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Voluntary agreements as an instrument to substitute regulating and economic instruments

Lessons from the German voluntary agreements on CO₂ reduction

Paper submitted to the
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Abstract

Voluntary agreements in various forms are being increasingly regarded as an instrument to substitute or complement regulating and pricing instruments. As, from a theoretical point of view, this instrument has strong proponents and opponents, it is important to make a careful analysis of the achievements of current voluntary agreements and their specific advantages or drawbacks in their specific objective and social context. The following paper analyses the voluntary agreements of the German economy with respect to CO₂ emission targets, achievements up to 1995, the monitoring process implemented, as well as the foreseeable progress up to 2005. The analysis distinguishes among the industrial branches (where trade associations signed the declaration for their member companies), the electricity supply sector and the remaining energy sector (gas and water supply, municipal supply companies, mineral oil trade), which, for the first time, has declared reduction targets for their clients. For voluntary agreements to become as successful as regulating and economic instruments, it is important for all the parties involved to see the declarations as a process which transforms the quantitative goals into moving targets.

Voluntary agreements as a substitute for or complement to regulating and pricing instruments: theoretical considerations

Declarations and voluntary agreements of individual industrial associations or large companies have been increasingly discussed and practised in attempts to limit CFC production and emissions, to increase the energy efficiency of mass-produced products, and to reduce energy-related CO₂ emissions in the industrialized countries. The hypothesis which is explicitly, or implicitly, assumed for this instrument is that the actors using it in individual branches and companies can achieve similar environmental benefits as dictated by the state in regulations or taxes, but at lower costs (CEC, 1996; IEA, 1995; Solsbery/Wiederkehr, 1995; van Dunne, 1993; Schafhausen, 1994). For several years, German industry has been signalling its interest in voluntary agreements through talks between the head organisation of German industrial associations, BDI, a few member associations and the Federal Government. The industry sees such agreements as their contribution to climate protection if regulating or price measures of the state, i.e. the impending heat recovery ordinance and CO₂/energy tax, could be avoided or delayed. A similar situation also exists in the Netherlands.

The German economy, which is represented by the BDI as well as by several associations of the energy supply sector, is convinced that improving energy efficiency and reducing CO₂ emissions are more likely to be achieved at a reasonable cost through voluntary agreements with clear targets than by imposing a CO₂/energy tax or regulation (BDI, 1995). In support of this position, the industry argues that, on the one hand, energy-intensive branches introduce - when it comes to reinvestments - the most recent and energy-efficient technologies anyway, and that, on the other hand, energy-related regulation would entail such an administrative cost to the companies that it would hardly be paid off by the energy cost saved. Therefore, energy taxes would have only a small impact on energy efficiency and would tend to increase the general tax burden and reduce the competitiveness of the German economy.

This line of reasoning was also expressed in the *Declaration of the German Industry for Climate Protection* of March 10, 1995, in which

- ten member associations of the BDI (extended to 14 in 1996),
- the association of industrial power generators, VIK,
- three associations of the energy supply sector: the association of gas and water supply companies, BGW, the head organisation of electricity supply companies, VDEW, and the organisation of municipal companies, VKU (the mineral oil association, MWV, joined the declaration later on),
- as well as the German Association of Industry and Commerce (DIHT).

declared that, compared to 1987, they would reduce the specific energy consumption of their member companies by up to 20 % by 2005. This declaration was amended in several points on March 27, 1996 and re-aligned on 1990 as the base and the target was sharpened to 20 % (BDI, 1996).

The declaration stressed that there are branch-specific potentials for a CO₂ reduction, which were individually evaluated by the industrial associations. The declaration also announced a transparent and verifiable monitoring process and fixed the date for the first monitoring report for Autumn 1997. Finally, the declaration stated the expectation that "the Federal Government should give priority to this private initiative rather than to regulating and fiscal measures for climate protection and should definitely renounce the introduction of a CO₂/energy tax" (BDI, 1996).

The German Government considers the declaration of the BDI with its 14 associations of energy-intensive industries as well as the four associations of energy supply industries (BDI, 1996) as "a way to more self responsibility of the German economy" (Bundesregierung, 1995). The Government declared "that regulative measures for climate protection such as the heat recovery ordinance will currently not be pursued further and private initiative should be given priority according to the coalition treaty of the government parties". But the German Federal Government also stressed the possible complementary role of voluntary agreements saying: "If the agreements do not meet the targets, the Government has to reconsider the necessary steps. Regarding the introduction of a CO₂/energy tax at the EU-level, the Federal Government pursues a solution which covers at least the EU, does not increase total tax income and does not change the competitiveness of industry."

