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Harald Kotsch*

Joint Implementation

Issues in the Further Development of the Concept

As a theoretical concept for cutting down on greenhouse-gas emissions where this can be done most cost-effectively, Joint Implementation is both straightforward and convincing. However, there are a number of issues relating to the putting into practice of the concept which have yet to be resolved.

For any given incremental sum of money, it is possible to do a lot more to protect the climate in developing and transition countries than it is in industrial nations. In contrast to the industrial countries, little has so far been done to put environmental standards into practice in the less advanced countries, which is why, despite the fact that emissions per head of population are generally lower, they normally generate higher emissions of CO₂ per unit of real gross national product than the industrial countries do.¹ That being so, most of the "cost-effective" potential for avoiding greenhouse-gas emissions can be found in the developing and transition countries.²

These are the circumstances which generated the idea of Joint Implementation (JI), adopted as an instrument of protection against climate change by the UN Framework Convention on Climate Change in Rio de Janeiro in 1992. Joint Implementation offers the option to OECD countries, the EU, the Central and Eastern European countries and the newly independent states of the former Soviet Union (together referred to as "Annex-I Parties") of fulfilling the obligations they had entered into under the terms of the Convention more cheaply in other countries, i.e. they can have any reductions which they manage to achieve in foreign countries credited to their own reduction targets. This credit system is made possible by the fact that the man-made greenhouse effect is a truly global problem. Where the greenhouse gases of carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), the precursors of ozone (O₃), CFCs etc. are actually emitted is really immaterial, since they are eventually spread evenly throughout the Earth's atmosphere. The problem of "hot spots" does not arise in connection with the global question of climate change.³

Nevertheless, many developing countries have tended to adopt a rather reticent attitude to Joint Implementation, as indeed they have to the

establishment of binding international objectives on the reduction of emissions. They regard these compensation projects as an attempt by the industrial countries to extricate themselves from their obligation to reduce emissions of greenhouse gases on their own territory by means of a "cheap buy-out".⁴ Even though their environmental standards are stricter and their population is far smaller, the industrial countries are the main culprits in the man-made greenhouse effect, as they emit the vast bulk of the noxious substances involved because their economic activity is far more extensive.⁵ To take account of the developing countries' reservations and in view of the fact that a number of issues relating to the crediting of emission reductions achieved in foreign countries remained unresolved, it was decided at the first "Conference of the Parties" following up the Convention in Berlin in 1995, to institute a Pilot Phase which is to run until the end of the decade, during which time solutions to the unresolved methodological problems should be worked out. No crediting will

* Federal Ministry of Economics, Bonn, Germany. The article represents the personal opinion of the author. He wishes to give special thanks to Axel Michaelowa for his helpful comments.

¹ See, e.g., Enquete-Kommission "Schutz der Erdatmosphäre" (abbrev. below to "EKS"): Klimaänderung gefährdet globale Entwicklung. Zukunft sichern – Jetzt handeln, Bonn 1992, pp. 60 ff.; J. Heister and F. Stähler: Globale Umweltpolitik und Joint Implementation: Eine ökonomische Analyse für die Volksrepublik China, in: Zeitschrift für Umweltpolitik und Umweltrecht, Vol. 18 (1995), p. 207, Table 1.

² Similarly, the prime potential for reforestation, which creates new "sinks" for greenhouse gases and is also therefore eligible for Joint Implementation, can also be assumed to lie outside the industrial countries.

³ Cf. EKS: Mehr Zukunft für die Erde – Nachhaltige Energiepolitik für dauerhaften Klimaschutz, Bericht des 12. Deutschen Bundestag, Bonn 1994, p. 282.

⁴ The EKS therefore took the view that the industrial countries must meet at least 80% of their obligations – which have yet to be firmly defined – on their own territories. See EKS: Mehr Zukunft ..., op. cit., p. 634.

