then translated into precise policy targets and instruments and implemented by the ME). This probably explains the lack of criticism of environmental groups and Parliament exclusion from the VA process. In addition, although climate change is an important issue in NGO activities, policies towards industry in this domain doesn't seem to concentrate their campaigning efforts.

Negotiation

The negotiation phase mainly involved the talks held by the ME with energy-intensive industries gathered in the energy commission at the 'umbrella' business association, the CNPF, some individual Industry Associations (IAs) and the largest energy-intensive firms. By 1995 some Ministry for Industry (MI) and ADEME representatives participated in the talks, with ADEME as technical advisor to the ME.

During negotiations, there was a considerable contrast in the views of the public sector and industry, and within industry itself. On the ME side, given the decision to use VAs as instrument, the objective was to make sure that precise goals in terms of reductions were set. That's probably the reason why, after a first scanning of industry views, the relevant «technical level» at the ME -the SEI (*Service de l'Environnement Industriel*)- set a standard VA procedure and text to be adopted (which will be dealt with below as the framework for the implementation phase).

On the industry side, despite a generalised willingness to participate in the dialogue, different perspectives appeared to be held by CNPF members. Firstly, some were reluctant either because they considered that industry had already shown a commitment to high energy-efficiency standards by their past investments, and thus they saw no need to sign a contract, or because further incentives were necessary for these sectors to participate (glass, paper, diary producers and the chemical industry). Secondly, some members found it in their interest to show their past progress and future commitments in energy-efficiency improvements (e.g. cement, lime and aluminium). Finally, industries participating in European-level IAs, e.g. UNICE (the umbrella IA at EU level), EURELECTRIC (European union of electricity producers), CEFIC (chemical European IA), were highly interested in the VA approach which appeared quite widespread in Europe, and further proposed the adoption of a common framework or even harmonisation of VA commitments at European level in order to level the playing field towards an environmental goal which was to a large extent negotiated at European level (Hellot, 1995).

Implementation

As mentioned above, after a first round of negotiations a standard VA procedure set the framework for the negotiation and signature of VAs, summarised in Box 1 below.

Some issues in the standard VA procedure and text are worth discussing. Firstly, as regards the information provision on energy saving measures and emissions, the SEI guidelines promoted the use of available inventories carried out by ADEME and associated research institutes. Nevertheless, industry estimates were also to be accepted to this aim, provided the methodology for estimation was made explicit and GIEC conversion factors for CO₂ from different energy sources (provided by SEI) was used. Secondly, as regards the discussions on the means to achieve the committed emissions reduction, priority was given to efforts specifically aimed at CO₂ reduction rather than fuel switching (due to the possibility of this leading to increases in natural gas prices) and reductions in electricity

consumption (due to the pre-eminence of nuclear power in electricity supply).

BOX 1: The standard VA procedure and text

The standard VA procedure involved an exchange of information between the concerned government bodies and industry, and a common time-frame and commitment specification:

- i) information on past emissions: background information on energy consumption and CO₂ emissions between 1990-1994 to be provided by industry;
- ii) discussion of feasible energy saving or substitution measures;
- iii) quantitative objectives: CO₂ emissions reductions should be set in specific terms (i.e., per unit of production) and, whenever possible, in absolute terms for the period 1990-2000.

Also a standard VA text was defined indicating:

- a) the policy context to the signature of the VA (i.e., Rio 1992 commitments) and a quote from the French memorandum of 21 March 1994, stating that no carbon taxation would be applied towards industry in view of Rio commitments, in order to avoid undesirable delocalisation effects was included.
- b) the information on emissions evolution, energy saving or emissions reduction measures and goals indicated above (nevertheless, VA commitments concerned quantitative objectives rather than specific technologies to be adopted)
- c) a regular reporting procedure on progress as regards emissions evolution and implementation of reduction measures was to be clearly stated.

It is worth noting that no sanctions and no third party monitoring provisions were included.

Source: Hellot (1995) and SEI (1994)

Thirdly, although the effects of structural change and of increased recycling (to be fostered through the agreements) would be taken into account, no particular interest was given to discuss and promote CO₂ reductions in non-core processes (such as lighting, heating, etc.). Finally, the lack of sanctions in the VA text is hardly surprising. Under the French constitution, VA contracts are in principle non-enforceable, as government is unable to sign contracts on issues covered by policymaking (which would mean unbalanced powers of the two parties to the contract). The only French VAs which found a way out of this enforcement limitation are those where -previous to the signature of a VA- a regulation set a fall-back policy instrument or regulation in case VA objectives were not met (e.g. the end-of-life car and packaging recycling schemes) (Börkey and Glachant, 1997, 1998).

After presentation of the standard VA procedure and text, dialogue continued on a branch-by-branch basis between the ME and industry, in order to gather the necessary information on past emissions, to discuss feasible measures and to set specific commitments and conditions to be included in the VA.

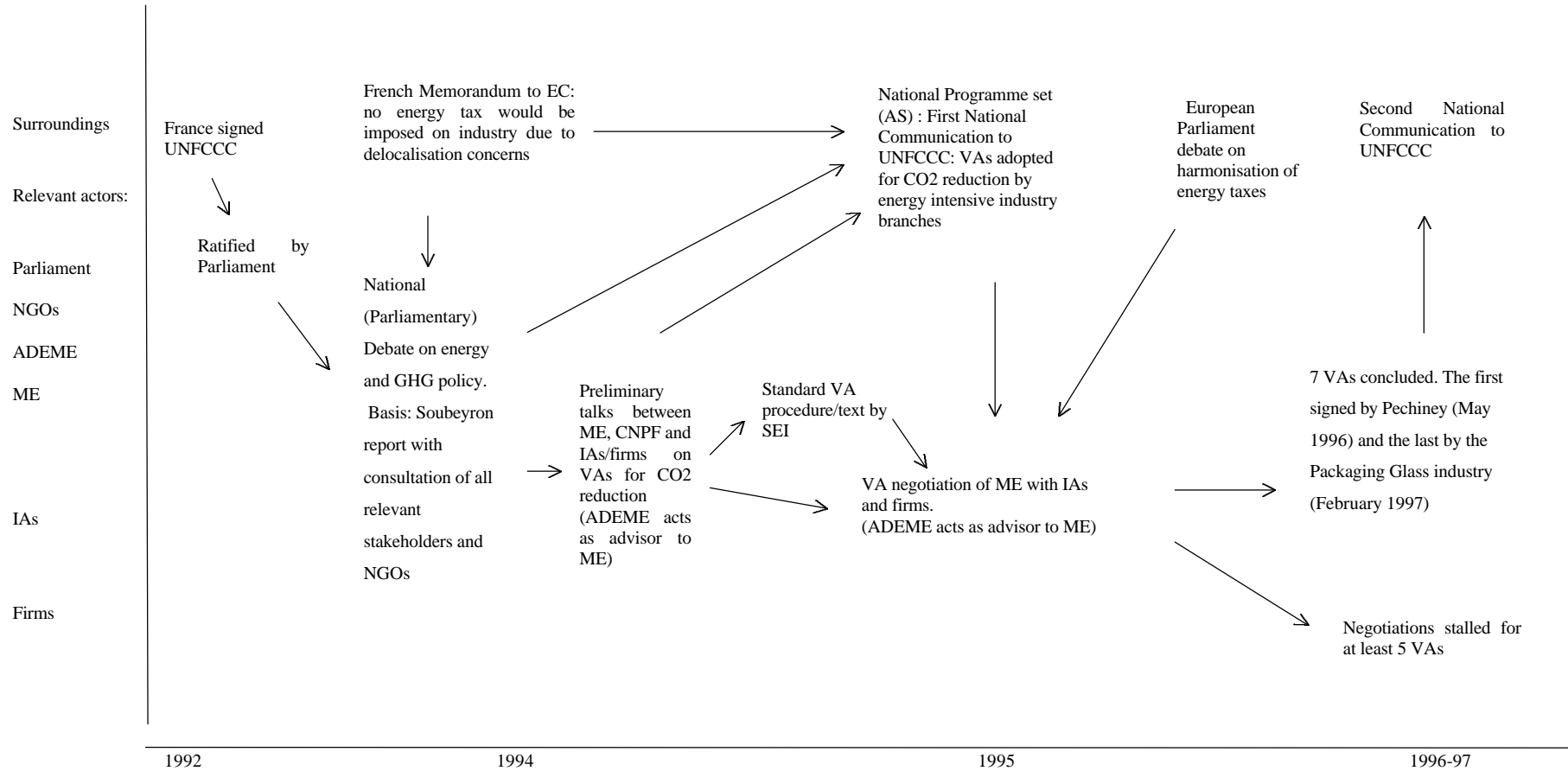
Although it was originally envisaged that most agreements would be concluded by the end of 1995, the first one was signed in 1996. This means that the VA negotiation phase took longer than expected, which probably explains that most agreements were finally concluded in a rush, as acknowledged by some interviewees, by the political level at the ME without necessarily fulfilling all the requirements set by the standard VA procedure.

Under the AS, a total of 7 VAs have been concluded. Five involved industry GHG emissions, concluded with the aluminium (May 1996), steel (December 1996), fat and magnesia lime (July 1996), cement (October 1996) and packaging glass (February 1997) sectors. In addition, two VAs related to transport GHG emissions were concluded: one -product-related VA on car CO₂ emissions- was signed by the automobile industry (Peugeot/Citroën and Renault in the framework of a European level VA) in September 1996, and another one was signed by 3 Suisses, a direct marketing firm, concerning CO₂ emissions from goods transport and delivery (October 1996).

Arguably, the differences in industry and government views and low private incentives for VA participation may help explain why many negotiations were unsuccessful. At an early stage, the full glass industry (the main sub-sectors being those of flat glass and packaging glass), the chlorine-soda (Rhône-Poulenc and Atochem), paper and pulp, dairy and sugar producers and foundries were involved in negotiations. For instance, the chemical industry required a guarantee that a carbon tax would not be applied at the European level, which could not be granted by the French government. Similarly, the flat glass industry did not conclude a CO₂ VA. As an incentive for participation, this industry branch expected in return a new regulation on buildings imposing double-glazing. Nevertheless, the government body in charge of the issue (the Ministry of Housing) was reluctant to pass this regulation since it would imply higher housing costs. In the packaging glass case, the necessary additional incentive was provided by parallel negotiations aiming at adapting the new air pollution regulations to industry possibilities.

Summing up all the above, Figure 1 below, describes the AS policymaking and implementation process.

Figure 1 The AS policymaking and implementation process



c. Information availability

A techno-economic study conducted by ADEME/CEREN (1992) aimed at identifying industry energy savings potential on a branch by branch basis¹. This potential was calculated for specific processes as the difference between actual average energy consumption per operation and the best observed performance (best technique) in 1990.

Even though the availability of such a study may suggest that the ME had good information at the time of VA negotiations to assess energy efficiency improvements proposed by industry, it should be stressed that the results of the study were highly controversial. According to different sources, this was the case since the study was no longer up to date (it referred to 1990 data and VA negotiations took place in 1995) and the validity of the results (on profitability and applicability of individual technologies) had never been discussed with industry. All in all, it provided a starting point to the debate on branch-level technical solutions to improve energy efficiency, and eventually to discuss BATNEEC information, but it didn't provide standards against which industry's proposed energy efficiency improvements could be checked.

As regards the information and evaluation provisions, it should be stressed that VA reporting didn't really involve active participation of government officials. Rather it consisted of industry self-reporting to the SEI (ME). This didn't demand much effort from the public side: a maximum of three SEI officials have been involved (part-time) in following up the VAs. On the private side, one person per firm has been in charge of gathering the necessary information from the different relevant levels at the company, and one person at the industry association has collected and elaborated information from companies in order to prepare the branch-level report to the SEI. From the evidence gathered in the case studies, reports appear to be quite detailed as regards performance and undertaken measures. Nevertheless, it is difficult to assess to what extent this sort of reporting leads to learning on the public side. The global VA evaluation undertaken by the ME through a consultancy firm last year was not available.

¹ This study identified and analysed the scope for energy savings in 23 industry branches. It covered 188 techniques (11 core-processes, specific to the industry branch involved, and 7 non-core processes common to most branches). Industry energy consumption information was provided by the 1990 edition of EACEI (the annual survey on industry energy consumption) conducted by the Ministry for Industry and Agriculture, and specific surveys conducted by CEREN. In addition, for most techniques the cost per tep saved was obtained, and for the period 1990-2005, a trend of technology adoption was calculated. Nevertheless these projections should be taken with caution as the methodology is not completely clear as regards neither the role of energy and technology price evolution nor sectoral growth predictions. A low growth and low energy prices scenario was considered for 2005, which yielded a high estimate of savings for the 1990-2005 period: 45% of the total 1990 savings potential.

The ADEME/CEREN study provides an indication of the energy savings potential of the industries finally covered by VAs (see table 1 below). Taking somewhat aggregate definitions of each sector, they amounted to 40% of industry energy consumption, showed considerable potential savings as compared to industry average and also other energy intensive branches (like paper and steel) and also relatively low costs.

Table 1 Overall energy savings potential (ktep)

Industry	1990 energy consumption	1990 energy savings potential	% savings potential	% of total energy consumption	Average cost (index, per tep saved)
Steel	9656	1394	14	19	66
Aluminium, Cement, Plaster and Lime	5756	1614	28	11	83
Glass*	1594	206	13	3	99
Paper*	3390	291	9	7	77
Chemical	10243	1198	12	20	146
Total	50314	9401	19	100	100

* Energy savings potential refers only to core-processes

Source: ADEME/CEREN (1992)

d. VAs and actors relations

As regards the motivations for the adoption of VAs, it is worth mentioning that different views were held at the ME. The political level wanted to avoid adopting a CO₂ standard or a tax in a conflictive situation with industry, and therefore, VAs were preferred basically because the approach would be consensus-based. Nevertheless, the technical level was against VAs due to the limited enforcement possibilities. Also, given the tone of negotiations, and the dependence of ME on industry information and proposals, VAs could only belong to two types: unilateral commitments by industry or industry commitments with public « approval ». Officials at the SEI consider that the VAs signed belong in general to this second group, i.e. industry adopted self-designed commitments (based on investments and technical improvements largely planned since the late 1980s) and the ME simply approved them.

Nevertheless, SEI officials stressed that information gathering was quite important at the time in

order to learn about industry's situation concerning CO₂ and energy and the VA contributed to this, by providing data on developments in energy intensive industries for the period 1990-1995, and industry's plans for 1995-2000.