Economic research institutes and economists in administration and policy have doubts about the efficiency of such declarations and voluntary agreements (e. g. WI, 1995; ZEW, 1996). They argue that each company which, under given frame conditions, carries out more CO₂ reduction measures than it would do from a company-oriented point of view, will inevitably drift into a worse cost/benefit situation compared to its competitors. As no company would do this on a voluntary basis, the authors question the practical realization of such voluntary agreements, especially "if there are many participants and the associations do not dispose of mechanisms for sanctions" (Holzhey/Tegner, 1996; ZEW, 1996; DIW, 1995). The proponents of this line of thinking base their arguments to some extent on general considerations that, in a functioning market economy, there should be an equilibrium occurring at minimum costs. If one participant in the market deviates consciously from this minimum and carries out additional investments for the reduction of greenhouse gases, he is worsening his situation compared to other participants in the market, because he cannot be sure that they will react in a similar manner ('prisoner dilemma', see Bonus, 1979).

Institutes which work on a more empirical basis object to this way of thinking and argue that there are barriers and market imperfections which create substantial economic potentials for energy efficiency and substitution options, which could - at least partially - be realized by the efforts of companies and associations (e. g. through information, training and consulting). Or, in the cases of investments with comparable profitability, companies could consciously give priority to climate protection options (Gillissen et al., 1995; Jochem/Bradke, 1996). These two opportunities for investments in climate protecting options are summarized in the Anglo-Saxon specialized literature under the heading of "no regret" strategies (Howarth/Andersen, 1993; IPCC, 1996). The term indicates the situation of an untapped potential for economic measures of the investment or organisational type.

With this argumentation, the discussion between the two schools of thought shifts to the question of the amount of transaction costs necessary to overcome the existing barriers, and to the statement that two equally profitable investments may nevertheless have different secondary consequences. At present, it is not possible to finally resolve this controversy due to a lack of empirical evidence. However, it highlights the fact that, with the voluntary agreements of the German industry, a political instrument has been brought to a test stage in the field of climate policy for which the chances of success are judged very differently amongst scientists, administrators, and trade associations.

If the efficiency of voluntary agreements (i. e. the conformity with goals) is to be judged, the concrete shape of this instrument has to be taken into account as well as the more theoretical discussion of voluntary agreements being a relatively "soft" alternative to regulations (legally less binding, less scope for sanctions). It has to be considered, e. g. how the achievement of the target is to be monitored and how the specific measures undertaken by the party involved in the agreement are related to the changes observed in CO₂ emissions as these are influenced by numerous factors such as existing ordinances and financial incentives or upcoming contracting suppliers.

For the first time, the declarations of the German industry of March 1995 and 1996 do not have products as the object of a target (e. g. such as electric appliances or cars in 1978, or the CFCs in the late 1980s), but

- the production technology in the case of the industrial declarations, and
- the decisions and the energy use of clients in the case of the energy supply industries.

Changes in production technology or energy use of private households may be influenced by many factors and it will therefore be much more difficult to prove that the targets have been reached which places high demands on the monitoring process. As a kind of slogan, Hager (1993) says that it is only a small step from cooperation to collaboration, from informality to illegality. These expressions refer to an administration losing the neutrality which is vital to it. Parties not present at the negotiating table risk their interests not being considered in a sufficient manner. There is the possibility that solutions by consensus elude control by public discussion or by the courts (Hoffmann-Riem, 1990).

In contrast to the voluntary agreements in the Netherlands and in Denmark, where the associations or companies make a formal and legally binding treaty with the government, the declarations of the BDI and its 14 co-signing industrial associations, as well as of the four associations of energy supply industries (VDEW, BGW, VKU and the mineral oil association MWV), are unilateral declarations. Furthermore, the declarations take 1990 as the base year, not 1995, the year of the first declaration. 1990 was the year in which the East German industry - after reunification - shrank catastrophically, and in which the entire East German economy began a major restructuring process. This backdating of the base year to a point in time five years before the first declaration generates new problems for the evaluation as, for the period 1990 to 1995, apart from enormous structural changes, one has to distinguish between investments which were "carried out anyway" due to necessary

reinvestments being postponed for years or decades, and others which were carried out in expectation of a CO₂/energy tax ("special efforts").

The database for the declaration of the German economy

The base year 1990 (which is the base year chosen for the Climate Convention) is not without problems for the analysis in East Germany, as this year was largely dominated by the restructuring process, and the energy consumption statistics are therefore very often incomplete. But 1995, the year of the first declaration of the German industry, also brought with it a substantial change in the official production statistics, thus implying new uncertainties and the need for further estimates. Structural statistical problems will be added to these uncertainties in the next ten years

- because industrial companies are increasingly outsourcing parts of production and service areas, i. e. their production plants are partially accounted for under a different classification in the economic statistics (this has already been able to be clearly observed in East Germany since 1991);
- because the companies in industry and the service sector as well as public bodies are increasingly buying energy services instead of energy carriers which are either provided by energy supply companies or by third parties and induce obvious changes in the structure before production.

Hence, developments of specific CO₂ emissions may be observed which are difficult to interpret in branches which are greatly affected by structural changes.