⁵ See Bundesministerium für Wirtschaft (BMWi): Energiedaten '95, information brochure, Bonn 1995, p. 47.

yet take place during the Pilot Phase, so the projects during this period are being referred to as "Activities Implemented Jointly" (AIJ) rather than as "Joint Implementation".⁶

Pilot Projects Under Way

The federal government has drawn up a catalogue of criteria for a German pilot programme,⁷ which so far includes the following AIJ projects:⁸

□ PreussenElektra AG is to operate two wind power stations near Ainaz in Latvia jointly with local power companies; the power plants will each have an output of 600 kW. The two plants, which involve a capital cost of approximately DM 3 million, have been in operation since the end of 1995. It is estimated that they will allow CO₂ savings in the order of 2,480 tonnes per annum to be made, if the oil-fired thermal power stations normally used in Eastern Europe are used as the baseline for comparison.

□ RWE Energie AG and Bayernwerk AG (via its subsidiary Energieversorgung Ostbayern) are taking a stake in the modernization and renewal of an obsolete combined-heat-and-power plant at the VW/Skoda car manufacturing plant at Mlada Boleslav in the Czech Republic. The two German electricity utilities have each taken a 42.5% equity stake in the company providing the funding, and each has a 21% stake in the operating company. The new plant will have an electrical power output of approx. 70 MW, and a total thermal output of 260 MW. The expected reduction in CO₂ emissions is estimated at approx. 280,000 tonnes per annum (-42%).

Some international projects have also been initiated by electricity companies in the G7 countries, and RWE Energie AG is the German participant. Eight major electricity companies have joined together to form what is known as the "E7 initiative" to provide technical assistance and to facilitate project financing via multilateral organizations and foundations. Approximately 50 projects have so far been evaluated, and the first of these in which RWE is participating are now under way:⁹

□ In Indonesia, methods of laying on electricity supplies in remote areas are now under examination with the aid of 1,000 photovoltaic solar home systems (rated at 50 W each), one hybrid system (20 kW) and one mini-hydroelectric power station (200 kW). The E7 group is contributing \$3.3 million towards the total capital cost of \$4.3 million. As an alternative to using diesel generators to provide local electricity supplies, a CO₂ saving of 1,500 tonnes per annum is expected to be achieved.

□ In a remote area of Zimbabwe, an existing dam is

to be fitted with a 140-kW turbine, to develop the use of renewable resources for power generation.

□ In Jordan, a project to improve the efficiency of existing power stations is to be implemented.

For general economic policy reasons and also because of the tight budgetary situation, the German state does not propose to support any of the pilot projects. The only role played at the federal government level will be to provide scientific back-up and documentation.¹⁰

Other countries, too, have set up pilot programmes; in particular, the two vanguard countries as far as Joint Implementation is concerned, namely the United States and the Netherlands, have also led the way in setting up new projects.¹¹ The US administration has set up the US Initiative on Joint Implementation (USIJI) to provide support for overseas projects. For its part, the Dutch government set up a Pilot Project Programme (PPP) which will place particular emphasis on investigating implementation problems during the Pilot Phase. Similar endeavours are also in evidence in Scandinavia, Japan, Australia and other countries. The most prominent pilot projects in other countries include:¹²

□ Conversion of the thermal power station in Decin (USA/Czech Republic): gas is to be substituted for lignite as the power station's primary fuel source, three gas turbines are to be installed for combined-heat-and-power operation, and measures are to be taken to raise the efficiency of the district heating network. The project is being jointly funded, to the

⁶ Cf., e.g., Wissenschaftlicher Beirat der Bundesregierung: Globale Umweltveränderung: Welt im Wandel – Wege zur Lösung globaler Umweltprobleme, annual report, Berlin 1996, p. 104.

⁷ Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU): Gemeinsam umgesetzte Aktivitäten zur globalen Klimavorange (Activities Implemented Jointly) – AIJ, information brochure, Bonn 1996, p. 8.

⁸ See, inter alia, A. Bauer: Die Rettung des Planeten als Joint Venture – Industrie- und Entwicklungsländer testen gemeinsame Umsetzung von Klimaschutzmaßnahmen, in: Süddeutsche Zeitung, 14th Nov. 1995; H. Schüren: Erfolgreich im Wettbewerb. Kraftwerk für Skoda – RWE Energie mit dabei, in: Verbund, No. 171 (September 1995), pp. 196-197; F. Schaffhausen and A. Jochem: Germany Starts AIJ Pilot Projects, in: Joint Implementation Quarterly, Vol. 2 (1996), p. 2.