As regards the industry motivations, it seems worth advancing some evidence from the case studies. For the packaging glass industry, the main interest of VA participation was to obtain marketing advantages. This was particularly true in a context of aggressive marketing campaigns by competing packaging materials on environmental grounds in the early 1990s: their main competitor was aluminium, with its lower weight advantages. In addition, industry was in a good position to face a multi-issue VA showing environmental progress in many fronts: they had committed ambitious recycling objectives, could overcomply regarding NO_x and besides they could show an absolute reduction of CO₂ emissions. Another important driver for VA participation was given by ongoing negotiations on other environmental standards (see chapter III below). As regards evidence from the aluminium case, Pechiney considered it important to sign the VA on GHG emissions for image considerations, in particular as regards their CF₄ emissions which create a bad international image for the aluminium industry. In addition, due to the restructuring process in the 1990s it was also timely to commit to emissions reductions, since only small changes could be expected over the period 2000-2010 (see chapter IV below).

e. VAs vs. traditional policymaking

It was initially envisaged that AS and VA negotiations would be focused on energy efficiency goals but finally VA objectives were mainly set for CO₂ emissions. This meant that the SEI (the concerned body at the ME, traditionally in charge of environmental policymaking towards industry) became the relevant actor on the public side to discuss GHG reduction. In contrast, ADEME, the traditional actor in energy efficiency promotion had in general a minor participation in VA negotiation and formulation. As a result, the areas of competence of ADEME and the SEI remained separate, which indicates a lack of policy co-ordination towards the related goals of GHG abatement and energy efficiency promotion. This meant little debate and transfer of information between ME and ADEME, and also a failure to add «carrot-like» incentives to the VAs for CO₂ reduction, which could have probably fostered more ambitious goals in terms of energy-efficiency improvement.

Traditional regulation towards industry sets the obligation of large production sites (*installations classées*) to obtain operation permits issued by the DRIREs (regional agencies for the enforcement of environmental and industrial policy, dependent on both ME and MI). Permits do not in general

include energy efficiency parameters as such, although they do include operation standards for combustion plants. It is worth stressing that, so far, no specific regulations concern CO₂ emissions.

As regards energy efficiency, a 1977 regulation imposed mandatory energy audits, intended to help identify potential investments in energy efficiency. An evaluation report showed that compliance in 1994 was only 40%, partly due to inadequate resources (to subsidise audits). Overall the conducted audits showed that savings of around 3% of consumption could be attained through projects with pay-back periods of 4-5 years (CIME, 1998). A new law was passed in 1996 on Air Quality and Rational Use of Energy suppressed mandatory audits as of 1988, and the decrees implementing this law replace most existing legislation on energy efficiency. For large boilers, efficiency standards were updated in 1995 and 1998, and energy audits continue to be mandatory.

In parallel, energy efficiency and conservation programmes are run by the ADEME, set up in 1991, bringing together the old agencies for energy conservation, the agency for management of waste and the agency for air quality. The agency has run a programme of subsidies for energy audits and specific studies in SMEs since 1983, offering financial support of up to 50% of the cost of audits or feasibility studies. From 1998 onwards, ADEME offers subsidy programmes for audits and studies (including pre-feasibility and diagnosis) for all plants. Besides, a number of specific funds to promote investments in energy management have been in place, but have been found to have little impact: SOFERGIE, FOGAME, accelerated depreciation systems (which allowed for 12 month depreciation and amounted to a subsidy of 2-5% of investments) (CIME, 1998). It is expected that these funds will be either scraped or redefined. Finally, ADEME runs information and training programmes jointly with technical associations (chambers of commerce and industry, technical centres, association of energy management engineers, ATEE; and association of environmental engineers and technicians, AFITE).

The evaluation study by CIME quoted above showed that in general policies aimed at energy efficiency have been uneven (they followed price fluctuations and were mainly short-term orientated) and largely ineffective (poor objectives or low enforcement). Nevertheless, those promotional mechanisms aimed at financing studies or test-phase projects demanded low public funds and showed high returns (in terms of savings effects) appear to be effective even in periods of low energy prices.

In 1999 the ADEME has received an important increase in its budget², and is bound to launch a new system of subsidies to promote energy efficiency investments (with no apparent relationship with the VAs). On the basis of the above mentioned results on the evaluation of policies for energy efficiency, available statements by ADEME on the new energy efficiency policy package indicate that priority will be given to diagnostic and feasibility studies. In particular, the main axes for action have been defined to: i) Promote and help finance studies to generate information necessary for decisionmaking, ii) identify best-practice and disseminate results; iii) help finance investments (long-term), in particular in connection with other ADEME promotional activities (e.g., reduction of air pollution).

Overall, assessments of energy efficiency policies indicate that many weaknesses stem from the lack of clearly defined goals and the overlapping of programmes in place (CIME, 1998; IEA, 1999). As regards policies towards CO₂ emissions, lack of co-ordination and synergy between VAs and ADEME energy efficiency promotion activities should be added to the list of policy weaknesses.

f. The ongoing debate on GHG policy

As an EU member country, France faces the European « bubble » target set by the Kyoto Protocol (1997), i.e. 8% reduction of GHG emissions between 2008-2012 from 1990 levels. Under the burden-sharing agreement of the European Council of Environment Ministers (June 1998), France is bound to keep average GHG emissions over the period 2008-2012 at their 1990 level. And although GHG policy efforts so far were enough to deal with the Rio-related commitments, they are deemed insufficient to achieve the Kyoto-related objectives. This stems from the need to extend GHG action from 3 to 6 gases (CO₂, CH₄, N₂O plus HFCs, PFCs and SF₆) and in view of economic growth trends which –in the absence of any further policy action- may lead to an increase of 20% in French GHG emissions between 1990-2010 (CGP, 1999; MIES, 2000).

The challenge posed by Kyoto-related objectives lies at the heart of a hot policy debate which started in early 1999. Although the final policy package will be known later in the first quarter of 2000, some preliminary elements were already defined and are worth analysing.

The main GHG policy priorities and objectives for the period 2000-2010 were set in the new

² As of 2 February 1998, the government decided to create a fixed fund of 500 MF from 1999 onwards for energy efficiency policies and to promote alternative energy sources. In a press conference, ADEME stated that for the first time in its lifetime of 8 years, the agency has been given the financial means to be able to face the tasks attributed to her.

National Programme for the Prevention of Climate Change, issued on 19 January 2000. The new programme was announced with some delay (it was originally expected in autumn 1999), and it is still subject to revisions, all which reflects the not only problems posed by internal negotiation of the sensitive issues amongst the various ministries involved, but also the high stakes involved in the new GHG policy. In particular, the most sensitive issues lie in the introduction of an energy tax (and how to deal with energy-intensive industries) and the efforts to be required from the transport and household sectors.

On the basis of the Kyoto-related commitments, the overall objective is to attain GHG emissions of 144 million tons (of CO₂ equivalent) in 2010. In the absence of any policy measure emission estimates reach 175 million tons, but the revised baseline projection, given the policy measures already implemented, is 160 million tons. This yields a 16 million tons gap which, according to the new Programme, will be closed through:

- i) already announced measures currently under implementation (this mainly concerns the new instruments for energy efficiency promotion by ADEME, as mentioned above) which would bring about a 7 million tons reduction and
- ii) a new policy package which would lead to the remaining 9 million ton reduction.

A first element of the new policy package is the introduction of an energy tax towards industry. According to the new National Programme, the tax would start at 150 F/ton CO₂ (23 EURO) in 2001 and reach 500F/ton (76 EURO) in 2010, and is bound to yield a reduction of 6.7 million tons (CO₂ equivalent) in GHG emissions³). The tax rates are considered to be in line with the rates to be applied in other EU countries (Germany, Italy, UK) and those considered in the project for a EU directive on energy tax harmonisation (MIES, 2000).

This move had already been announced in May 1999, and is to be implemented in the framework of the general tax on polluting activities (TGAP). Launched early 1999 (putting together 5 pre-existing tax schemes on waste, air and water emissions), the TGAP will include an energy component as of 2001. Although the energy tax towards industry will be neutral overall (tax revenues will equal the reduction in payroll taxes, in a sort of double-dividend reform), if applied at the same rate to all branches, it would nevertheless have clear distributive effects within industry. Payroll tax reductions

³ The remainder to achieve the target of 9 million tons of GHG reduction would be provided by a mix of regulatory

will basically benefit labour-intensive firms, whereas the energy tax will impact more heavily on energy-intensive firms. In face of industry critiques, the government launched a consultation on the implementation of the tax involving all stakeholders in July 1999 and its results are expected for March 2000 (MATE/MEFI, 1999).

A second element of the policy package, which is already clear as well, is that energy-intensive industry branches are bound to be exempted from the TGAP extension to intermediary energy consumption. This follows the art. 13 of the European Parliament project for a directive on energy tax harmonisation, and the decision to exempt certain key industrial energy uses (chemical reduction, metallurgic and electrolysis processes and energy use either as raw material or aimed at electricity production) due to concerns over the competitive effects of imposing a full tax on these processes (MIES, 2000).

Still, many issues remain unclear regarding the tax exemptions. Firstly, the full list of industry branches and processes to be exempted have not been defined yet. Secondly, the particular means to implement the exemptions or to reduce the tax rate for energy intensive branches is still under debate. A particular concern in this regard is whether VAs will be given a role and whether a pure (grandfathered) tradeable permits (or a mix with VAs) will be the instrument to this aim.

In this last regard, industry is pushing for a policy-mix composed of a quota (set through VAs) and tradeable permits (in the form of credits for « early action » towards Kyoto). The mechanism is very similar to one proposed for the USA by the Environmental Defense Fund (1999), as shown by a document issued by Entreprises pour l'Environnement, an IA representing the largest French industry groups on environmental issues (EPE, 1999). It envisages the setting of quotas (through VAs) and the allocation of credits/debts respectively for emissions reductions above/below the quota for the period 2002-2005. Such credits should be valid to be used as tradeable permits after 2008, when the Kyoto commitments start to bind (and international markets for GHG permits are to be set). An open issue in this proposal is the baseline: if the Kyoto Protocol (taking 1990 as the base year and 1990 emissions as the baseline) is followed in this regard, then French firms could benefit from the reductions attained under the previous VAs, which mostly cover the period 1990-2000.

For its part, the ME considers the use of tradeable permits in order to guarantee a ceiling on absolute emissions by energy-intensive industries and to reduce the costs of GHG abatement. Also the new

measures for energy production, transport, residential sector and for industrial emissions other than CO₂.

National Programme states on these grounds that energy-intensive industry branches are likely to be given the right to participate in permit markets. Nevertheless, details on how such a market would work are still missing and they depend, to a large extent, on negotiations to set permit markets at the EU level (to be discussed the next Council of European Environmental Ministers, September 2000) and at the international level (to be dealt with at the next Conference of the Parties to the UNFCCC in November 2000).

Finally, the government's position regarding VAs is still mixed. On the one hand, the new National Programme makes a very critical evaluation of the VAs signed in the 1990s. In particular, the central role of industry in goal-setting, as well as the lack of control and sanctions, are considered to cast many doubts on their environmental effectiveness. On the other hand, with regard to how the tax exemptions would be granted, the National Programme states that in certain cases, agreements between firms and the government could be envisaged, but based on annual objectives for emissions and a system of verification and sanctions for non-compliance (but no further details on how negotiation and enforcement would be organised are provided) (MIES, 2000).

III. TWO CASE STUDIES ON VOLUNTARY AGREEMENTS

The French agreement scheme mainly aimed at limiting competitive effects of policies to curb CO₂ emissions for energy-intensive industries. The two industries covered in the case studies (aluminium and packaging glass) appear quite representative of the French AS target: energy and capital intensive industry branches (with clearly defined investment cycles), bound to be exempted from an eventual European carbon tax. The shares of the particular industry sub-sectors covered by the VAs in total industry energy consumption in 1990 were respectively, 3% and 2% for aluminium and packaging glass production, much larger than their shares in total industry sales, which amount respectively to 0.4% and 0.6%. They raised delocalisation concerns in case a EU carbon tax was applied as both sectors faced harsh international competition and had already expanded their worldwide operations. Furthermore, their high concentration probably facilitated VA negotiations: the 4 largest firms accounted in 1996 for 80% of sales and 91% of exports in the aluminium industry, and these figures were respectively 62% and 73% for the packaging glass industry. Finally, both sectors initiated in the early 1990s a deep restructuration leading to heavy investments in their core (energy intensive) processes and cost-reduction programmes, suggesting a context highly suitable to reinforce energy efficiency concerns. Therefore, this background restructuration process appeared crucial for the analysis of firms behaviour under the VAs.

A methodological note seems in order, keeping in mind that the focus of the VAIE case studies are the VAs signed at firm or branch level and the energy conservation projects (ECPs) implemented at firm level and contributing to the achievement of VA objectives. It appeared very difficult in the French case to identify energy conservation projects (ECPs) defined as «specific technical and organisational activities aimed at energy issues at firm level initiated by the specific voluntary agreement» (Kraemer & Hansen, 1999). This was due not only to the pervasive synergy between energy management improvements and developments other than the VA (e.g. industry restructuring), but also to the perception by industry representatives that VAs had no impact on energy practice (being their objectives set close to BaU). Consequently, the ECP concept was enlarged to incorporate the full range of firm activities with a major impact on CO₂ emissions and energy efficiency performance, and incorporated other drivers which, along with the VA, affected energy management decisions. This was done in order to «select energy conservation projects that illustrate changes in technical and organisational practice related to energy issues and knowledge, which is the main focus of the study.» (Kraemer & Hansen, 1999). Since this approach raised a «disentanglement problem», namely the difficulty in isolating the actual impact of the VA on CO₂ reduction as compared to other

drivers, an attempt was made at indicating the main drivers for the different ECPs analysed.

III.1. THE PACKAGING GLASS CASE STUDY

a. The agreement

The VA signed in February 1997 is a global one, covering all aspects of environmental management: solid waste, liquid effluents, air emissions (CO₂, SO_x, NO_x, particles) over the period 1990-2005. It also includes firms' commitment to obtain ISO 14001 certification by 2002 as a means to make the terms and objectives in their environmental management more transparent to local communities.