Despite these difficulties, in the following, an attempt was made to calculate the CO₂ emissions of individual industrial branches and of the share corresponding to the energy which supply companies are selling to their clients in private households and the tertiary sector (see Table 1).

In the industrial sector, the absolute CO₂ reductions from three associations (45 to 48 million tonnes up to 2005) have to be added to those CO₂ reductions for which the associations fixed only a specific goal (related to the production). By assuming a certain development of the production for the individual branches, for this group, a CO₂ reduction of about 7 to 10 million tonnes by 2005 is obtained (see Table 1). In total, the declaration of the German industrial sector implies an absolute CO₂ reduction target of 52 to 59 million tonnes by 2005.

A glance at the statistics of the years 1990 and 1995 shows that industry's fuel-related CO₂ emissions alone were reduced by 44 million tonnes CO₂, i. e. by 23.8 %, and the electricity-related emissions by a further 25 million tonnes if the electricity demand is

Table 1: CO₂ emissions of the member companies (or client groups of the energy supply associations) for 1990 and 1995 in Germany, as well as the CO₂ reduction envisaged according to the 1996 declaration of the German industry

	CO ₂ -emissions 1990		CO ₂ emissions 1990		CO ₂ reduction by 2005 accord. declar. March 1996		difference in 2005 compared to 1990 in million tonnes
	in million tonnes ¹⁾		in million tonnes		in million tonnes		
	fuels ²⁾	electricity ³⁾	fuels ²⁾	electricity ³⁾	absolute	estimate ⁴⁾	
cement	9.1	2.8	8.51	2.68		0.5 - 1.0	
lime	2.0	0.4				0.3 - 0.4	
brick industry	2.4	0.1				0.3 - 0.4	
refractory industry	1.6	0.9				0.25 - 0.3	
iron/steel	56.7	14.6			17.8 - 21.0		
chemical industry	34.1	38.9	> 45.0		23.8		
pulp/paper	7.1	7.8				0.7 - 1.5	
non-ferrous metals	4.3	10.9				1.5 - 2.0	
glass	3.3	1.5				0.5 - 0.8	
ceramics	2.0	1.6				0.3 - 0.4	
textile industry	5.1	4.3				2.0 - 2.5	
sugar	4.1	0.9				0.6 - 0.8	
potassium	2.2	2.5	0.94	0.3			
Total industry	169.7	136.8	126.8	111.9	45.3 - 48.5	7.0 - 10.1	52.3 to 58.6
VDEW (electricity)	289.0	-	270.0	-	27.0	-	27.0
VIK (cogeneration)	n.a.	n.a.	-	-	-	-	-
BGW (gas)	52.4	-	75.6	-	47.3 ⁶⁾	-)
VKU (municipality)	80.1 ⁵⁾	56.0	87.7	60.0 ⁷⁾	34.0 ⁸⁾	-ca. 13 ⁹⁾) 53.5 ¹⁰⁾
MWV (mineral oil)	70.0	-	80.0 ⁷⁾	-	-	-)
Germany	998.2		882.4		105.0 - 110.0	25.0 - 31.0	132.8 to 139.1 ¹⁾
¹⁾ rounded				⁶⁾ individual target without overlap with the gas industry's target			
²⁾ without fuel-related CO ₂ emissions for autogeneration of electricity				⁷⁾ estimate for 1995 on the basis of 1994			
³⁾ calculated with the specific emissions of gross electricity generation				⁸⁾ individual target without overlap of 25 million tonnes with VKU			
⁴⁾ estimate concerning production development and declared reduction of the specific energy consumption or the specific emissions				⁹⁾ without substitution of heating oil by gas			
⁵⁾ of which 40 % for industry, 60 % for private households and tertiary				¹⁰⁾ integrated target of CO ₂ reduction			

weighted with the specific CO₂ emissions of the public electricity supply. Therefore, the declarations of the industrial associations have, in sum, already seen their targets achieved by the end of 1995. This may not be necessarily true for the individual targets, but a better compliance with individual targets in the future could only further improve the result.

The situation is quite different for the target groups of the four energy supply associations. The target here is about 80 million tonnes by the year 2005 when taking into account all double counting (see below). With the exception of the electricity supply sector, which had already achieved a reduction of 19 million tonnes CO₂ by 1995, the other energy supply associations were less successful in their reduction efforts. On the fuel side, about 17 million tonnes were saved in the tertiary sector, whereas the emissions from households increased by 5 million tonnes due to the cold winter. If the values are climate corrected, then 7 million tonnes less were emitted than in 1990. In total, for these two target groups, a reduction of 19 million tonnes (including electricity-related CO₂ emissions) was achieved by 1995, i. e. 37 % of the target for the year 2005.

For the declaration of the German industry in total (industrial sector plus energy supply sector), the CO₂ reduction target was about 130 to 140 million tonnes, of which about 100 million tonnes (i. e. 75 %) had already been achieved in 1995.