⁹ See H. Rentz: Electric Utilities Promote AIJ, in: Joint Implementation Quarterly, Vol. 2 (1996), pp. 4-5.

¹⁰ See BMU: Gemeinsam umgesetzte ..., op. cit., p. 8.

¹¹ Cf., inter alia, Joint Implementation Network (JIN): JI/AIJ initiatives during the Pilot Phase, unpublished working paper, Groningen 1996, pp. 3 ff.

¹² Cf., e.g., A. Michaelowa: Internationale Kompensationsmöglichkeiten zur CO₂-Reduktion unter Berücksichtigung steuerlicher Anreize und ordnungsrechtliche Maßnahmen, HWWA research project commissioned by the Federal Ministry of Economics, Hamburg 1995, pp. 33 ff.

tune of approx. \$600,000, by the Wisconsin Electric Power Company, the Edison Development Company and NIPSCO Development Co. (total capital cost is approx. \$7 million); these companies are assuming that they will be granted more favourable regulatory conditions in return for their involvement. Construction commenced in September 1985. The estimated future reductions in CO₂ emissions come to 6,000 tonnes per annum as a result of the fuel substitution and 20,000 tonnes per annum thanks to the combined-heat-and-power solution.

□ Various projects operated by the FACE foundation: this foundation has been set up by the federation of electricity generators in the Netherlands (SEP), whose members are public-sector monopoly enterprises. In a voluntary scheme to compensate for the CO₂ emissions generated by a new power station by developing new "CO₂ sinks" elsewhere, the foundation is supporting reforestation projects in Malaysia, Ecuador, Poland, the Czech Republic, and the Netherlands itself.

□ ILUMEX (Norway/Mexico): Approximately 1.7 million light bulbs in the two Mexican cities of Guadalajara and Monterrey are being replaced by fluorescent bulbs requiring only about 25% of the power input and lasting approximately 13 times longer. The total cost of the exchange is approx. \$23 million. The Mexican government is guaranteeing a sum of approx. \$10 million, and Norway is putting in approx. \$3 million. This demand-oriented project is expected to reduce emissions by about 100,000 tonnes of CO₂ per annum.

As a theoretical concept – to cut down on greenhouse-gas emissions where this can be done most cost-effectively – Joint Implementation is both straightforward and convincing. However, there are a number of issues relating to the practical implementation of the concept which have yet to be resolved, and these will be dealt with below.

Adequate Incentives?

Since it is not yet proposed to operate the crediting system during the Pilot Phase, there is no immediate incentive for profit-seeking enterprises, but only a rather diluted indirect motive for getting involved in "pure" AIJ projects abroad, linked only to protection against climate change. Companies operating in the field of environmental technology may want to establish a name for their products and technologies with the help of non-profit-making projects, in the hope that they will receive increased attention from

potential customers for JI projects later on, when the crediting system is in full operation. A demonstration plant can provide effective publicity, which may prove important in gaining follow-up orders and tapping the market. On the other side of the coin, though, companies need to be aware that comparable products and technologies may also be offered by their competitors later on. If the probability of this happening is rather great, that will substantially reduce the incentive to carry out pure AIJ projects.

Another factor which plays a part from the German point of view is that no direct government support for pilot projects has yet been promised. Government support for AIJ projects has been forthcoming in countries such as the USA and the Netherlands in particular:¹³ a number of American states have decided to allow companies to fulfil their environmental requirements by reducing emissions abroad, even during the Pilot Phase. In the Netherlands, companies participating in pilot projects are entitled to additional tax depreciation allowances which they negotiate directly with the responsible ministry. Moreover, earnings from "green" investments are tax-free to Dutch investors. So the question arises as to whether Germany, too, ought to switch to providing direct support in order to offer similar opportunities to domestic companies carrying out pilot projects. Of course, if other countries follow suit or the USA and the Netherlands extend their support still further, that could generate an international race to subsidize exports of environmental technology.