It was signed by Container glass IA (CSVMF) and the ME, whose participation was interpreted by interviewees as a sign of approval of industry's own commitment. Overall, 8 firms (and 21 production sites) participate in the agreement: BSN Emballage & Verdome, Saint-Gobain Desjonquères, Saint-Gobain Emballage, Tourres & Cie, Verrerie du Languedoc, VOA, VMC and Verreries de Masnières. Nevertheless, the list of participating firms is just indicated in the VA in order to indicate the coverage of the industry engagement (all firms of the packaging glass industry participating in the CSVMF at the time are included in the list), since firms do not individually face VA commitments. In spite of non participation of the flat glass sector, it is worth indicating that most of the industry was covered in the agreement: from 1998 data, the packaging glass branch accounts for 65-70% of production and sales in the glass industry.

VA objectives

Targets were set both in terms of overall reduction of emissions/waste for the period 1990-2005 and in specific terms (emissions per unit of product) with a clear indication of past performance and a timetable of reductions.

As regards the CO₂ reduction objectives, tables 2 and 3 below indicate that a 10% reduction in absolute emissions (given a hypothesis of 13% increase in production) and a 27% reduction in specific emissions were committed for the period 1990-2005.

Table 2 Selected objectives of the packaging glass VA

Environmental Area	Reduction goal 1990-2005 (%)	Timetable for emissions (index 1990=100)					
		1990	1993	1996	1999	2002	2005
Solid Waste	49	100	96.5	80	69	56	51
Liquid effluents	92	100	82	55	22	10	8

CO ₂ emissions	10	100	98	100	95	91	90
SO _x	59	100	94	95	60	50	41
NO _x	58	100	79	72	58	54	51
Particles	28	100	81	86	79	75	72

Table 3 Packaging glass VA commitments on CO₂ emissions and recycling

Environmental area	1990	1993	1996	1999	2002	2005
Recycling rate (% cullet per ton produced)	45	53	58	67	75	77
Specific CO ₂ emissions (gCO ₂ /hl)	38.1	38	34	31.3	29.1	28
% reduction in specific CO ₂ emissions	0	0	-11	-18	-24	-27

The VA text includes some indication of the technical means for achieving CO₂ emission reductions, which are worth mentioning due to the multiple links found between different VA objectives and other firms initiatives identified from firms' interviews:

a) Recycling and lighter bottles. Increased recycling allows for a lower energy demand (remelting of glass is less energy demanding than melting of raw materials) and a lower use of carbonated raw materials, hence leading to reduced CO₂ emissions. In particular, at the time the VA was signed it was estimated that 200 kg less of CO₂ emissions resulted per extra ton of recycled glass added to the raw materials mix. The recycling efforts have been motivated by the directive on packaging waste recycling, under which the glass industry has committed an overall rate of 75% recycling by 2002 (as included in the VA). Production of lighter bottles was motivated by the aim to achieve waste reduction at the source, also in the framework of regulatory pressure (directive on packaging waste). In this connection, industry committed to reduce the quantity of glass in each container.

b) Energy savings, through the replacement of old furnaces, the technical improvement of modern ones and by the optimisation of energy use in all cases. These measures were concomitant to restructuration efforts in the industry. As regards the optimisation of furnace combustion parameters, these were also made in the light of new regulations on NO_x, SO_x and particulate matter.

c) Rational use of different energy sources: namely, increasing the use of dual energy systems and

increasing the natural gas share in the fuel-mix, which implies lower CO₂ emissions. For plants based on heavy fuel oil this switch is also motivated by the objective to reduce sulphur emissions. The particular measure of specific emissions adopted (gCO₂ per hl content of glass containers) is noteworthy, since its reduction relies to a large extent on the recycling and lighter bottles objectives.

Information and evaluation provisions

The results from the VA would be verified every three years (1996, 1999, 2002, 2005) by a task force with participation of ME and industry representatives, not only in order to evaluate progress but also to readjust targets, if necessary. As will be seen below, progress reporting basically relies on industry's branch-level self-reporting to the ME.

Also, in the framework of « transparency » concerns expressed by the ME and given firms interest to obtain ISO 14001 certification, each site would create in co-operation with the ME annual reports on their environmental management which would start at the beginning of 1998. It is worth mentioning that this last requirement has not been fulfilled to date.

b. The policymaking and implementation process

Policy Formulation

In the French case, the policy formulation phase overlaps fully with the AS implementation phase, namely, the setting of the standard VA procedure, as presented above in chapter II.

Negotiation

Negotiations over CO₂ reductions were framed by other concerns of the glass industry overall regarding environmental regulations. After the issuing of a 1993 regulation specifying new air pollution standards for the glass industry, negotiations started between industry and ME/ADEME representatives. Industry was in particular pushing for specific emission standards (rather than concentration standards) and also for a reduction of the tight limits set for particle emissions, which couldn't be met with available technologies at a reasonable cost. In return, industry was prepared to increase their NO_x abatement over and above the 1993 regulation standards. This led to the creation of a working group to discuss best available technologies (BATs) for curbing air emissions in the

glass industry, with participation of all sub-sectors of the glass industry (flat glass, fiber glass, glass crafts, cristal and packaging glass) and representatives from ADEME and ME.

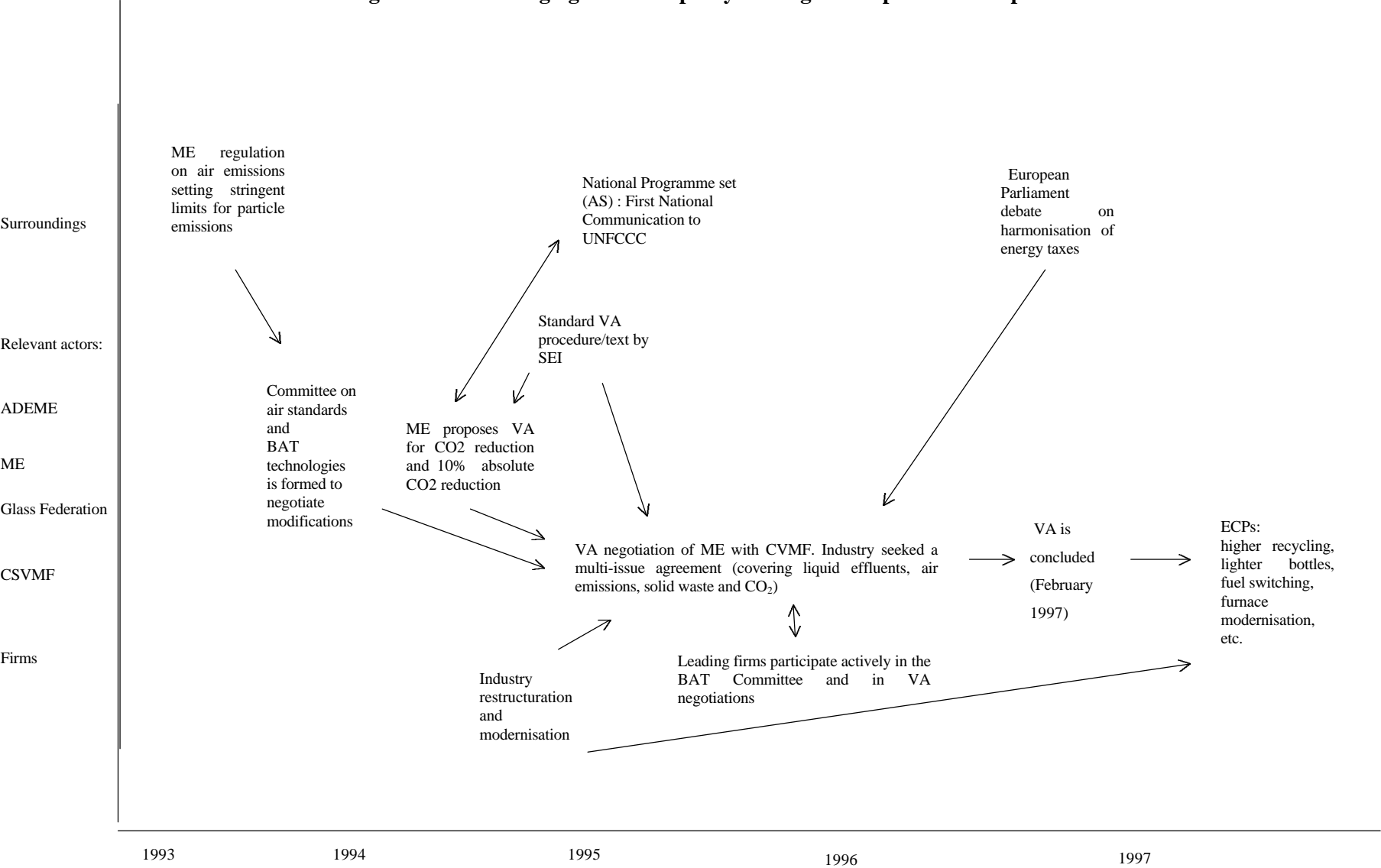
In this context, the former minister for the environment pushed to introduce CO₂ reductions in the VA, and finally only the packaging glass sub-sector accepted. Industry sources stressed that there were no real negotiations on CO₂ objectives. ME representatives asked for a 10% reduction which seemed feasible in the framework of all the measures to be implemented in the packaging glass industry (see the ECP section below). At this point it is worth stressing that carbon reductions didn't require specific and additional technical efforts. Rather they would constitute windfall reductions from the restructuring and air emissions reduction efforts in place.

As regards the actors involved, industry representatives claim they have only dealt with the Ministry for the Environment for all issues related to the VA and in particular CO₂ emissions reduction. It seems that ADEME's role in negotiation has been far more active concerning air pollution standards than in CO₂ reduction issues.

For its part, the working group on BATs is still active and information exchange has been underlined by industry representatives as one of the positive results of the negotiations leading to the VA. As a matter of fact, an ADEME official stressed that after the fall in ADEME's subsidies for energy efficiency, the agency had lost track of industry's performance in the energy efficiency field. On the one hand, unlike the DRIREs, ADEME has no power to monitor firms, so their role is restricted mainly to provide incentives (in this regard it is expected that ADEME's new subsidy package for R&D and demonstration to provide more leverage). On the other hand, even if basic glassmaking technology is more or less well known, CO₂ emissions and energy consumption highly depend on many parameters (recycling rate, type of furnace and design, fuel mix), and on the type of product, all of which are highly variable depending on market conditions.

Figure 2 below summarises the above description of the policymaking and implementation process for the packaging glass VA.

Figure 2 The Packaging Glass VA policy making and implementation process



Implementation phase: energy practice and ECPs

Although the VA text indicates the means by which the stated CO₂ objectives would be attained, the VA does not really describe the different steps that firms would undertake. Nor are individual company commitments set in this regard.

As regards industry burdensharing, the IA negotiations were led by the two largest firms (SG and BSN) who then encouraged smaller firms to participate. In view of the high share of the two leaders in industry production and their ongoing restructuring, they could in principle explain most of the expected emissions reductions. Nevertheless, the leaders seem to exert pressure on smaller firms to show progress within the IA, despite the implicit burdensharing concentrated on the efforts of the largest firms. Actually the considerable information exchange within the IA on environmental technologies to reduce air emissions, and the bilateral technology transfer agreements between the large firms (who are also leading suppliers of glass making technologies) and the smaller ones seem to allow for such a dialogue.

A finer description and enlargement of the above mentioned technical means contributing to CO₂ reduction (which we assimilate to ECPs) were obtained from firms' interviews:

a) Glass recycling and lighter bottles

Although in many cases there is still scope for increasing recycling, there are also some limits to its development: whereas cullet (broken glass) share in the raw material mix can reach 90% for green glass (champagne bottles), 70% can be the absolute maximum for other products due to technical reasons. In addition for coloured glass, improvements are underway as regards separate collection of glass waste, in order to increase availability of colourless recycled glass).

Firms' evidence provides some interesting examples: the SG Oiry site mainly produce green glass (champagne bottles) and has already achieved a high level of recycling (92% of the raw material mix is composed of cullet (broken glass), up from 85% at the time the VA was signed). For this plant, glass colour separation has never been a significant problem since there are other ways to guarantee quality and colour of products (besides, SG participates in a recycling firm). At present, the technical limit to recycling has been reached for this furnace. In contrast, Tourres exhibited recycling levels which were originally low (due to the high share of colourless and light-coloured glass in their product-mix). Nevertheless, the recycling rate is now

improving quickly and have reached a rate of cullet in raw material mix of 80% for green glass, and 50% overall. This was possible due to an organisational change, namely a partial acquisition of a glass treatment and separation centre, which guarantees access to separated and high quality recycled glass.

As regards lighter bottles, despite some marketing advantages (lighter bottles may better compete with other materials) and regulatory compliance interest, some limits are found. Interviewed firms stressed that although for wine and beer bottles the overall objectives have been reached without major problems (wine bottles' weight has been from 340 to 300 g), for higher segments of the market (Champagne bottles, spirits, perfume flasks) the market trend is not necessarily towards lighter bottles. In that sense, firms seem to face a market limit to introducing lighter bottles.

b) Modernisation and optimisation of furnace operations

Furnace energy efficiency determines to a large extent CO₂ emissions, since furnace operation accounts for some 70-80% of the packaging glass industry energy consumption. Furthermore, energy efficiency parameters in furnaces are basically predefined at the time of design and build-up, given the relevance of energy costs from furnace operations and due to the fact that furnace modifications can only be introduced every 5 years. Although their total lifespan may reach 20-30 years, furnaces are only stopped every 5 or 10 years for reconstruction or replacement of refractories. In addition, firms stressed that it is very difficult to change furnace performance parameters ex-post, save for minor improvements. All the above suggests that changes in furnace energy efficiency follow technical change quite closely and also stresses the relevance of investment cycle for achieving substantial energy efficiency improvements in this industry.

Fine-tuning of furnace performance concerns basically two issues: first, the optimisation of combustion processes, and second, insulation. Although new furnaces are bound to include the last technical developments to reduce energy consumption and to optimise combustion, energy efficiency may conflict with other objectives, such as quality and furnace durability. In this regard, firms are not prepared to risk potential changes in operation parameters which might stem from attempts at changing furnace energy-efficiency (and the additional gains in terms of efficiency improvements seem to be marginal). Saint Gobain ranks among the leaders not only in glass production but also in furnace technology development. The firm conducted major modifications at five furnaces and built two completely new furnaces in the 1990s as part of the restructuration plans, and save for one case (at the Oiry site) where they were testing and trying a major capacity expansion beyond normal

practice, they have been merely adopting the best well-proved models, which allowed for a reduction in energy consumption of up to 20% as compared to the previous ones.

c) Fuel switching

This change was expected to have a large effect on industry, in face of the trend towards liberalisation of energy markets in France. Firms were expecting a major switch from fuel-oil to gas, given its low investment requirements (save for pipe costs and some necessary fine-tuning of processes). Nevertheless, from firms interviews it was learnt that in view of higher than expected natural gas prices, fuel switching hasn't been as important as initially predicted.