This high compliance with the target poses two types of questions:

- A CO₂ reduction in specific emissions of more than 2 %/year (necessary to keep the emissions at the 1995 level as production is still growing) seems feasible for the next ten years in the three final energy-consuming sectors under consideration. How much should the targets, therefore, be revised and increased, particularly for the industry that already met its target by the end of 1995? ESSO (1996) assumes such a decrease in its recent energy demand projection even for West German industry.
- The structural change caused by the German reunification between 1990 and 1995 was so intensive that one could think about making 1995 the second base year of the declaration.

Statistical difficulties with the monitoring process are particularly obvious in connection with the declarations of the three energy supply associations, VKU, BGW and MWV

- because of the considerable overlap of target groups (see below), and
- because of fuel substitution in new and old buildings. In these cases, the definition of the baseline and the delimitation towards the energy saving measures of other actors, e. g. reinforcement of building codes, is unclear (see below).

In reference projections, Prognos (1995) obtains the result that the specific overall CO₂ emissions will be reduced by about 35 %, i. e. if a 40 % increase in gross

domestic product between 1990 and 2005 is assumed, the CO₂ emissions should have decreased by 9.5 % to 909 million tonnes in 2005 (Table 2).

Table 2: Direct CO₂ emissions of the emittents affected by the declaration of the German industry and of emittents not affected, Germany 1990, 1995 and 2005 (reference projection)

sectors	1990	1995 ¹⁾	reference projection 2005 ²⁾
	million tonnes CO ₂		
affected by declaration			
• industrial branches ³⁾	134.0	95.0 ⁴⁾	102.0
• private households	128.6	135.4 ⁵⁾	129.3
• tertiary sector	78.8	58.7	81.0
• public electricity supply	289.0	269.0	260.0
intermediate sum	630.4	558.1	572.3
not affected by declaration			
• remaining industry	35.7	31.8 ⁴⁾	28.5
• transport	184.0	195.9	224.0
• remaining transformation sector (refineries, indust. CHP, coking plants)	148.1	96.6	84.2
total sum	998.2	882.4	909.0
Figures including corresponding shares of CO ₂ emissions related to district heat			
¹⁾ preliminary ²⁾ Prognos, 1995 ³⁾ incl. potassium mining ⁴⁾ estimate ⁵⁾ without climate correction			

Sources: Arbeitsgemeinschaft Energiebilanzen; VDEW, 1996; DIW, 1996; Prognos, 1995

Analysis of the declaration of the German industry

The fuel- and district heat-related CO₂ emissions of the industrial sector (including non-energy mining) decreased from a level of 170 million tonnes in 1990 to 127 million tonnes in 1995 (see Table 3). According to the reference projections (Prognos, 1995), the emissions would stagnate at this level in the future. The CO₂ reduction achieved was essentially a consequence of the collapse and restructuring of the East German industry as well as of the substitution of lignite by other fossil fuels. The importance of these changes can be seen from the fact that the final energy demand of the East German industry decreased from about 840 PJ in 1989 to 296 PJ in 1995, i. e. by 65 %. Also significant are the indirect emissions from electricity generation which caused CO₂ emissions of around 132 million tonnes in 1990. These

decreased by 19 % up to 1995 as a consequence of the shrinking demand in the East German industry, higher efficiency levels in power plants and a better use of capacities in nuclear power plants (Table 3).

Table 3: Fuel- and electricity-related CO₂ emissions of the industrial sector for the years 1990 and 1995 in Germany and reference projections up to 2020

	emissions		reference projection ¹⁾		
	1990	1995	2005	2010	2020
	million tonnes CO ₂		million tonnes CO ₂		
fuels					
• industry, West	120.7	111.3	112	111	111
• industry, East	49.0	15.5	16	16	17
• industry, Germany	169.7	126.8	128	126	128
electricity					
• industry, West	92.9 ²⁾	87.8	93.5 ³⁾		
• industry, East	38.7 ²⁾	18.4	24.3 ³⁾		
• industry, Germany	131.6 ²⁾	106.3	117.8 ³⁾		
Total (Germany)	301.3	233.1	243.8		
1) Prognos, 1995					
2) 1990: specific CO ₂ emissions West: 149 kg/GJ _{el} and East: 312 kg/GJ _{el} ; 1995: 142 (West) and 299 (East)					
3) 2005: West: 135 kg/GJ _{el} and East: 260 kg/GJ _{el} (gross values)					

Sources: Arbeitsgemeinschaft Energiebilanzen; Prognos, 1995; VDEW, 1996; DIW, 1996; own calculations

Considering that the fuel-related emissions have been reduced in relative terms by about 25 % in the last five years, and assuming that, up to 2005, the future reduction were to keep pace with the growth in industrial production, then CO₂ emissions in industry would stagnate at the level of today. The total reduction between 1990 and 2005 would easily exceed the 25 % national reduction target of the Federal Government.