In view of the relatively limited incentives for pure pilot projects in Germany, domestic companies will quite probably seek to declare a large number of their foreign orders which have associated reductions in the concentrations of atmospheric greenhouse gases as AIJ, and later JI projects. In other words, a considerable amount of rent-seeking would occur. Consequently, the ecological allocation effect (incremental reductions in emissions) would be relatively slight when set against the amount of funds employed (crediting, and possibly also direct grants). This phenomenon could only be avoided if there were some way of applying rigorous, practicable criteria to separate genuine ecological compensation projects from "autonomous" contracts which would be profitable in their own right and would thus be carried out in any case. Unfortunately, we cannot assume that it will be possible to "sort the wheat from the chaff" in this way.

¹³ See A. Bauer, *op. cit.*

Policy Prerequisites

To ensure that there will be an incentive for industrial countries to carry out JI projects once the Pilot Phase is complete, they have to agree to a binding objective on the reduction of emissions ("flat rate"), or at least to agree to binding objectives specific to each country, on a graduated basis geared to relative economic strength (fair "burden sharing"). In fact, at the 1992 Rio Conference, the industrial countries made only a vague promise to reduce their greenhouse-gas emissions to 1990 levels by some future date which they did not specify any more closely. Then, at the first Conference of Parties in Berlin in the spring of 1995, the resistance put up by several industrial countries meant that the resolution passed (the so-called Berlin Mandate) stated only that a stricter goal would be worked out in time for the third Conference of Parties in 1997.

Of course, passing resolutions to set binding reduction targets does not in itself go far enough, and the industrial countries really ought already to have environmental policy instruments in place to provide firms in those countries with a genuine incentive to carry out JI projects.¹⁴ So far, however, there is no sign of any imminent agreement on the introduction of market instruments worldwide to reduce greenhouse-gas emissions. For quite some time, attention was focused on the EU, which made the attempt to institute a CO₂/energy tax. But in the event, a Draft Directive put forward by the EU Commission came to grief last year because repeated demands from individual member states for special exemptions meant that the final result would ultimately have been an empty shell.

Avoiding Additional Burdens

The quest to create sufficient incentives for carrying out compensation projects soon leads to a dilemma: how can the incentives be created without at the same time adding to the tax or regulatory burden? The self-interest of companies in participating in JI projects will be all the greater, the more rigorously environmental-policy measures – such as the introduction of a CO₂ tax or the broadening and toughening of command and control instruments¹⁵ – are implemented. However, most industrial countries at present are at pains to avoid imposing any further burdens on business by creating new taxes and charges or tougher regulations. One apparent way out of this dilemma is provided by "direct" subsidies for projects. Yet the resulting increase in government funding requirements can ultimately only be met by

increasing taxes and charges or by raising the level of government debt. Thus the only alternative really worthy of discussion is for government support to be provided temporarily during the Pilot Phase, so as to get the ball rolling.

Another aspect which needs to be considered in the discussion of alternative measures to protect against climate change is that the different instruments available vary in the amount of incentive they provide to get involved in Joint Implementation projects. In the case of command and control instruments, of voluntary self-restraint to reduce CO₂ emissions,¹⁶ or of the provision of environmental licences free of charge, it will be up to the firms concerned to carry the cost of achieving the desired reduction in emissions (this is the "weak" polluter-pays principle). By way of contrast, if a tax is imposed or certificates are auctioned, firms will also have to pay a financial penalty for their remaining emissions (the "strong" polluter-pays principle). Under a system involving a CO₂/energy tax or the auctioning of environmental licences there will thus be a double incentive to engage in JI projects. It is therefore safe to assume that if one of the first three types of instrument is put into practice, the number of Joint Implementation projects realized will be considerably smaller than it might have been if a tax or a licence-auctioning system had been introduced.¹⁶

Apportioning the Costs

One point which has not yet been cleared up in the discussion is whether the donor in a Joint Implementation project ought to bear all of the costs involved, or whether and to what extent the recipient could also carry some share of them. If the former pattern were adhered to, there can be no doubt that quite a considerable number of projects that might