Fuel switching possibilities also depend on firm characteristics. Due to localisation, Tourres uses a by-product from ethylene cracking as main fossil fuel. Being a fuel with very-low sulphur content and good conditions of supply, it is very unlikely that they would choose to switch to natural gas.

d) Energy management and ISO 14001 certification

Firms in this industry normally include energy efficiency parameters in their environmental management systems, but they basically concern their core production processes. Although VA objectives are usually adopted in their action plans, CO₂ objectives are not on the list of key actions since it is not a parameter formally included in regulations, thus not considered as crucial as other emissions. As regards firms' evidence, progress seems to be faster in SG than in Tourres. The Oiry site was certified in May 1999, and the objectives and procedures set at Oiry would be checked and applied to the other sites with minor modifications. Tourres started in September 1998 its preparation for certification, but had to interrupt it due to a major reorganisation of production which needs to reset many procedures. Both firms declared that the usual procedure is that objectives according to process characteristics, clients demands and local concerns are set at plant level, but the objectives and procedures are subject to revision and approval by the board of directors before starting the certification procedure.

Nevertheless, it is worth pointing that preparation for ISO 14001 certification seems to require considerable efforts as regards reviewing environmental and energy management. The first steps to ISO 14001 certification include: i) A thorough environmental audit (environmental impact analysis) ii) identification of major action areas iii) listing of priority areas for action, and setting of objectives for each of them, iv) registration and checking of procedures for each action area.

As regards technical assistance for energy management, although smaller firms in the glass sector participate in ADEME's PEE programme (providing support for the setting of environmental management, eventually leading to ISO 14001 and EMAS certification), it is worth mentioning that larger firms (SG, BSN and Tourres) consulted the PEE recommendations, but basically organised their own procedures towards the ISO 14001 certification of their management systems.

e) R&D efforts

SG has a specialised unit for glass furnace design and development which concentrates learning and know how for all activities of glass production (although incorporation of new technologies at the production sites obviously involves plant personnel who can bring in their own know how). Over the last 10 years, SG has concentrated R&D efforts on i) modeling of furnace operation parameters (for furnace design, transfers) where considerable progress has been achieved and ii) development and test of new solutions for improving energy efficiency, in collaboration with refractory manufacturers (like the technological improvement of bricks by a company of the SG group specialised in their development and production).

Apparently most energy efficiency improvements in furnaces which have been extended in the 1990s are well-proved improvements developed and tested after the oil crises of the 1970s. These improvements mainly include the incorporation of better insulation (fireproof bricks) and regeneration systems which were gradually adopted in the last 20 years. Industry seems to have exploited by now all profitable improvements developed in the 1970s, and it is believed that decreasing returns have phased in, they are basically taking fixed standards for regeneration levels. This means that a serious energy efficiency jump would then need a new technology jump, i.e., a drastic change in relative energy prices. In this regard, it was stressed that an energy tax as discussed at present wouldn't be enough to lead to a major breakthrough.

For their part, smaller firms in the sector obtain their technologies from larger firms, as is the case of Tourres who has a contract with SG for technology provision. From all the above, it is recognised at ADEME that there is little margin to offer technical assistance to the packaging glass industry, as it is mostly composed by world leaders who have their own R&D centres to develop and adapt technologies. Although the energy agency keeps in touch with technical centres of large firms, information on furnace design is hard to obtain because that is commercial information. ADEME's role was apparently far more important some 20 years ago with their subsidies for demonstration activities, when firms were testing a new generation of furnaces (whose up to date versions they are

using these days). At that time there was a jump in specific energy consumption of about 20%. Nowadays ADEME's role is far more important in pushing firms to install emissions control/measurement systems, they provide evaluation and subsidies for that (which comes from a recycling of the tax to polluting activities, the TGAP).

c. Summary of the evidence on energy practice

Organisation of energy management: firms answers in this regard were quite homogeneous as regards general organisation, but some differences were found regarding equipment.

Firstly, both firms interviewed declared not to have a unique energy manager at plant level. Actually, the task is divided between the Melting Operations Manager (in charge of furnace-based energy consumption) and the Maintenance Manager (for other sources of energy consumption). At the Saint Gobain group there is an Energy Director who is in charge of negotiating sources of energy, conditions of supply and prices for all companies. The group has a general energy policy which requires each plant to present annual energy budgets, and to reduce specific energy consumption each year. Furthermore, in case of building or rebuilding of furnaces, plants are required to at least maintain or improve their energy efficiency parameters. The means to achieve these objectives is decided at plant level, by the respective melting operations manager.

Secondly, at both the Oiry SG site and Tourres furnace energy consumption is checked against performance standards. This is also a result of regulations regarding performance of combustion equipment. In contrast, and although both firms seem to have followed the regulations demand of regular energy audits, no much has been done in this regard concerning non-core processes. In this regard the Oiry site experience with the ISO 14001 audit and procedures helped uncover efficiency differences at the plant and to set performance standards for some non-core processes. As regards Tourres, commitments with EDF (the electricity supplier) requires checking minimum performance standards for some main processes (including compressed air, steam, energy and electricity), although many non-core activities were highlighted as requiring standardisation and efforts to improve energy efficiency (e.g., fans and engines). In general, firms declared that packaging glass producers are at the frontier regarding the energy-efficiency of furnace operation, but there is perhaps more room for improvement in non-furnace operations (e.g., annealing, compressed air and feeder operations).

Thirdly, firm's size seems to make a difference for control equipment available and some

management practices. Whereas in the SG site energy consumption is checked every month, at Tourres this is done every 2-3 months. Similarly, although the main firms do have the equipment to check for CO₂ emissions from combustion, that is not the case for Tourres who cannot afford the control equipment (instead of a costly fixed measurement equipment they are about to include a mobile one).

Recent changes in energy management: firms do not recall a drastic overall change in their energy management in the past few years as a result of the VA. Nevertheless, in a context of restructuring, ISO 14001 certification efforts, and given the traditional relevance of energy costs in total costs, much attention has been paid to these costs in the last decade. Besides it was stressed that the carbon tax debate and the VA have stressed the importance of energy efficiency issues.

Investment decision criteria: Similar criteria were found to be used by both firms to select energy-efficiency related projects. The decision on investments is usually made at the top of the organisation, and although all types of improvements are relevant for productivity and competitiveness, directors usually focus on immediate return investments associated to quality and competitiveness considerations. Although normally taken into account, PBP is not the decisive criterion to choose and rank investment options in none of the interviewed firms. Quite often energy or other cost-reducing investments are undertaken despite a high PBP simply because a furnace stop is planned.

Nevertheless, the relevance of financial considerations (and hence firm size) seems worth pointing out. At Tourres, due to a tight budget for investment (set each year), two types of investment compete for funds: technical improvements which mean higher competitiveness (as regards productive capacity for new products, higher quality, etc.), and cost reducing improvements. Cost improvements with a low PBP may not be undertaken due to lack of funds (that is typically the case for non-core processes). Investment decisions are proposed and ranked by the plant director and his team and is then approved or modified by the board of directors.

At SG lower returns (longer PBPs) from energy efficiency investments may be accepted: a PBP of 5 years is quite often accepted and even projects with longer PBPs have been undertaken for furnace-related investments (whereas the normal required return for investments is 2-3 years).

d. Elements for an assessment of VA impact

Overall, the packaging glass IA estimated the potential impact of each technical measure to achieve

the CO₂ goal. Roughly, the expected participation of each solution (without considering furnace replacement) was expected to be: recycling: 30%, lighter bottles: 30%, fuel switching: 30%

At present, industry is nearly mid-way towards the end-date of the VA (2005). Although the 1999 evaluation results are still under elaboration, information provided by the industry association indicates that the weight of the different technical means to achieve CO₂ objectives has somewhat changed. Firstly, given higher than expected natural gas prices, the relevance of fuel switching proved smaller than predicted. Secondly, progress towards the recycling goal is nearly under schedule (65% has been reached around May 1999) but might find some problems in the future to keep up with the schedule due to bottlenecks in the availability of recycled glass. Thirdly, progress towards lighter bottles proved slower than expected, in particular due to many clients' refusal to adopt lighter packaging. From all the above, the packaging glass IA currently estimates that the relative weight of the different measures will be: recycling 50%, lighter bottles 25%, fuel switching 20% and other various smaller energy efficiency efforts 5%.

As regards overall progress towards the CO₂ objective, industry is still confident that the specific emissions objective will be kept (related specific energy consumption targets only implied a 1% improvement per year). Nevertheless, some problems may be encountered for the overall reduction objectives due to an increase in production higher than expected at the time the VA was signed (although a 8% increase in production was predicted for 1999 from 1990 levels, this prediction increased to 16% in 1998).

Technical and organisational change effects on energy practice

The evidence above indicates that the VA played only a minor role in changing firms energy management practice nor its organisation, all issues which don't seem to have changed much over the last few years. Nevertheless, some changes appeared to have happened due to a higher priority of energy issues spurred in the early 1990s by the threat of a carbon tax and the organisational change brought about by the need to involve all personnel in setting and testing procedures for ISO 14001 certification, major investment programmes and cost reducing efforts. In this context, the VA didn't pose additional challenges or efforts, but seems to play a role in making both firms and the IA measure CO₂ emissions, which is not spurred by other firms initiatives.

As regards organisational changes, it should be stressed that most efforts undertaken in the period covered by the VA involve modernisation, cost reduction and emissions reduction, stemming to a

large extent from major technological improvements (involving not only plant equipment but also changes in energy and environmental management spurred by ISO 14001 certification). In this regard, the BaU nature of the VA objectives seems to have basically favoured short term improvements, and not to promote long term effects. In particular it is worth underlining that industry admits that non-core processes still require energy efficiency efforts which have not been spurred by the VA, probably due to its BaU objectives and the lack of co-ordination in GHG policy (the AS and VAs) and energy efficiency policy (ADEME's promotion activities).

The role of parallel developments

One major finding of the packaging glass case study concerns the close links between many other developments (restructuring efforts, negotiations over environmental regulations concerning air emissions, investments) and the actions to achieve the VA CO₂ reduction objectives. It is clear from the evidence that there have been many sources of synergy from other firms initiatives which contributed to the VA goal on CO₂ emissions reduction.

Nevertheless, it also appears clearly from the evidence that the VA played only a minor role among the other developments in changing energy efficiency, given that most CO₂ reductions stem from activities undertaken to achieve other goals (cost reduction, modernisation, compliance with other environmental regulations or other VA goals, etc.).

Fulfilment of the VA targets

The little evidence available indicates that specific CO₂ reduction objectives are very likely to be achieved, although whether the industry branch will achieve the absolute emissions targets is still uncertain given a higher than predicted production level. Besides, many of the assumptions in the business as usual scenario (e.g. natural gas prices, evolution of improvements regarding recycling and lighter bottles objectives) were not confirmed, which implied the need to include some further efforts in order to keep the specific emissions objective.

Summing up, although the VA seems to have helped secure an improvement in specific CO₂ emissions, its impact regarding absolute emissions remains uncertain. In a changing industry scenario, leading to prediction errors in BaU estimates, the VA seems to have provided an « insurance » to guarantee some progress, by creating an incentive to push industry efforts to meet their VA commitments. Furthermore, the VA has led to an additional dialogue and information

exchange on energy efficiency among firms which facilitates decisions on corrective measures if necessary. Still, it seems that some more efforts regarding energy efficiency could have been achieved through a VA, had more co-ordinated policies been pursued, and had non-core process energy efficiency improvements been included as an additional target.

III.2. THE ALUMINIUM CASE STUDY

a. The agreement

The VA was signed in May 1996 by ME and Pechiney, the main French and European producer of primary aluminium and aluminium products. The VA only concerns GHGs, focusing on CO₂ and CF₄ emissions reductions and specific energy consumption for the period 1990-2000. The agreement covers Pechiney's production of alumina (basic raw material), and both primary and secondary aluminium production. Pechiney is the only French producer of alumina and primary aluminium, although some 12 firms produce along with Pechiney secondary aluminium. The VA covers 8 production sites, namely, one alumina plant, 4 plants producing primary aluminium, and three plants producing secondary aluminium: two from melting of intermediate products and one from recycled aluminium.

VA objectives

VA targets were set both in terms of overall emission and specific emission reduction for the period 1990-2000 (where data for 2000 reflect predictions at the time the VA was signed), as seen in tables 4 to 6 below.

For overall CO₂ emissions, the target set involved an increase of 2%, while for specific CO₂ emissions, a reduction of 19% is committed for the period 1990-2000 (as seen from the bottom lines of columns (8) and (9) in table 4), both stemming from the reduction in specific energy consumption of 7% for thermal energy and 2% for electricity.

The agreement explicitly states that objectives follow from energy efficiency improvements technically and economically worth undertaking for the period 1990-2000, given some hypotheses regarding production increase, and changes in energy supply (Pechiney planned to start cogeneration activities at one site). Furthermore, the VA text explicitly excludes energy improvements due to higher end-of-life aluminium recycling, despite its potential to reduce energy consumption by a factor of 5. Firm representatives claim that the reason for this was Pechiney's focus on large investments at the time the VA was negotiated. In contrast, now that the heavy investment stage is over recycling efforts would be worth considering in an eventual continuation of the VA. A major issue in this regard would be the scope for increasing aluminium use and recycling in transport vehicles. An

increase in end-of-life aluminium recovery and recycling is expected, although recycling is pursued only as long as it makes economic sense (the cut off price is given by bauxite price).