On the other hand, the electricity demand of German industry decreased from 748 PJ in 1990 to 640 PJ shortly afterwards and then increases again in line with the reference projection to 790 PJ by 2005 (+5 %). CO₂ emissions, however, still decrease by about 11 % due to higher power plant efficiencies, higher use of natural gas and CHP plants (see Table 3).

In total, the CO₂ emissions of industry would be reduced by about 20 % according to the reference projections (Prognos, 1995), if one assumes that the specific CO₂ reduction can be achieved on the electricity supply side. If, however, the reasons for the reduction of direct fuel-related CO₂ emissions in the industrial sector are considered in more detail, it can be shown to be essentially a consequence of the following factors:

- an important structural change in energy-intensive branches (inter-industrial as well as intra-industrial changes) to less energy-intensive production, especially in the Eastern part of Germany. *Ceteris paribus*, inter-industrial structural changes contribute more than 12 million tonnes CO₂ to the reduction of emissions up to 2005.
- A considerable structural change between energy carriers to the advantage of natural gas and a higher share of electrical energy. Again the change in the East Germany is more pronounced. Keeping all other factors constant and taking into account the industrial structural change, the contribution of these factors is about 4 million tonnes CO₂ for the substitution among fossil fuels and 15 million tonnes for the substitution of electricity for fossil fuels.
- A considerable improvement in energy efficiency, again with a larger impact in East Germany due to the shut-down of old plants and the construction of the technologically most advanced new production sites. The contribution of energy efficiency is about 25 million tonnes in the reference projection, although this includes the non-specified inter-industrial structural changes.

Whereas the industrial structural changes and fuel substitutions are mostly determined by autonomous developments, the processes used and product quality standards (i. e. they can hardly be influenced by energy policy related measures), energy efficiency is a parameter which can be the target of energy and climate policy. The success of measures is most easily analysed if the declarations of the industrial associations have physical production as the denominator for specific CO₂ emissions. This is possible in nearly all of the 14 branches involved. In the chemical and textile industry, the products are so heterogeneous that net production has to be taken as the reference value. These two branches, however, have also specified absolute CO₂ or energy reduction targets so that the question of intra-industrial changes is not relevant (see Table 4).

As 1995 is the first year of the declaration, the effects of "additional efforts" can, in principle, only be expected to start in 1996. The CO₂ emissions of the German industry for 1995, however, are only slightly different from the reference projection for 2005 (see Table 2). The question therefore has to be asked whether the stagnation of CO₂ emissions could be expected to occur anyway during the next 10 years as a consequence of improved energy efficiency, structural changes and energy carrier substitution when assuming an increase in industrial production of 2 % per year (Prognos, 1995). The development over the past 25 years, in which the specific

energy consumption decreased by about 2.5 % annually, tends to support this hypothesis (Schlomann, 1996). This does not exclude the possibility that

Table 4: Energy consumption 1990, energy and CO₂ reduction targets in the declarations of the BDI and its member associations from 1996, as well as an energy demand projection for 2005 for German industry

Sector	energy consumption 1990 in PJ		specific (sp) or absolute (a) energy or CO ₂ emission reduction by 2005			
			declaration of BDI and sector declarations from 1996	Ref. va- lue ⁴⁾	reference projection (Prognos, 1995)	
	Fuels	Elect.			Fuels	Elect.
potassium mining	36.4	10.9	sp: CO ₂ ³⁾ -66% a: CO ₂ ³⁾ -78%	p -	a: CO ₂	-75%
construction materials	227.6	32.5	no target	-	a: 7.4%	a: 11.1%
- cement	109.5	13.2	sp: fuels: -12.5%	p	n.a.	n.a.
- brick industry	24.3	2.2	sp: CO ₂ -15% (West)	p	n.a.	n.a.
- lime industry	31.1	2.6	sp: CO ₂ -70% (East)	p	n.a.	n.a.
- refractory ind.	8.1	1.0	a: energy -20% ²⁾	-	n.a.	n.a.
iron and steel	675.0 ¹⁾	78.5 ¹⁾	sp: energy -15 - 20% ²⁾	p	n.a.	n.a.
non-ferrous metals	52.0	64.2	sp: CO ₂ -17%	p	sp: energy:	-30%
pulp and paper	96.9	45.3	a: CO ₂ up to -26%	-		
chemical industry	460	198	sp: energy -22%	p	a: energy:	-26%
glass industry	67.0	14.9	sp: energy -20%	p	sp: energy:	-28%
ceramics			sp: CO ₂ -22%	p		
textile industry	55.2 ¹⁾	19.4 ¹⁾	sp: energy -35%	npv	sp: energy:	-35%
sugar industry	36.0 ¹⁾	3.0 ¹⁾	a: CO ₂ -35%	-		
			sp: energy -22% ²⁾	p	sp: energy:	-15%
			sp: CO ₂ -25% ²⁾	p		
			sp: CO ₂ -25%	p		
			sp: energy -20%	p		
			a: energy: -20% ²⁾	-	a: energy:	-28%
			sp: energy -19% (West)	p	n.a.	n.a.
			energy -80% (East)	p		
subtotal of energy in PJ	1705	467			1244 ⁵⁾	415,0 ⁵⁾
other non-participating branches	516	288	no declaration		483	370
total	2222	755	sp: CO ₂ -20%	np	1727	785
					sp: -45%	-25% ö