¹⁴ Cf., e.g., H. Dungen and D. Schmitt: Klimapolitik in der Sackgasse? Einsatzmöglichkeiten für Kompensationslösungen, in: Wirtschaftsdienst, Vol. 72, p. 272; EKS: Mehr Zukunft für ..., op. cit., p. 282; A. Michaelowa: Internationale Kompensationsmöglichkeiten ..., op. cit., pp. 75 ff.; H. Rentz: Joint Implementation in der internationalen Umweltpolitik – Eine theoretische Analyse möglicher Ausgestaltungen, in: Zeitschrift für Umweltpolitik und Umweltrecht, Vol. 18 (1995), pp. 185 ff.; or finally, Der Rat von Sachverständigen für Umweltfragen: Zur Umsetzung einer dauerhaft-umweltgerechten Entwicklung, annual report, Bonn 1996, p. 333, where the view is expounded that Joint Implementation is simply an "add-on" instrument.

¹⁵ Cf. inter alia, A. Michaelowa: Joint Implementation: A Promising Instrument for Climate Protection, in: INTERECONOMICS, Vol. 30, No. 4 (July/August 1995), p. 163 ff.; H. Rentz: Joint Implementation ..., op. cit., pp. 179-203.

¹⁶ Further problems in applying Joint Implementation in combination with voluntary self-restraint are pointed out by H. Dungen and D. Schmitt: Klimapolitik – Chancen für internationale Kompensationslösungen, in: Wirtschaftsdienst, Vol. 73 (1993), p. 652.

actually make good sense would be excluded from the outset. To give an example, a German electricity utility supporting the construction of a power station in China is hardly likely to be prepared to carry the entire cost of the project, as the possibility of crediting the CO₂ reductions achieved in China to Germany's account would not be a sufficient incentive in this case. The cost of the power station is unlikely to be fully offset by the "savings" made on the potential cost of emission reductions at home, or possibly by a credit against a CO₂/energy tax – certainly, it would not do so unless the tax on emissions were prohibitively high. Of course, the incentive to the German electricity utility would be lower still under a system of voluntary self-restraint or environmental licences issued free of charge, since the "only" savings it then made would be on the cost of emission reductions at home.

The situation might be quite a different one if the utility were also able to earn a profit on the operation of the Chinese power station. Naturally enough, the recipient countries often have misgivings about this type of structure (not least in project types associated with public utilities). Even so, due to a lack of sufficient funds at home, many transition and developing countries are currently entering into joint ventures. These usually include an agreement that the foreign equity involved will eventually be transferred to ownership within the recipient country. There are further advantages to joint ventures from the recipient countries' point of view: the foreign companies involved have the necessary technical and business expertise to operate the plant, and also maintain close relations with the builders of the plant and machinery (the donor companies in JI projects will normally purchase the emission-reducing products and technologies from outside rather than manufacturing them themselves). The potential for Joint Implementation projects can also be expected to increase if this scheme is permitted to apply not only to joint ventures but also to projects involving a parent company in the donor country and a subsidiary in the recipient country.

As regards projects in which there is no equity participation on the donor's part, there is a good case for only burdening the donor with a portion of the project cost, so as not to over-dilute the incentive. One possible arrangement might involve donors carrying only the incremental costs arising out of JI projects relative to the reference models they supersede. On the other hand, the greater the proportion of the cost that needs to be borne by the

recipients themselves, the less incentive they in turn will have to implement the projects. Indeed, their incentive will be reduced to zero if the cost they are still required to bear is greater than that of executing the reference models. That, of course, would result in higher greenhouse-gas emissions in the recipient countries. Yet, when seen from their point of view, these costs can be externalized worldwide; that is, they can be externalized as long as no binding reduction objectives have been set (so far, at least) for the recipient countries themselves. The point which particularly the NICs and transition countries need to bear in mind is that the further their economic growth progresses, the more they, too, will come under international pressure and have reduction targets imposed upon them. From that point of view, it is to their advantage to have some "cost-effective" potential to reduce greenhouse-gas emissions available in their own country, and not to have "sold this off cheaply" beforehand to those responsible for emissions in industrial countries.¹⁷