Table 4 Aluminium VA CO₂ reduction objectives

Activity	Production (Kt)			CO ₂ emissions (Kt)						Specific CO ₂ emissions (t/t)		
	1990 (1)	2000 (2)	Δ% (3)	1990 (4)	2000 ^a (5)	2000 ^b (6)	Δ(a/90)% (7)	Δ(b/90) % (8)	Δb/a% (9)	1990 (10)	2000 (11)	Δ% (12)
Alumina	463.9	450.0	-2.9	321.9	312.2	353.2	-3.0	+9.7	+13.1	0.694	0.785	+13.1
Primary Aluminium	325.9	447.1	+37.1	898.8	1233.0	903.5	+37.1	+0.5	-26.7	2.76	2.02	-26.5
Second. Aluminium (refusion)	61.1	68.8	+12.6	19.9	22.4	20.6	+12.5	+3.5	-8.0	0.33	0.30	-9.1
Second. Aluminium (recycled)	45.8	50.0	+9.2	30.9	33.8	24.7	+9.4	-20.0	-26.9	0.68	0.49	-27.9
Total				1271.6	1601.5	1302.1	+25.9	+2.4	-18.6			

a. Calculated on the basis of 1990 levels of specific energy consumption

b. Calculated on the basis of expected 2000 levels of specific energy consumption

As regards CF₄ emissions, only stemming from (primary) electrolytic aluminium production⁴ the committed reductions were 63% for overall emissions and 73% for specific emissions.

Table 5 Aluminium VA: CF₄ reduction goals

Activity	Production (Kt)			CF ₄ emissions (t)			CF ₄ emissions(kg/t)		
	1990	2000	Δ%	1990	2000	Δ%	1990	2000	Δ%
Primary Aluminium	325.9	447.1	+37.1	308	115	-62.6	0.95	0.26	-72.6

To summarise the VA expected effects regarding GHGs, CF₄ emissions are translated into CO₂ tons equivalent, giving an overall objective for reducing its «potential for global warming » of 33%:

Table 6 Aluminium VA total GHG reduction goals

	1990	2000	% change
CO ₂ emissions (ton)	1271600	1302100	+2.4
CF ₄ emissions (CO ₂ ton eq)	1570800	586500	-62.6
Total global warming potential (CO ₂ ton eq)	2842400	1888600	-33.5

Finally, as regards information and evaluation provisions, the VA information on CO₂ emissions is based on an energy audit conducted for all VA sites in 1990. The firm committed to prepare an annual report of progress regarding CO₂ emissions, not only for evaluation purposes but also to allow for flexibility in case it was needed to adjust calculations and commitments included in the VA.

b. The policymaking and implementation process

Policy formulation

As in the packaging glass VA, the formulation phase mainly followed the «standard» VA presented in chapter II.

⁴ CF₄ emissions stem mainly from the « anode effect », which is produced in discontinuous process of electrolytic aluminium production, when the alumina charge is low in the electrolysis vat. Continuous alumina charge may reduce this effect by keeping the appropriate level of alumina in the aluminium bath, but requires a process change.

Negotiation

The group-level Energy Director (who usually negotiates energy supply conditions) was in charge of negotiating the agreement from the firm's side. The agreement was originally aimed at energy consumption and then turned into a GHG emissions agreement. After a restructuration in energy management within the group, it is now the Director of Environmental Affairs and Industrial Risks for the Aluminium Metal Group who is in charge of all issues related to the VA. Dialogue has always been with the ME (in particular SEI), without any contact with ADEME.

Apparently, no real negotiations were involved. The firm undertook a thorough energy audit and analysed the possibilities for improving energy efficiency and GHG emissions and set a BaU objective for the year 2000, which was proposed to the ME. The trade off involved was clearly that the firm would considerably reduce specific emissions but slightly increase absolute emissions of CO₂. The proposal was accepted by the ME.

Actors' motives

From ME and firm interviews it was gathered that the ME was trying to engage industry in signing VAs, as a way to have arguments against the use of a European carbon tax. Besides, VAs were being used in other European countries and the ME was interested in launching a similar programme in France. This impression might well correspond to the fact that the aluminium VA was the first one to be signed.

For the firm, the main interest was to show a better performance regarding GHGs, due to its beneficial image effects. This was due in particular to environmental groups criticism towards the aluminium industry for its CF₄ (also known as PFCs) emissions. Other than natural sources, the aluminium industry is nearly the only responsible for emissions of CF₄, a quite stable gas, which makes its concentration levels both worrying and easy to calculate. In view of all the above, an international debate took place in the aluminium industry, and it was discovered that new plants with a continuous charge of raw materials (alumina) showed low CF₄ emissions. Consequently by the mid 1990s, in many countries aluminium producers have committed to switch to the low emission-process (Gagnier & Berthoud, 1999). Hence, it was mainly due to image considerations and the international debate and commitment of the aluminium industry that Pechiney proposed to include CF₄ reductions into the CO₂ VA. This also allowed to show an overall reduction in absolute GHG emissions (see Table 6).

The early 1990s was one of deep restructuring for the company. An ambitious modernisation plan was started: to update plant technologies, to open new plants (one was started up in 1992) and to close down the ones with poor productivity performance.

In 1995, at the time of VA negotiations, Pechiney was launching a cost-reduction initiative, called the Challenge Programme. Its objective was to reduce costs by 20% between 1995-1999, with a minimum closure of plants, fostering productivity increase through investment and maintenance of R&D policy (Pechiney, 1996).

From all the above, the VA objectives appear as highly related to other firms initiatives. The most obvious example is that investments linked with reduction of GHG emissions were spurred by the objective of updating technology and the international pledge by the aluminium industry regarding CF₄. In addition, the firm considered important to show that it seriously followed their energy costs, and finding a solution to the anode effect meant also reducing energy losses and energy costs.

It is also worth mentioning that since the investment phase was well under way by the time the agreement was signed, most of the specific emissions objectives were relatively secured (save for the cogeneration project and some cost-reduction initiatives). The impression that all specific emissions reductions were nearly achieved by the time the VA was signed was confirmed by many interviewees and the ME information reported in chapter I.

As regards the perspectives of energy efficiency improvements in the future, although modernisation and technology acquisition was important over the period 1990-2000, only small changes at the margin could be expected since no technological change is planned for the period 2000-2010. It was stressed that is very difficult to reduce energy consumption drastically without a major technological improvement, and at present process efficiency is largely optimised up to the level where it is economically viable to do so. Furthermore the firm expects production levels to remain nearly constant towards 2010. For these reasons, the firm hopes to keep credits from their efforts since 1990 as regards Kyoto mechanisms.

Implementation: ECPs

The following actions were identified as undertaken to achieve energy efficiency CO₂ reduction improvements:

- 1) Heavy investments: mainly concentrated in technical improvements of the electrolysis process.

2) Small improvements in energy efficiency: improve metering equipment, improve burner jets performance; process optimisation in primary production and in remelting processes, increase of production capacity (which reduces specific emissions)

3) Training programmes.

As regards the internal burden-sharing and implementation of VA objectives, the translation of overall group VA objectives into plant-level goals was done through dialogue between each plant director and the group energy director, after the scope for improvement was calculated for each plant. Nevertheless, this didn't necessarily mean the definition of plant specific policies derived from these negotiations but the derivation of a list of improvements per plant. The only exception was the plan to reduce CF₄ emissions: since this issue was very sensitive, there were directives set at group level and then disseminated to all plants involved, in a top-down approach.

Pechiney has always developed and used their own technology for electrolysis, which helped guarantee a constant modernisation and update of their core-process technology. As regards non-core processes, the group does not always have an interest in developing their own technologies (e.g., furnaces for foundries), and thus the firm negotiates with suppliers to obtain the needed technology specifications and parameters. The technical group at Pechiney would only make small changes to these processes (e.g., adaptation for a switch to gas).

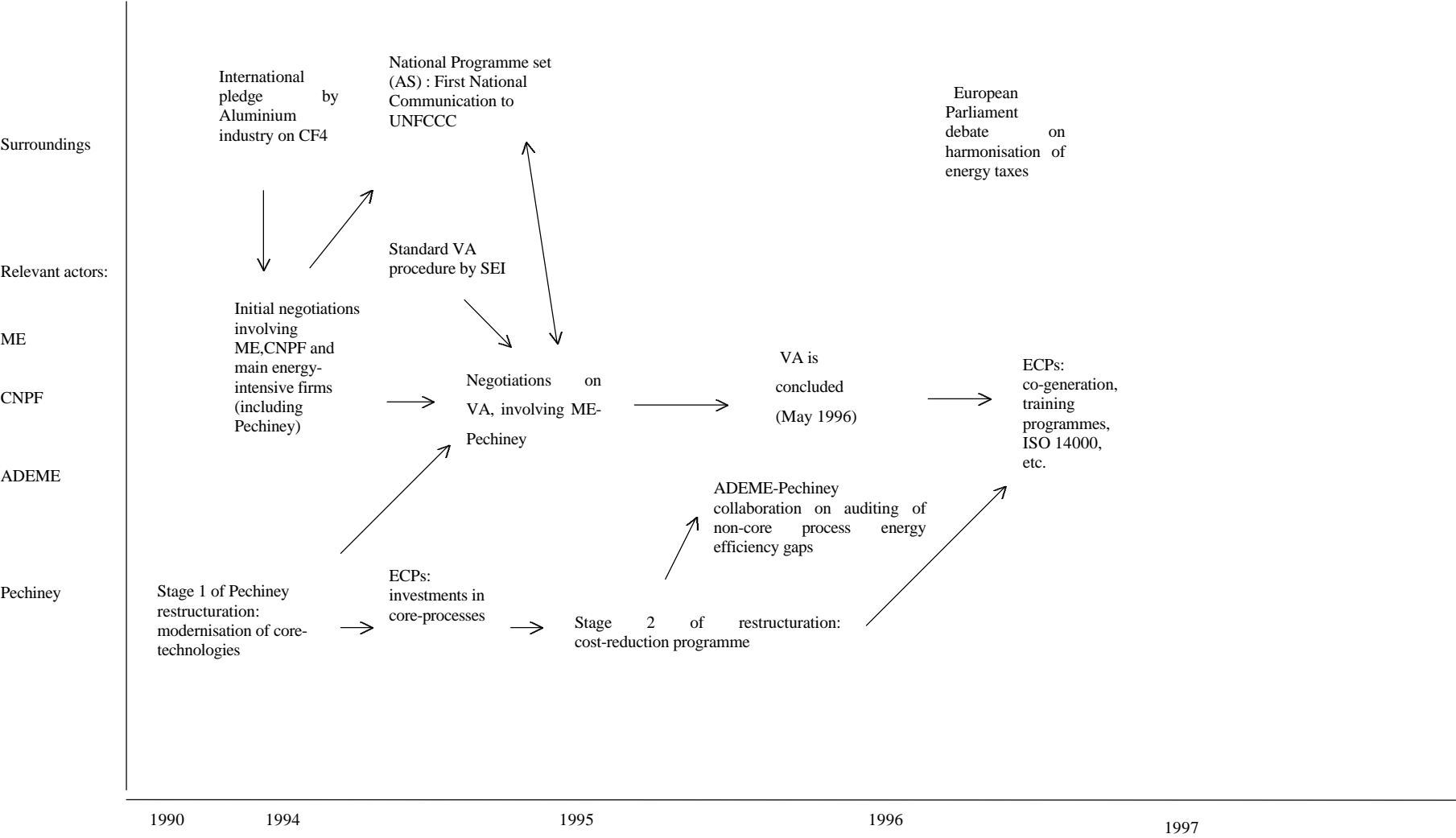
For the implementation of the modernisation plan, technology adoption decisions were not taken at plant level but at the group R&D department level: there are two such departments, one for alumina and another one for aluminium. In general, both plant managers and staff from the R&D departments have been involved in the recent modernisation/restructuring process. Nevertheless, a top-down approach is also bound to dominate in this regard, since technology availability and investment cycles define to a large extent the timing of investments.

As regards how energy efficiency standards are chosen at plant level, it was noted that electrolysis plants search to optimise their optimal overall cost, which not always means minimum energy costs. Besides, from a pure productivity perspective the firm does not need to reduce energy costs too much (efforts on this front are not new). Furthermore, there seems to be some kind of trade-off between scale economies and energy efficiency, since achieving maximal economies of scale sometimes does not necessarily imply optimal energy consumption.

The above evidence on the policymaking and implementation process for the Pechiney VA is

summarised in Figure 3 below.

Figure 3 The Aluminium VA policy making and implementation process



c. Summary of evidence on energy practice

As regards the organisation of energy management, each major plant has an energy manager, and although major lines of energy policy are defined at the group energy director level, plant energy managers are in charge of defining their own energy consumption objectives.

The VA meant no additional pressure as regards firm's practice on energy and raw material consumption. As a matter of fact, given the cost reduction programme, there were already goals in place regarding overall cost reductions. And save for CF₄ objectives, the cost-reduction objectives were enough to attain VA objectives. Overall, all actions regarding investment and process optimisation activities were decided due to their economic return, which is consistent with VA objectives being no more than BaU.

Investment decisions have taken environmental issues (GHG emissions) as one variable among many others, and for the period 1990-2000 productivity considerations in particular appear as more important factors in investment decisions than VA commitments. To some extent, environmental benefits have been considered as « zero cost benefits » derived from investments which were decided due to their economic return in the first place. Apparently, the VA only meant following energy consumption more closely in order to detect deviations from expected practice (but this was also motivated by the cost-reduction programme).

The only major change in the organisation of energy management is the start of activities aimed at ISO 14001 certification, launched in the first half of 1999. The firm expects to progress slowly: the objective is to certify one French plant by year 2000, in order to profit as much as possible from the change in environmental management. ISO 14001 helps make progress only in areas predefined by the firm, so once objectives and procedures are well defined then it is easy to use ISO 14001 in order to improve all aspects of environmental management which need efforts. It is considered that having ISO 14001 systems in place would have helped to follow progress regarding the VA in order to evaluate it in a decentralised fashion, as there is the risk that plants do not adopt the VA objective adopted by the group.

d. Elements for an assessment of VA impact

From the 1997 progress report issued by Pechiney, it is clear that most of the objectives have already been achieved (in particular specific emissions reduction of CO₂ and CF₄ of 19% and 73%). In

addition, being all major investments planned for the period 1990-96, no major change was expected for the period 1997-2000.

Nevertheless, as regards absolute emissions, the report states that it is highly uncertain whether the commitments will be kept. Although absolute CF₄ emissions were in line with the VA objectives, and overall emissions in 1997 appeared to be low as compared to the VA predictions, it was due to unexpectedly low production of aluminium (which resulted in an overall 40% reduction of GHGs from 1990 levels). Nevertheless, new forecasts for production levels for the year 2000 suggest that the overall emissions commitments won't be kept and CO₂ emissions will be higher than originally expected in the VA. In this regard, it must be noted once more that now that all expected improvements in specific emissions have been met, the level of activity gains a decisive weight in emissions performance.