¹⁾ incl. an estimate for East Germany

²⁾ base year 1987

³⁾ including changes in electricity demand

⁴⁾ p: physical production;

npv: net production

⁵⁾ without sugar

Sources: BDI 1996; Prognos 1995; Arbeitsgemeinschaft Energiebilanzen; IKARUS-databank

individual industrial branches, e. g. the cement industry, or the refractory, glass or steel industries, may encounter more difficulties in achieving their individual targets. These considerations indicate that the global target of the BDI, which has an economic reference value (the net production of the German industry), should be recalculated based on the individual declarations. The reference projections of Prognos (1995) show a decrease in the specific fuel consumption by 45 % and of the specific electricity demand by 25 %. The values for the specific CO₂ reduction are therefore even higher.

The following remarks are particularly important for the implementation of a suitable monitoring process to check the progress made in CO₂ reduction:

- in three industrial branches there are compatibility problems between the official statistics, statistics of the associations and the national energy balance because the coking plants, power plants and the petrochemical industry are partly accounted for under different headings (coal mining or iron industry, electricity sector or coal mining, refineries or basic chemical industry). The voluntary agreement can only be made for individual coking plants, power plants and petrochemical plants. The hard coal mining and the mineral oil sector have, however, made no declaration for their member companies.
- For combustible production waste it has to be established what should be considered CO₂-free and what not. Renewable waste such as that of the wood and paper industry could be considered as CO₂-free. The question is still open in the cases of household and industrial waste as well as sewage sludge which have to be used thermally anyway. Production waste which can be recycled in a material form (e. g. plastic waste, used oils, tyres) as well as additives should, in the opinion of the authors, be accounted for with their CO₂-factors to the extent that these can be attributed to a single use.
- Many industrial associations point at the "additional efforts" which their member companies carried out between 1990 and 1995, especially in East Germany. This argumentation gives rise to some controversy: one point of view is that the companies would have invested in the most modern technology in any case and that these investments were initiated before March 1995. The other viewpoint is that the companies anticipated the introduction of an EU-wide energy/CO₂ tax at the beginning of the 90s by making investments in higher energy efficiency.

Analysis of the declaration of the electricity supply sector (VDEW)

The association of electricity supply companies (VDEW) was one of the first associations to submit a progress report in March 1996 following the first

declaration of German industry of March 1995 (VDEW, 1996). This report distinguishes different measures which the public electricity supply sector has initiated in order to achieve its reduction target. It does not, however, specify which of the measures undertaken are "additional efforts" of electricity supply companies in the context of the declaration:

- demand-side management: the report mentions expenses of 800 million DM/y for advice to clients which has, however, been offered for decades. It is further planned to establish "Guidelines for carrying out DSM projects", though without specifying CO₂ reductions for clients.
- The report sees further profitable potentials for improvements in the efficiency of existing power plants. By 2005 this should lead to an annual CO₂ reduction of 5 million tonnes/y. 41 single measures were initiated after March 1995, especially for steam boilers and turbines (expected reduction 1.8 million tonnes CO₂ per year). Measures carried out in nuclear power plants are expected to lead to an increase in power output of over 100 MW (expected reduction: 0.7 million tonnes CO₂ per year)
- Combined heat and power generation is mentioned in the frame of district heat generation with five new combined heat and power plants brought into service in 1995. A further 40 engine-driven small co-generation plants are mentioned which were being planned or constructed in 1995.
- Also mentioned in the report is the start-up of new power plants with high efficiencies between 1996 and 1998 (two on the basis of hard coal, four lignite plants and seven more combined heat and power plants, mostly on the basis of natural gas). Hard coal plants are partly substituted by the natural gas plants.
- Development of renewable energies: since 1995 some smaller hydro plants with about 85 MW have been built at an investment cost of 800 million DM (reduction: 0.08 million tonnes CO₂/y). In addition, 90 million DM were spent on wind power, biomass combustion and photovoltaics. The report also refers to the imported electricity based on water power from Scandinavia which will have larger CO₂ reduction effects from 2003.
- Joint implementation projects (e. g. 1.2 MW wind power in Latvia at the end of 1995, a 17 MW gas turbine for Königsberg/Poland in 1998 and the installation of 1000 small PV plants in Indonesia) as well as the Eta-competition for rational use of electricity in industrial processes are mentioned in the report.

In total 2.5 to 3 million tonnes CO₂ reduction are explicitly mentioned which can be expected in 1995 and the following two years. However, there are still some open questions regarding the monitoring:

- what increase in electricity demand is the electricity sector expecting up to 2005 in order to reach the absolute CO₂ targets of 27 million mentioned in the declarations?