Establishing Baseline Scenarios

When drawing up the emission documentation for a JI project, the reduction in emissions to be generated by the project needs to be properly established. One particular difficulty in this is that, taken by themselves, many projects do not in fact reduce emissions but increase them relative to the status quo, e.g. when a new power station is built to accommodate economic growth. In this case, the calculation needs to consider how much greater the emissions in the recipient country throughout the lifetime of the project would have been without Joint Implementation, i.e. if a power station using older technology had been built instead, with poorer thermal efficiency and lower environmental standards. Consequently, a baseline "business-as-usual" scenario needs to be drawn up for each project.

Even when older, "end-of-the-pipe" forms of environmental technology are installed, preparing the reference scenarios is quite a cumbersome task. An example of this might be the fitting of additional filtering plant to a conventional power station, which will reduce emissions by a given amount. A major source of problems is that the filtering impact of the removal technology on the one hand and the efficiency of the plant as a whole on the other depend on numerous factors, meaning that greenhouse-gas

¹⁷ Cf., e.g., O. Rentz et al.: Die Kompensation in der Klimavorsorge – Chancen und Grenzen, unpublished working paper, Karlsruhe and Hamburg 1996, p. 3; JIN: JI/AIJ initiatives ..., op. cit., 1996, p. 2.

emissions can vary considerably depending on operating conditions. Determining baseline scenarios is therefore a time-consuming and costly business. Because "end-of-the-pipe" techniques cannot be used to reduce emissions of CO₂, the most important greenhouse gas, it will be necessary to resort to a greater extent to modern, integrated environmental technology in the JI projects. Yet that will only make it still more complex to set up "business-as-usual" scenarios, as the reduction in emissions achieved by a JI project will have to be assessed by comparing it with a conventional reference plant.

Another aspect which has to be considered from the reference point of view is that the economic utilization level – and hence the ecological effectiveness – of a project will also depend on the level and growth of macroeconomic activity in the recipient country. Thus a macroeconomic forecast would need to be made for the entire lifespan of a new plant, which for many projects such as power stations might run into several decades. Forecasting on such a long-term basis is, of course, a very uncertain affair. So there is quite a chance that the credits granted in connection with a particular JI project may prove in retrospect to have been wrong. That in turn raises the question of whether the credits should subsequently be corrected, if indeed that is at all possible.

The relatively high cost of establishing reference models, which constitutes fixed cost for the projects involved, could mean a considerable number of JI projects being ruled out from the beginning, or could mean greater recourse being taken to rather old-fashioned "end-of-the-pipe" technologies instead of their modern, integrated counterparts. One way of countering these tendencies may be to standardize projects.¹⁸ Certain types of project would need to be laid down which could frequently be applied, in order to lower the average cost of establishing baseline scenarios. The selection of such projects would have to take place during the Pilot Phase. Thus it would

have to be determined at this early stage which countries and/or companies and their products were most likely to be considered for actual projects, and would later gain most from "profitable" Joint Implementation projects (i.e., would have "first-mover" advantages).

German Environmental Technology for JI Projects?

The question for Germany's environmental industry is to what extent it will later be able to participate in Joint Implementation. German firms are right at the top of the international league in the field of environmental technology. For many years, their share of world trade was greater than that of US and Japanese companies. More recently, though, they have been displaced from the number-one spot by their American competitors,¹⁹ which may be due to greater support for the industry in the United States or to differing economic situations in the respective export markets. At any event, the strong position of German firms on the world market has led to considerable expectations that JI projects will generate substantial demand for German eco-products, thus helping to promote growth and employment in Germany. However, this assessment could prove to be seriously flawed.