At the time the firm interviews were carried out, concerns were concentrated in the fact that the continued fall in production had led to a raise in specific emissions. Nevertheless, the firm is still confident that the specific emissions objectives will be kept in the year 2000. In contrast, uncertainty remains regarding the absolute emissions targets, as they still expect production to increase more than predicted for the period 1990-2000. It was highlighted that in a ten year period the scenario for the firm could change dramatically and so their VA commitment involved a considerable risk, as is clearer now regarding the production level, and also the energy prices energy, and structural change. For instance at the time the VA was signed, Pechiney planned to increase their cogeneration activities in order to obtain steam for the electrolysis process, but finally due to cost reduction objectives, it was decided to outsource: a cogenerator would sell steam to the firm and electricity to EDF.

Technical and organisational change effects on energy practice

Despite the impressive overall reduction in GHGs over the period covered by the VA, it is quite clear that the agreement didn't lead to major changes in the firm's energy practice, which were mostly driven by modernisation and cost-reduction efforts already decided at the time the VA was signed. In this regard, GHG emissions reduction appear as a mere windfall from those efforts. These were undertaken under clear quantitative objectives which will basically set the efficiency parameters for the next decade, given that no further technological improvements are envisaged.

Probably the only energy practice change which may solely be attributed to the VA is the calculation and reporting of overall and specific CO₂ emissions.

In addition, it is worth pointing out that efforts towards ISO 14001 certification (which were not considered as goals in the VA) were only started once the major restructuring of firms operations was achieved, so its additional benefits and effects for energy practice will be achieved outside the VA period, probably missing some potential for further synergy which would have resulted from the introduction of VA objectives in the continuous improvement goals of plants' environmental (and energy) management system.

Relation to parallel developments

As in the packaging glass case, synergy stemmed from other firm initiatives, such as the investment and cost-reducing programme undertaken by the firm. Nevertheless there seems to be an overriding weight of cost-reduction and modernisation objectives in firms efforts, under the strain of tight timetables which probably led to overlooking non-core processes. In this regard it is worth mentioning that although an energy audit and collaboration with ADEME was started to improve energy efficiency of non-core processes, it is difficult to assess its role in the general framework of the other efforts (no detailed information was available in this regard).

Fulfilment of VA targets

As in the packaging glass VA case, specific emissions goals seem to be guaranteed but there is high risk of non compliance with absolute emissions targets. It is worth noting that due to the fact that most technical changes had been already undertaken by the time the VA was signed and that the VA explicitly states that specific emissions are the «de minima» objectives, the aluminium VA was subject to less risk of non compliance than the packaging glass VA and mostly played a role of publicity of technology improvements which allows for lower specific GHG emissions.

IV. A QUALITATIVE ASSESSMENT

As stated in the introduction, the case studies aim at a better understanding of VA formulation and negotiation phases, as well as at expanding our knowledge of VA policymaking by shedding light on the VA implementation process. In so doing, the fieldwork has also led to qualitative information which allows for a preliminary assessment of the experience with VAs for CO₂ emissions reduction in France.

In this connection, this section presents a summary of results from the qualitative assessment exercise, whereas a more thorough presentation covering all the VAIE criteria is presented in Appendix 3.

It is worth stressing that an exhaustive evaluation of the French AS was out of the scope and the possibilities of this study. In particular, it was impossible to evaluate whether the original AS goal in terms of CO₂ reduction is bound to be achieved or not, lacking both an evaluation of VA performance by the ME and the basic data on CO₂ emissions to conduct it.

a. Impact

Target ambitiousness

As regards the AS, it is important to keep in mind that the initial objective of the ME (before the National Programme was drafted) had been to achieve through the AS the same results (in terms of emissions reduction) that would have been brought about by a carbon tax. Nevertheless, according to most interviewees, the objectives finally adopted appear less ambitious than that, as they did not require much effort in CO₂ abatement (energy efficiency improvements) over and above what appeared profitable in the absence of policy measures (i.e. close to the baseline or BaU scenario).

A similar conclusion may be drawn by comparing the estimated potential for CO₂ reduction with the actual commitments under the AS. In the first French communication to the UNFCCC, the potential for reduction of industry CO₂ emissions was evaluated at 5 MtC between 1990-2000⁵, while the

⁵ This reduction was deemed achievable if the required pay-back period (PBP) from investments in energy efficiency was extended from the usual 2-3 years to 4-6 years, or if a carbon tax of 70 Ecu was set.

committed CO₂ reduction under the VAs were estimated at 1 MtC in the first communication (RF, 1995) and 1.45 MtC in the second communication (when all VAs were already in place) (RF, 1997). This last figure represents 29% of the estimated savings potential.

The main explanatory factors for the low ambition in the AS commitments are, as indicated in section II, the particular conditions under which the VAs were negotiated (lack of clear threat of alternative regulation), the lack of a well-articulated policy-mix to exploit the synergy between the VAs (negotiated by the ME) and other «carrot-like» instruments (such as ADEME's instruments to promote energy efficiency) and the internal divisions at the ME (where the opposition of the technical level to VAs diminished the chance to actively pursue more ambitious targets).

None-the-less, it is important to stress that even if VA targets do not appear ambitious from the perspective of the additional efforts required, their magnitude appear quite impressive as regards the committed reductions in specific emissions (see table 7). This applies in particular to the packaging glass and aluminium branches, covered in our case studies. The fieldwork results indicate that the restructuration and modernisation efforts by these branches in the 1990s may explain to a large extent the important reductions attained in specific CO₂ and CF₄ emissions.

Target Achievement

At an aggregate level, it appears impossible to evaluate whether the above mentioned goal of CO₂ reduction by 1.45 MtC is bound to be achieved or not, lacking both a ME evaluation of the AS and data on industry emissions at the right disaggregate level. In any event, the new National Programme confirms that compliance with the Rio commitments is not at risk and appears to be guaranteed (MIES, 2000).

From ME information at the VA level and from our case studies it appears that most VA objectives will be attained. More specifically, VA targets regarding specific emissions look likely to be kept, but two out of four absolute emissions targets remain uncertain (i.e. the aluminium and packaging glass VA goals for absolute CO₂ emissions), in view of an upward revision of production forecasts (see table 7 below).

Table 7 Results under the industry VAs signed

Industry/ Firm	VA objectives (CO ₂)		Period ⁽²⁾	Results of firms/IA self-report ⁽²⁾	
	Absolute	specific ⁽¹⁾		1997	1998
PECHINEY Aluminium	CF ₄ : -63% CO ₂ : +2%	CF ₄ : -73% CO ₂ : - 19%	1990- 2000	80% of committed CF ₄ absolute reduction attained. Both VA objectives for specific emissions reached in 1997	Absolute CF ₄ objectives attained, uncertainty over objective for absolute CO ₂ towards 2000. No change
STEEL INDUSTRY	-10%	-14,6 %	1990- 2000	No results but upward revision of objectives 1990-2000: -12% reduction of absolute emissions -16,3% reduction of specific emissions	-11,2% for absolute emissions achieved -12,5 % for specific emissions achieved
LIME INDUSTRY	-	-5%	1990- 2000	-2,2% for specific emissions achieved	-3,2 % for specific emissions achieved
CEMENT INDUSTRY	-	-10%	1990- 2000	-11,8% achieved for specific emissions	- 13,25% for specific emissions achieved
PACKAGING GLASS INDUSTRY	-10%	-27% (g per hl)	1990- 2005	+5% for absolute emissions observed (1990-96), although 1990 levels were to be kept; -6% in specific emissions (-11% expected). 2005 objective is due to be kept due to increased recycling.	No progress in absolute emissions -10% (1990-98) but 1999 objective was -18%.

Notes: (1) Specific emissions denote emissions per ton of production, unless indicated otherwise.

(2) Reductions for each relevant period (1990-x) concern reduction from 1990 levels.

SOURCE: ME, Pechiney (1998), FCSIV (1997)

VA effects on firms' energy practice

The case studies evidence indicates that VAs haven't spurred major changes in firms' energy practice. Only a closer control of CO₂ emissions can clearly be attributed to the VAs.

Keeping in mind that VA objectives did not require much effort in energy conservation over and above what appeared profitable to firms, other objectives have kept higher priority (motivated by concerns spurred by environmental regulations, restructuring, modernisation and cost-reduction efforts, etc.). In both case studies, CO₂ reductions have mostly resulted from efforts towards these objectives. Even if some firm initiatives have had a direct impact for CO₂ emission reduction, like the inclusion of higher pay-back-periods in energy-saving projects, they appear mostly motivated by other long term concerns (such as cost reduction and industry's expectations of energy taxes in the future).

Summing up, it appears very difficult to identify energy saving measures solely prompted by the VAs. Besides, no specification of technical or organisational change aimed at achieving the VA objectives was included in the VA texts. It is also difficult to imagine which additional provisions could have been included, as the two industry branches studied had already developed a high competence in energy management before the signature of the VAs due to the high relevance of energy costs for their competitiveness. Arguably, the only example of an energy management requirement included in a VA (the ISO 14000 certification provisions included in the packaging glass agreement) would have probably come about even in the absence of a VA, as ISO 14000 certification constitutes a voluntary mechanism where firms participate whenever they find it profitable. In this regard, Pechiney has started the process towards certification even if it was not included in the VA provisions.

Summing up, although the case studies have uncovered many firms' efforts with an impact on energy management (investment, technical and organisational change, ISO 14001 certification, etc.) it is very difficult to relate them to the VA. In general they seem to have been driven by other considerations: competitiveness, restructuring, marketing advantages, etc.

Discussion

All the above indicates that the considerable CO₂ emissions reductions under the two VAs covered in

the case studies appear closely related to the ongoing restructuring efforts by the concerned industry branches, which suggests a good timing for the negotiation of VAs. Furthermore, the VA targets have mostly been met through investment and technical and organisational change efforts profitable to firms. Although this does not imply major «additional» efforts over and above a business-as-usual or baseline scenario, it suggests that the VA emissions reductions have been cost-effective.

These two results are in line with a common trade-off found in VA evaluation: although the VAs seem to show a good performance as regards their target achievement and their cost-effectiveness, they do not appear very ambitious as regards the environmental targets adopted.

On the positive side, we have that in a context of restructuring and investment efforts, VA objectives close to BaU may imply considerable emissions reductions. Furthermore, given that the forecasts in the early 1990s had not anticipated the low energy prices towards the late 1990s, the fact that firms are bound to keep most of their commitments (at least in terms of specific emissions reductions, mostly determined by technological change and investment) and hence the investment projections in energy savings would mean some progress after all. In this regard, the VAs may have provided a sort of insurance, although they have been insufficient to provide a cap on absolute emissions.

Finally, it is important to keep in mind that many political considerations played a key role in the adoption of VAs as a policy instrument. On the one hand, as mentioned above, the adoption of a carbon tax involved a risk of industry loss of competitiveness and eventual delocalisation, and from this perspective, the government was keen in avoiding this risk through a consensus approach towards energy-intensive industries. Both ME and industry representatives interviewed confirmed this view and, as a matter of fact, a similar statement is included in the introduction to the « standard VA text». On the other hand, political considerations quite often lead policymakers to rely on dynamic and concentrated industries easier to deal with. In the CO₂ case, focusing on a few key energy-intensive industries also made it more likely to bring about improvements, although it should be noted that industry accounted for 24% of GHG emissions in 1990 and had already showed considerable progress in the previous decades: industry CO₂ emissions fell by nearly 20% between 1973-90, due to continuous improvements in energy efficiency. In contrast, the transport and residential sectors showed in the same period a continuous growth in both their share and their absolute emissions but posed more challenges for policymaking (RF, 1995). These two sorts of political considerations implied that a very delicate balance had to be kept in the kinds of efforts to be required from industry

as regards CO₂ reductions. This delicate balance still looks relevant for the next round of GHG policies, as illustrated by the consensus among many government officials and analysts on the need to continue industry efforts towards CO₂ reduction but making sure that policy does not exert excessive pressure on this sector (Energie Plus, 1998; CGP, 1998).

b. What difference have VAs made for policymaking?

Surprisingly enough, the VAs for CO₂ emissions reduction in France seem to imply a policy continuation in many ways.

Firstly, despite the introduction of a new actor in the dialogue on energy-related issues with industry (the ME, in charge of GHG policymaking), the areas of influence of the new actor and the traditional one (ADEME, in charge of energy efficiency promotion) remained well differentiated as no effort was made to co-ordinate energy efficiency and GHG policies. Thus, it could be said that the introduction of GHG policies didn't affect the logic of ongoing energy efficiency policy.

Secondly, CO₂ reduction was a new issue in the environmental policy agenda, which has in the French case quite often led to a dialogue approach between ME and Industry (Börkey & Glachant, 1997).

Thirdly, VA policymaking followed to some extent the usual procedure in French environmental policymaking (where laws set general policy guidelines which are implemented by the ME with considerable discretion as regards the specific instruments and goals). Although no actor other than ME, Industry Associations, MI and ADEME had any participation in VA formulation nor negotiation, a parliamentary debate on energy policy and environmental impact was launched before the setting of the AS. It involved all stakeholders and provided information regarding the environmental and economic trade-offs involved in GHG policies, but did not involve a direct debate on neither specific policies nor goals. From this perspective, VAs don't exhibit less stakeholder involvement than traditional environmental policymaking.

Fourthly, there is an additional element that seems worth pointing in the French case: the traditional relevance of the European policy debate in shaping French environmental policies (Lévêque, 1999). At the time the AS was being defined in France, VAs for CO₂ reduction or energy efficiency improvement were already discussed or in place in other European countries. This probably reinforced the case for the use of VAs in France.

As regards the VA role in information provision, there is mixed evidence. VA negotiations and formulation led to a substantive information collection by the ME regarding industry's past record and future prospects regarding emissions, though it is unclear whether this meant useful learning for future GHG regulation.

On the one hand, the ME seemed to get more information on aggregate evolution of emissions at industry level rather than detailed information on technical possibilities to reduce emissions at firm level (although some technical information is also available for the largest plants). Firms sometimes admit that there are still many efforts to be made to improve energy efficiency in non-core processes. In this last regard, the ME has not gathered much information through VAs and it has not helped reduce asymmetric information problems. Although ADEME is undertaking a new study on the potential of energy improvements in industry it is not clear to what extent this will be used in the next round of industry regulation regarding CO₂ emissions unless a closer ME-ADEME co-operation is initiated.