- As the municipal supply association, VKU, has also made a voluntary commitment, the question has to be raised how the individual efforts of the municipal suppliers and the member companies of VDEW could be monitored in order to avoid double counting of "special efforts" in the fields of DSM measures and CHP.
- If the supply companies adopt large CHP plants from energy-intensive companies as energy service companies (e. g. BASF in 1995; Hoechst in 1997/98), how is this outsourcing accounted for in the monitoring of the industrial branch concerned and the electricity supply industry?

If the target level for 2005 is about 265 to 260 million tonnes CO₂, and electricity demand is expected to increase by a modest 15 % up to 2005 (or an additional 270 PJ), the question seems justified whether a further reduction in CO₂ emissions due to "special efforts" is feasible, especially considering the high technical potential for efficiency improvements in new power plants.

Analysis of the declaration of the gas, municipal supply and mineral oil sector

The declarations of the gas and water association, BGW (1996), the association of municipal supply companies, VKU (1996), and the associations of the oil and oil trade industry, MWV/IWO/gdbm (1996), do not aim at CO₂ reductions of their own member companies, i. e. of gas supply companies, of municipal supply companies and of refineries and the mineral oil trade. Their target groups are their clients, mostly in private households and the tertiary sector, or - in the areas which are supplied by municipal companies - also their own plants and the industrial companies. According to rough estimates, the CO₂ emissions of the energy consumers covered by the three declarations were about 250 million tonnes.

As a consequence of fuel substitution, especially in East Germany, the CO₂ emissions should have been - *ceteris paribus* - greatly reduced by 1995. But as the climate became colder by about 10 % and the heated surfaces increased by 7 %, the fuel-related CO₂ emissions of private households and the tertiary sector decreased by only 6 % between 1990 and 1995 (see Table 2). After correction for changes in the climate, the reduction in CO₂ emissions were 15 % or about 30 million tonnes for both sectors.

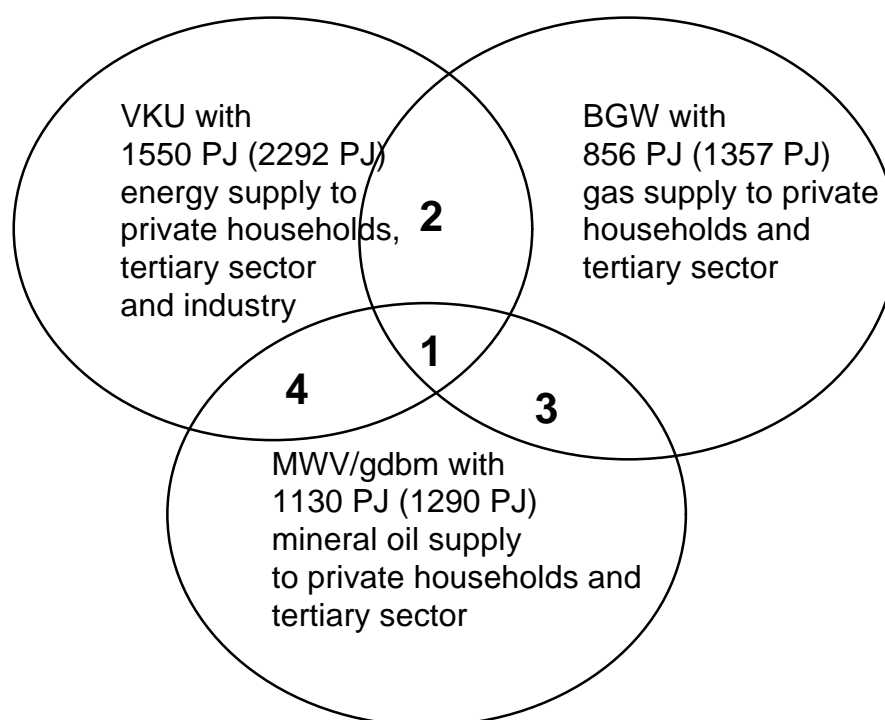
The statistical basis is particularly difficult for these target groups, but the greatest problems arise from overlapping target groups and targets so that the monitoring and accounting of any CO₂ reduction achieved will be very difficult if not impossible to carry out (see Figure 1). In order to avoid double counting, a careful evaluation is

necessary for private households, the tertiary sector and even industry (in the case of municipal companies).

The problems with the monitoring process become evident if one compares the energy supply of the member companies of the VKU with the energy balance for private households and tertiary sector in the cases of electricity and gas:

- about 88 % of the gas supply to private households and the tertiary sector is provided by municipal supply companies (Schiffer, 1995, p. 139), i. e. about 1190 PJ. How is the responsibility divided between VKU and BGW?
- As the municipal companies also supply industrial companies with about 240 PJ, how are the results of efforts made by the VKU and industrial associations evaluated (without double counting)?
- The municipal companies have a share of 27 % in the electricity supply with a higher share for private households and the tertiary sector which consumed 840 PJ in 1995. There is also considerable overlap with the declaration of the electric utilities.

Figure 1: Overlap of target groups in the declarations of the energy supply sector, figures for 1990 (West Germany) and in brackets for 1995 (Total Germany)



- 1: substitution of light fuel oil by gas, electricity or district heat
 2: substitution of gas by district heat and electricity (and vice versa)

- 3: substitution of light fuel oil by gas
- 4: substitution of light fuel oil by electricity or district heat

Sources: VKU, 1994/95; Arbeitsgemeinschaft Energiebilanzen 1990 and 1995

Recommendations

Before any recommendations are made, one should recall the frame conditions and other prerequisites which create an environment for voluntary agreements. The **frame conditions** of the companies and energy consumers obliged to put the voluntary agreements into practice are partly positive and partly negative:

- negative effects on the profitability of energy efficient plants and machines include several factors inducing decreasing energy prices (liberalisation of the electricity and gas markets in the late 1990s, lower investment costs for new power plants, Iraq's oil production coming back onto the market). Furthermore, the globalisation of companies and the indebtedness of public bodies cause hesitation when it comes to re-investments with high energy saving potentials.
- On the positive side, many forms of energy services have been created as a consequence of company outsourcing, the lack of capital in the public sector and as a strategy of smaller energy supply companies to bind customers in liberalized electricity and gas markets.

As well as these frame conditions, a few **prerequisites** should be kept in mind:

- profitable but untapped energy efficiency potentials in buildings, machinery and plants can be observed to a large degree in all energy-consuming sectors (IEA, 1991; WWF, 1996). Energy-efficient re-investments for depreciated production plants also carry untapped potentials which, however, entail changes in the priority setting of companies and building owners.
- There are many barriers which prevent the realisation of the above mentioned potentials, which could, however, be reduced through adequate measures (Gruber et al, 1993). Voluntary agreements could be important steps in this direction.

Set against these frame conditions and prerequisites, the following **recommendations** can be made to make voluntary agreements a success in combating energy-related greenhouse gas emissions:

- technical progress and unforeseeable structural changes as well as the uncertain development of future production imply that the Federal Government and the parties involved should understand the declarations to be a **process** which makes the quantitative goals **moving targets**.

- The "special efforts" of the actors should be concentrated on **neglected energy converting off-sites**, on promoting **re-investments into depreciated energy-intensive production plants**, and on introducing more suitable investment calculation procedures (profitability calculation instead of a risk calculation). Here, the associations should develop suitable information and training campaigns, perhaps with the support of third parties and with public support for the curricula.
- The "**special efforts**" mentioned by the associations should be **monitored by independent experts**. This measure would greatly increase the credibility and acceptability of this controversial instrument.
- The existing potential for **combined heat and power generation** in industry and the tertiary sector should be the subject of further negotiations and discussions in order to reduce barriers and to realize the potentials. Using an accepted ombudsman in cases of dispute or doubt is strongly recommended.
- The parties should constantly update their knowledge on profitable potentials in industry, the tertiary sector and private households through independent technical-economic analyses of CO₂ reduction potentials in order to be able to set **adequate and moving targets** and design suitable measures.
- For those groups in the tertiary sector and private households for which the four energy supply associations have formulated targets, **special monitoring and evaluation procedures** should be developed in order to separate the impact of the measures initiated by the four associations from those of other actors.
- The Federal Government should - in the spirit of voluntary agreements being regarded as an ongoing process - conduct **talks each year** with individual associations in order to discuss the achievements of the last year and to re-evaluate the targets if necessary. The consequences of structural changes or unexpected production developments should also be part of these discussions.
- The Federal Government should address industrial associations and the association of electricity supply companies, VDEW, as to whether one association could carry out the **introduction of emission certificates** on a pilot scale. This pilot stage could be the start of a more market-oriented process in a given branch to achieve given CO₂ reduction targets with minimal costs.
- The Federal Government should **promote contracting markets** for CO₂ reduction using suitable measures and should remove existing barriers (e. g. caused by unclear legal situations).

The authors believe putting these recommendations into practice would greatly enhance the climatic relevance of the voluntary agreements of the German economy.

Overall, the authors consider the discussion process between the associations and the Government to be useful in order to concretize the voluntary agreements, to show the representatives of the industrial and commercial associations how seriously the

Government regards voluntary agreements and to make clear that, in the case of a lack of progress, the alternatives of a heat recovery ordinance and of an energy/CO₂-tax are still possible. There are, however, doubts whether the targets can be reached considering the lack of suitable sanctions for individual member companies which are not willing to cooperate. The question, which has been raised by sceptics, whether such commitments are a strategy of the German economy to "gain time" in matters concerning climate policy will only be able to be answered definitely after several years of monitoring.

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