On the other hand, after the restructuration efforts undertaken in the 1990s both industry branches covered in the case studies appear to have no room for substantial technical change in the next 10 years. Consequently, the information gathered is valuable regarding core-process energy efficiency and the adoption of specific energy-saving measures in particular plants which have a major incidence in industry numbers.

As regards information dissemination within industry, it is worth noting that networking on energy issues wasn't specifically fostered by the VA. Nevertheless, firms from the glass industry acknowledge an increase in intra-sectoral dialogue regarding energy issues, on which firms were previously unwilling to co-operate upon given their sensitiveness (closely linked to competitive parameters). All in all, in the packaging glass case, it was probably the multi-issue nature of the VA which created more room for a discussion forum on restructuration efforts and energy efficiency issues. But even in this case it is difficult to assess the VA effects for learning and reducing transaction (adoption) costs of energy saving projects, as there seem to be other channels for learning (among the different plants of the large firms; on a bilateral basis between large firms and SMEs through technology supply).

Summing up, although it may have led to some valuable information acquisition by the ME (a new actor in dealing with industry on energy-related issues) VA policymaking didn't imply a reduction of asymmetric information problems. Similarly, VAs meant no major departure from traditional

environmental policymaking, neither as regards stakeholder participation nor in the creation of networks for information dissemination on technologies.

Institutional demands

It could be said that the VAs didn't pose many specific nor new institutional demands to neither the public nor the private sectors. On the private side, it demanded some effort regarding negotiation, information collection and presentation, but it was mainly in charge of staff usually dealing with energy and environmental issues on a daily-basis and was not identified by interviewees as a major burden.

On the public side, it is important to underline that VAs had been signed before by the ME, and the SEI officials in charge of following-up the VAs were already specialised in environmental regulation of the particular industries involved in the VAs for CO₂ reduction. In addition, it may be argued that one main challenge of the CO₂ VAs would have been to co-ordinate ME policy with ADEME efforts in promoting energy efficiency improvements. These efforts were not undertaken and remain a challenge for the future GHG policies. Finally, it is worth noting that as regards monitoring and enforcement we have a paradox: Although some criticism is justified regarding the lack of efforts towards follow-up, monitoring and enforcement of the French VAs, in view of their modest ambitiousness (firms found it in their own economic interest to undertake most of the energy efficiency efforts committed under the VAs) it could be said that the decision of not devoting too many resources to monitoring and enforcement was justified.

V. CONCLUDING REMARKS

This study on the French experience with voluntary agreements for industry CO₂ emissions reduction focused on the whole policymaking process (it covered the formulation, negotiation and implementation phases). In addition, three relevant policymaking levels were studied: the agreement scheme (the general framework for the use of agreements), the voluntary agreements (concluded at firm or branch levels, in particular, by the packaging glass industry and Pechiney), and the energy conservation projects (activities undertaken by firms to reach the VA objectives). The main findings from the analysis may be summarised as follows:

The French VAs were applied mainly due to political considerations regarding the distribution and delocalisation effects of a carbon tax. Overall, VA policymaking didn't imply a major departure from traditional policymaking. As regards participation of environmental groups and parliamentary involvement, the VA process mainly involved representatives from industry and the Ministry for the Environment, but previous to the adoption of VAs as instruments, a parliamentary debate on GHG policy involved all stakeholders. This appears quite close to traditional environmental policymaking in France (i.e. the broad objectives are set by law, but the Ministry for the Environment has considerable discretion as to the precise policy instruments and targets). Furthermore, as regards policy towards energy efficiency, the introduction of GHG concerns left energy efficiency policy towards industry largely unchanged.

As regards VA impact, it is important to discriminate between VA target ambitiousness and target achievement. Regarding the former issue, VA objectives seem relatively modest, in the sense that they mostly involved efforts which appeared profitable for firms to undertake (i.e. they were close to business-as-usual performance). But even if close to business-as-usual performance, the objectives appear considerable in quantitative terms (in particular the specific emissions objectives covered by the case studies). This mainly results from the deep industry restructuration, investment and cost-reduction activities initiated by these sectors in the early 1990s, which suggests a good timing of VA negotiation for CO₂ reduction.

Many factors were identified as hindering more ambitious VA targets. Firstly, at the time of VA negotiation, firms faced no clear threat of alternative GHG policy instruments, as the option of a national carbon tax had been discarded (only a vague threat remained regarding an eventual European carbon tax). Secondly, internal conflicts at the Ministry for the Environment (where only

top officials at the political level were in favour of the VA approach), jeopardised the chance to negotiate more ambitious goals. Although a well-designed plan had been prepared for information exchange and VA negotiation, in the end, the VAs were concluded in a rush at the political level, and VA objectives mainly amounted to a public recognition of industry self-commitments. Thirdly, the lack of co-ordination between VA initiatives (led by the Ministry for the Environment, in charge of GHG policy) and the Energy and Environment Agency (ADEME) activities to promote energy efficiency (dwindling since the mid 1980s) hampered the use of a well-articulated policy-mix involving incentives towards more ambitious targets. An improved co-ordination between GHG policies and energy-efficiency promotion (given the recently increased budget of ADEME) remains a crucial policy challenge for the future.

As regards VA target achievement, firms appear mostly in compliance with VA commitments (in particular those involving targets for specific emissions) despite the lack of sanctions for non-compliance. Furthermore, the packaging glass case shows that even if the VA objectives for specific emissions were close to business-as-usual ex-ante, they turned out to imply some additional efforts by the firms ex-post, in view of the low energy prices of the late 1990s. This means that the VA objectives provided a sort of insurance and guaranteed some improvement on specific GHG emissions by a group of energy-intensive sectors. In contrast, both case studies show that the achievement of the « not so ambitious » targets for absolute emissions may be seriously undermined by production levels which turned out to be higher than predicted at the time the agreements were signed.

Regarding VA impact on firms' behaviour, it was very difficult to identify efforts towards energy efficiency improvement (or CO₂ emissions reduction) which were mainly motivated by the VAs. Probably, the low ambition of VA objectives meant a higher priority of other developments (e.g. restructuration and cost-reduction, technology modernisation, concerns spurred by other environmental regulations, etc.). Further drivers for energy efficiency improvement (and GHG emissions reduction) were provided by ISO 14001 certification (another voluntary initiative, which helped identify further scope for energy efficiency improvements), image considerations (cf. CF₄ reduction by Pechiney), environmental policies (set e.g. to increase recycling, to reduce of air emissions, etc.) and energy policy developments (in particular, de-regulation of energy markets opened the scope for cogeneration).

Finally, although the crucial importance of defining VA enforcement mechanisms remains incontestable as a general normative prescription (and appears key to VA credibility in the future),

the empirical evidence seems to somehow weaken the case for criticising the low public follow-up and enforcement efforts in the studied VAs. In particular, given that the VA objectives were not really ambitious and that firms had their own interest in implementing the involved efforts (due to modernisation and cost reduction plans and to the image advantages associated to VAs), the decision of not devoting too many resources to follow-up and enforcement could appear, to some extent, justified.

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Appendix 1. LIST OF ACRONYMS

ADEME	Agence de l'Environnement et la maîtrise de l'énergie (French Environment and Energy Agency)
AFITE	Association Française des Ingénieurs et Techniciens de l'Environnement
AS	Agreement Scheme
ATEE	Association Technique Energie Environnement
BATNEEC	Best available technology not entailing excessive costs
BaU	Business as Usual
CEREN	Centre d'Etudes et des Recherches Economiques sur l'Energie
CF ₄	Carbon tetrafluoride
CNPF	(French Umbrella Business Association)
CO ₂	Carbon dioxide
CSVMF	Chambre Syndicale des Verreries Mechaniques de France (IA of packaging glass and tableware glass branches)
DRIRE/s	Direction Régionale de l'Industrie, de la Recherche et de l'Environnement
ECP/s	Energy Conservation Project/s
EPE:	Entreprises pour l'Environnement (industry association concerned with environmental issues)
GHG/s	Greenhouse Gas/es
IA/s	Industry Association/s
ME	Ministry for the Environment
MI	Ministry for industry
MIES	Mission Interministérielle pour l'effet de serre (Inter-ministerial task force on the Greenhouse effect)
MtC	million tons of CO ₂ equivalent
PBP	pay-back period
PEE	Programme Entreprise Environnement
SEI	Service de l'environnement industriel, Ministère de l'Aménagement du Territoire et de l'Environnement
SG	Saint Gobain
SMEs	Small and Medium Enterprises
TGAP	Taxe Générale sur les Activités Polluantes
UNFCCC	United Nations Framework Convention on Climate Change
VA/s	Voluntary Agreement/s
VAIE	Voluntary Agreements, Implementation and Efficiency

Appendix 2. LIST OF INTERVIEWEES

Guy Tackels - Saint-Gobain Conceptions Verrières - Environmental and specialised R&D
Nicholas Harris - Saint-Gobain Emballage - Technical, R&D and Environmental Direction
Mr Labeyrie - Saint Gobain Emballage - Head of Melting Operations, Oiry site
Guillaume Woringer - Saint Gobain Emballage - Plant Manager (Oiry site)
Pierre Degremont - Tourres et Cie (Verreries de Gravelle) - Head of Quality Systems
Guy Michel - ADEME - Industry Directorate, Engineer in charge of building and glass sectors
Richard Armand - Entreprises pour l'Environnement - Managing Director
Michel Labarre - Pechiney - - Aluminium Metal Group - Director, Environmenal Affairs and Industrial Risk
Yves Hellot - ADEME - Industry Directorate
Didier Bosseboeuf - ADEME
François Durand - SEI - Ministère de l'Aménagement du Territoire et de l'Environnement
Christophe Ewald - SEI - Ministère de l'Aménagement du Territoire et de l'Environnement
Mr De l'Hôpital - BSN
Antoine Bonduelle - INESTENE/Réseau Action Climat (NGO group on Climate Change issues) - Researcher
Olivier Gillet - Aluminium Specialised Engineer - ADEME
Benoît Simon - CIRED - Researcher

Appendix 3. Assessment according to VAIE criteria

The primary target of the assessment exercise is to analyse the experience with the agreement scheme (AS) -setting the policy framework to conclude agreements at branch or firm level-, the voluntary agreements (VAs) concluded with individual branches or firms and the energy conservation projects (ECPs) -undertaken by firms to meet the VA targets- (Kraemer & Hansen, 1999). To this aim, a number of common VAIE hypotheses and assessment criteria were explored based on the evidence from the case studies.

As regards the hypotheses, they explore at the AS level the motivations for using agreements, the actors involved, the relation to previous policy practice and also the expected results. With regard to the VA, they focus on their flexibility, the use of sanctions, their effects for different types of firms and their long-run effects as regards industry and government knowledge of energy saving opportunities. Finally, as regards the ECPs, they focus on their importance relative to other activities, the actors involved (within the firm), and their main motivations.

As regards the assessment criteria, they mainly refer to the procedure and content of VA policymaking (focusing on the institutional demands posed by the AS, and on a list of normative requisites regarding AS/VA organisation and content) and the VA impact (focusing on static and dynamic efficiency concerns, political concerns, etc.).

a. VAIE Hypotheses regarding AS

AS.1 IAs basically support agreements in order to avoid stricter regulation in the future (e.g., emission standards)

This statement is partly confirmed by the French case. Nevertheless, it should be stressed that the threat of stricter regulation was highly uncertain at the time the agreements were negotiated. In particular, after the policy statements of the French government in 1994 and 1995 the threat of a French carbon tax had all but disappeared, although the threat of an eventual EU energy tax couldn't be discarded (as shown by the hot debate at the European Parliament in 1997-99), and firms probably saw VAs as a means to obtain a reduction or an exemption from it.

In addition, other elements shaped the motivation of packaging glass and aluminium producing firms to participate in VAs, as mentioned above: the need for an environmentally friendly image, and

restructuring efforts which made it timely to negotiate environmental requirements at a time when new investments were shaping and setting their technological capabilities for the following decade.

AS 2. Politicians primarily support agreements to actively work for environmental protection without overburdening firms

This statement is true in the French case. Many studies financed by the ME in the early 1990s aimed at identifying the potential competitive effects on energy-intensive industries, and in general there seemed to be reasons for concern. The main motivation in starting a dialogue between ME and industry was then government's willingness to prove that there was a consensus in the need to avoid firms delocalisation. Both ME and industry representatives interviewed confirmed this. Actually, this statement is included in the « standard VA text». Nevertheless, it is worth pointing out that the political level at the ME was more committed to VAs than the technical level. In the end, the final negotiations and signature of the agreements involved mostly officials at the political level.

AS 3. Agreements as a policy instrument close out the influence of parties not directly involved in the process, e.g., environmental organisations

This is true in the French case not only for environmental organisations but also for Parliament, as no actor other than ME, Industry Associations, MI and ADEME had any participation in VA formulation nor negotiation. Nevertheless, it is worth pointing out that a parliamentary debate open to all stakeholders on energy policy and environmental impact was launched in November 1994, before the setting of the National Programme, i.e. the basis for the AS. This provided the government with information regarding the main concerns of different stakeholder groups regarding the environmental and economic trade-offs involved in GHG policies, but did not involve a direct debate on neither specific policies nor goals. Taking into account that this very much follows the usual procedure in French environmental policymaking (where laws set general policy guidelines while the ME has considerable discretion to set specific instruments and goals), VAs don't exhibit less stakeholder involvement than traditional environmental policymaking.

As regards environmental groups, their perspective was clearly in favour of a carbon tax as the policy instrument to deal with CO₂ emissions. Consequently, NGOs opposed VAs from principles, a case which was strengthened by the low ambitiousness of the VA objectives finally adopted and the lack of sanctions in case of no compliance. Nevertheless, it is important to stress that environmental NGO participation as regards national policies concerning industry CO₂ emissions is not pervasive. No document was found stating NGO position regarding the VAs, so it may be said that there was a rather « silent » opposition of environmental NGOs vis-à-vis VAs.

AS 4. AS are a continuation of the logic of previous policy towards industry

The AS seemed to imply a policy continuation in many ways. Firstly, despite the introduction of a new actor in the dialogue with industry (the ME) as regards GHG emissions issues, due to the lack of co-ordination between the VAs handled by ME and ADEME's promotion of energy efficiency, the areas of influence of the two bodies remained separated, and hence the introduction of GHG policies didn't affect the logic of ongoing energy efficiency policy. Secondly, CO₂ reduction was a new issue in the environmental policy agenda, which has in the French case quite often led to a dialogue approach between ME and Industry (Börkey & Glachant, 1997). Thirdly, there is an additional element that seems worth pointing in the French case: the traditional relevance of the European policy debate in shaping French environmental policies (Lévêque, 1999). At the time the AS was being defined in France, VAs for CO₂ reduction or energy efficiency improvement were already discussed or in place in other European countries. This probably reinforced the case for the use of VAs in France.

AS 5. The effects of the agreements in terms of energy savings are very close to the base-line scenario

This statement seems correct for the French case. As mentioned above, our fieldwork results indicate that VA objectives mostly involved improvements that industry found it profitable to undertake (close to BaU). Nevertheless, it is worth pointing to two additional considerations highlighted by the French experience. Firstly, in a context of restructuring and important investment plans, BaU reductions may prove to be substantial (specific emissions targets look quite above the past trend). Secondly, BaU estimates of energy efficiency and CO₂ emissions are based on forecasts (e.g. for energy prices and production levels) which are quite often subject to error, as proved to be the case in the French VAs studied. In this connection, if absolute emissions targets prove to be (at least nearly) kept, then the statement above might be proved wrong (which still seems unlikely at this stage, notably due the upward revision of production predictions).

b. VAIE Hypotheses for Voluntary Agreements

VA 1. Firms have big room for interpretation within the different VA contracts

This hypothesis is confirmed by the two case studies of VAs. It is true not only as regards the flexibility in the implementation of the standard VA procedure as regards objectives and reporting procedures, but also, given each VA objectives, firms were free to choose the means to achieve them.

In addition, having two types of objectives might have also added flexibility to the VA commitments.

In contrast to specific objectives which depend mostly on technology improvements and investment decisions (and are likely to be kept), absolute objectives depend more on production levels, for which the forecasts were revised upwards for the year 2000. From the Aluminium VA text it may be interpreted that specific emissions goals were ‘*de minima*’ objectives, which will definitely be kept. Probably both types of objectives were set in order to provide some insurance against forecast errors (and this interpretation may also apply in the packaging glass VA case).

VA 2. Authorities seldom use sanctions if firms to not keep VA commitments

This was never considered in the French case, in particular since no sanction provisions were included neither in the standard VA text nor in the VAs actually signed. Furthermore, according to the French Constitution it is not possible to enforce VA commitments, unless a fall-back regulation is explicitly included (which is not the case in CO2 VAs). Nevertheless, firms are likely to comply with their specific commitments (and the reasons for an eventual non compliance with absolute commitments stem mostly from prediction errors).

VA 3. (adapted) VAs have a different impact on large firms as compared to SMEs

This seems to be confirmed by the packaging glass case study: large firms find it easier to comply, due to different pollution measurement equipment, restructuring efforts, etc. Besides, the VA negotiation process seems to have involved mainly the big actors.

VA 4. In the short run, VA does not improve the level of energy efficiency 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

This hypothesis is not confirmed in the French case, where VA characteristics do not suggest major long-term effects on energy efficiency practice. Although many efforts seem to be undertaken by firms which have an impact on long-term energy management (investments, technical and organisational change, ISO 14001 certification, etc.) it is very difficult to relate them to the VA. In general they seem to have been driven by other considerations: competitiveness, restructuring, marketing advantages, etc. Besides the two industry branches studied had already developed a high competence in energy management, which constitutes a core issue for their competitiveness due to the high impact of energy costs.

VA 5. Firms get more information through VA networks on energy efficiency, which reduces transaction costs of energy saving projects

No significant information exchange among firms seems to have resulted from VA negotiation and

implementation, and it wasn't specifically fostered through the VA. Nevertheless, interviewed firms from the glass industry mentioned that dialogue had increased considerably regarding energy issues, which are normally a quite sensitive issue much linked to competitive parameters that firms were previously unwilling to co-operate upon. That is not the case regarding recycling, for instance, where the industry has been co-operating for some 25 years now. All in all, in the packaging glass case, it was probably the case that the multi-issue VA gave a forum for discussion of restructuring efforts and energy efficiency issues, but it is difficult to assess its effects for learning and reducing transaction (adoption) costs of energy saving projects. Nevertheless, there seem to be other channels for learning. The two main firms have many plants using the same processes, and considerable learning stems from that (usually one plant initiates efforts in a test-phase, and then verified procedures are extended to other sites). As regards smaller plants, it is usually the bigger firms (notably SG for the SME interviewed) who supply smaller firms with technology. This means that dialogue on main technology parameters, at least for core-processes may be discussed at least on a bilateral basis.

VA 6. Authorities get a deeper knowledge of the specific production processes through VAs (VAs decrease the asymmetric information problem)

Considering the information in the VA text and in the reports of progress, the ME seems to get more information on aggregate evolution of emissions at industry level rather than detailed information on technical possibilities to reduce emissions at firm-by-firm level. Nevertheless some technical information is also available, in particular regarding the adoption of specific processes in particular plants which have a major incidence in industry numbers.

c. VAIE Hypotheses for Energy Conservation Projects

ECP 1. Energy conservation projects are often a minor appendix to everyday life of the firm, therefore they will be related to other issues the firm finds more important

This seems to be confirmed by the two case studies, and is mostly due to the fact that VA objectives did not require much effort in energy conservation in addition to what appeared profitable to firms. This led to a higher priority of other objectives such as environmental concerns spurred by regulations, restructuring efforts, competitiveness issues, etc.. In both case studies, most sources for CO₂ improvements seem to stem from efforts towards restructuring, compliance with other regulations, cost-reduction, etc..

ECP 2. Most ECPs are implemented in a top-down approach from management

This is not completely confirmed by the case studies. Although it was found that the implementation of many VA and other restructuring objectives implied a top-down approach, that is not the case for energy efficiency improvements, which are mostly decided at plant level.

ECP 3. ECPs are often rather technical and therefore involve mostly the technical staff

This hypothesis is not confirmed in general. In particular, firms implementing ISO 14001 systems need to involve all staff in the process. Similarly, the restructuring process parallel to the VA timeframe also helped change management practices and involved most personnel. Besides in large firms where energy has a high relevance in costs, there is a continuous debate on energy practice involving the group-level energy director and energy and maintenance managers at individual plants.

ECP 4. ECPs do not relate to the public relations strategy of the firm (information disclosure)

This hypothesis cannot be rejected nor confirmed by the case studies. Both agreements gave much importance to image considerations which allowed for giving much importance to particular ECPs (like the CF₄ issue in the Pechiney VA and recycling objectives in the packaging glass VA). Furthermore, ISO 14001 also relates to transparency and aims at showing continuous improvement in environmental management.

d. VAIE assessment criteria

d 1. Static efficiency concerns (environmental and cost effectiveness)

A usual concern in VA evaluation is to analyse firms' burden-sharing of efforts towards the collective VA goal, in order to check that it is undertaken at minimum cost (i.e. low cost sources for reducing emissions bear most of the reduction burden). From this perspective, the French VAs seem to have been quite cost-effective, since they gave firms a maximum of flexibility to meet the VA goals and furthermore, the VA objectives mostly led to the adoption of emissions reduction efforts which firms found worth undertaking due to their economic returns.

Nevertheless, as pointed out by Börkey & Glachant (1999), it is worth separating VA environmental effectiveness (which relates to the ambitiousness of the VA objective), from VA cost effectiveness (which relates to the costs of achieving the adopted VA objective). From this perspective, the French VAs exhibit a trade-off quite often found in VA evaluation: although the French CO₂ VAs seem to show a good performance as regards cost-effectiveness, they do not appear very ambitious as regards the environmental targets adopted (OECD, 1999).

d 2. Dynamic efficiency concerns

Other than the impact of the VA and its cost-effectiveness during the period covered by the agreement, it may also be asked whether the VA objectives and their implementation lead to positive longer-term effects. As mentioned above, the VAs do not appear to have spurred major changes in firms' energy practice.

Firstly, no binding specification of the means to achieve the VA objectives was included in the VA texts, nor demanded by the ME. Secondly, no specific changes in energy management by firms was required by the VA, save for the transparency and information requirements by the ME, which resulted in ISO 14000 certification provisions in the packaging glass agreement. Although a closer control of CO₂ emissions can be seen as an energy management change resulting from the studied VAs, arguably the preparation of the environmental management systems for ISO 14000 certification is an improvement which would have resulted from firms competitive concerns in the absence of policy action. Even if some firm initiatives seem to have had a direct impact on CO₂ emission reduction (e.g. inclusion of higher PBPs in investment decisions, some « additional » improvement in energy efficiency in non-core processes in the packaging glass case, etc.) they seem to be mostly motivated by long-term concerns (cost-reduction, industry's anticipation of a carbon tax, etc.).

d 3. Institutional demands on regulator and regulated part (e.g. necessary expertise, control and enforcing)

It could be said that the AS didn't pose many specific nor new institutional demands. Firstly, VAs had been signed before by the ME, and SEI officials were already specialised in environmental regulation of the particular industries involved in the VAs for CO₂ reduction. Secondly, it may be argued that one main challenge of the CO₂ VAs would have been to co-ordinate ME policy with ADEME efforts in promoting energy efficiency improvements. These efforts were not undertaken and pose a challenge towards the future.

On the benefit side the AS led to a substantive information collection by the ME regarding industry's past record and future prospects regarding emissions, though it is unclear whether this meant useful learning for future GHG regulation. On the one hand, both industries studied underline that restructuration efforts undertaken in the 1990s leave no room for substantial technical change in the next 10 years, so the information gathered is valuable regarding core-process energy efficiency. On the other hand, firms admit there are still many efforts to be made regarding energy efficiency in non-core processes. In this last regard, the ME has not gathered much information through VAs.

Although ADEME is undertaking a new study on the potential of energy improvements in industry it is not clear to what extent this will be used in the next round of industry regulation regarding CO₂ emissions unless a closer ME-ADEME co-operation is initiated.

Finally, it is worth noting that as regards monitoring and enforcement we have a paradox: although some criticism is justified regarding the lack of follow up, monitoring and enforcement of the French VAs, in view of their modest ambitiousness (firms found it in their own economic interest to undertake most of the energy efficiency efforts committed under the VAs), it could be said that the decision of not devoting too many resources to monitoring and enforcement was justified.

d 4. Political considerations (e.g. distribution of costs and benefits with AS)

Political considerations played a key role in AS adoption. As mentioned above, industry loss of competitiveness and eventual delocalisation was perceived as the risk involved in the adoption of a carbon tax (the policy alternative to VAs hotly debated at the beginning of the 1990s). Government was keen in avoiding this risk through a consensus approach towards energy-intensive sectors which faced international competition. Furthermore, another political consideration worth mentioning is that quite often policymakers rely on more dynamic and concentrated industries rather than more atomised sectors, due to the ease of dialogue. In the CO₂ case, focusing on a few key energy-intensive industries also made it more likely to bring about improvements.

d 5. Risk (of failure or non-compliance)

Firms seem to comply with the VA commitments (at least with those regarding specific emissions) in their hope to show progress and to keep an environmental image. Nevertheless, it is clear that non compliance with absolute objectives won't involve sanctions. For the government, this may pose serious problems as it would imply the need to reduce emissions elsewhere in order to keep Kyoto commitments, and hence the need for a new policy package in January 2000.

e. Normative criteria for the AS

e.1. Checklist of Organisational Prerequisites

A clear statement should be articulated concerning the role, rights and responsibilities of all parties	VA objectives were clearly stated, but burdensharing among firms for branch-level VAs was not.
The government should have an agency close enough to	There exists such an agency (ADEME)

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	but was not involved in VA negotiation nor enforcement.
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e.1. Checklist of Organisational Prerequisites (continued)

The jurisdiction in question should have an administration to interpret the terms of an agreement scheme	Not relevant
Environmental interests should be sufficiently organised and informed concerning the environmental performance and potentials of firms and industrial sectors	Environmental groups were not involved in VA negotiation nor follow up
A system involving concerned parties, independent of industry, should be established to monitor and verify progress towards, and achievement of targets	No independent monitoring was set, but rather based on IA self-reporting to the ME

e.2. Checklist for the Contents of the AS

Improvement targets and procedures should be transparent, known and understood by the key stakeholders involved	Objectives clearly stated at VA level but not at AS level.
There should be a mechanism for imposing sanctions in the event of non-compliance	No sanctions were included.
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 a VA	An independent (bottom-up) estimate of the scope for energy-efficiency improvements was available but it was not conducted by the ME with the purpose of better directing VA efforts. Estimates relevant for VAs basically came from industry.
Obstacles to restrain free riders should be implemented when AS involve a collective of firms (only relevant where in AS where industrial organisations have been involved)	No provisions included, but there doesn't seem to be a free-riding problem.

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 (for more details go to <http://www.akf.dk/vaie>).

Task A: Theoretical model and meta-analysis, followed an approach from Economics and included three models on voluntary agreements. Two models are confronted with a meta-analysis based on existing case studies 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 some simplifying assumptions the analysis derives welfare implications of agreements. Reference: M. Chidiak, M. Glachant & 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. Reference: T.P.Kraemer & K. Hansen (1999): Task B - Framework for the Country Studies, AKF Forlaget, Copenhagen

Task C: Country Studies. The five country studies in Denmark, France, Germany, the Netherlands and Sweden are based on case studies. The objective is primarily to identify impact mechanisms at firm level in relation to the implementation process. References:

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

K. Johannsen: Voluntary Agreements, Implementation and Efficiency. The Danish Country Study. Case studies in the sectors of paper and milk condensing, AKF, Copenhagen

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

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

M. Rietbergen, M. Breukels & K. Blok: Voluntary Agreements, Implementation and Efficiency. The Netherlands Country Study. Case studies in the sectors of paper and glass manufacturing, Utrecht University.

Task D: Actual outcome - the non-intervention case. Three methods: monitoring of 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. Reference: M. Rietbergen & K. Blok: The Environmental Performance of Voluntary Agreements on Energy Efficiency Improvement, The task D report from the VAIE Project, Utrecht University.

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, focusing on the question of implementing agreement schemes at the EU level. Reference: P. Helby: Voluntary Agreements, Implementation and Efficiency. Task E. Transferability of case study lessons to voluntary agreement schemes at the European Level, Lund University.

Task F & G: Conclusions and Policy Recommendations, summarises the findings from the project and gives policy recommendations concerning voluntary agreements. Reference: S. Krarup & S. Ramesohl: Voluntary

Agreements - Hot air or a key to higher energy efficiency, AKF Forlaget, Copenhagen.