The whole idea on which Joint Implementation is based is the fact that, for a given sum of money, a far greater reduction in greenhouse gases can be achieved in some countries, particularly developing countries, than it can in the Western industrial countries where relatively high environmental standards have already been implemented. While a lot can be achieved with relatively simple means in the developing countries, emissions can only be reduced in the industrial countries by deploying "high tech". Looked at in this way, it is rather odd that JI projects are felt to be a means of transferring technology from industrial to developing countries. According to the German federal government's catalogue of criteria, for example, the main emphasis in pilot projects is supposed to be placed on the application of modern technologies.²⁰ Yet these technologies have primarily been developed for use in industrial countries, and whether or not they could be effectively operated in developing and transition countries needs to be looked at very carefully. We have to avoid the use of "oversized engineering" in Joint Implementation if such projects – rather like many of the conventional development aid projects in the past – would give a false basis for sustainable economic activity in the Third World.

¹⁸ Cf., e.g., J.-H. Luhmann et al.: Making Joint Implementation Operational – Solutions for Some Technical and Operational Problems of JI in the Fossil Fuel Power Sector, in: Wuppertal Papers, No. 31, Wuppertal 1995.

¹⁹ Cf. B. Gehrke et al.: Industrieforschung sowie internationaler Handel, Produktion, Beschäftigung und Investitionen im forschungsintensiven Sektor der deutschen Industrie, Beitrag zur "erweiterten Berichterstattung zur technologischen Leistungsfähigkeit Deutschlands" im Auftrag des Bundesministeriums für Bildung, Wissenschaft, Forschung und Technologie (BMBF), Hanover 1995, p. 69, Table 2.10. However, as the authors themselves point out, these figures need to be interpreted cautiously. Firstly, their report only covers "end-of-the-pipe" technologies and, secondly, the products with potential uses in environmental protection can also be used in other contexts.

²⁰ Cf. BMU: Gemeinsam umgesetzte Aktivitäten ..., op. cit.

Their high level of technical sophistication is not the only feature of German environmental products: they are also usually very expensive. For that reason, the utilisation of these modern forms of environmental technology is often not (yet) profitable, even in Germany, despite the very high environmental standards applied there. This situation is only partly attributable to the fact that external environmental costs have not been sufficiently internalized, or to unfavourable geographical conditions. In many cases, another part of the reason is that these forms of technology have not yet matured to full marketability, even for applications in the German home market. But in the present day, many developing countries hardly have any environmental standards as yet, so it could well be possible to attain substantial emission reductions in those countries even with "second or third-class" environmental technologies. Technologies of that kind, of course, have to be sold at relatively low prices and, under normal circumstances, can hardly therefore be produced competitively in an expensive production location such as Germany.

Another special feature of German industry is that small and medium-sized enterprises still account for quite a large share in comparison with other countries. In many cases, these firms manufacture one-off items of equipment for their customers on a bespoke basis. Yet these are not the sort of products which can readily be standardized, which would otherwise be one way of limiting the average cost of establishing reference scenarios. The small and medium-sized enterprises in any case suffer from cost and information disadvantages when distributing their products around the world.

The problems described above in connection with the use of German environmental technology in AIJ or JI projects are likely to lead to increasing calls for government subsidies to be provided. Those making such calls might refer to the more or less open subsidies already being applied in, for example, the USA and the Netherlands. However, from the point of

view of fair resource allocation one probably ought to ask if Joint Implementation projects make any sense at all under such conditions.

Relocation of Production Abroad

For quite some time, there has been an intense, often emotionally conducted debate going on concerning the relocation of production and jobs to other countries. Attention is drawn to the fact that German companies are carrying out direct investment abroad on a large scale, while there is relatively little incoming direct investment from firms in other countries. The research so far conducted into this suggests that the main reason underlying German foreign investment is that firms are endeavouring to tap new markets in the course of economic globalization.²¹ Although other reasons such as high costs in general, and high labour costs in particular, are becoming more important, they have so far only had a large impact in triggering relocation in a relatively small number of labour-intensive industries such as shoemaking and leather or garments and textiles.

According to survey findings, the strict environmental protection measures in Germany have also played a relatively insignificant part in this phenomenon.²² However, that is a situation which might change when Joint Implementation gets under way. If the industrial countries were indeed to lay down binding reduction targets for greenhouse-gas emissions and to apply corresponding measures, these countries would be at a disadvantage, as business locations, relative to the developing countries, which are not planned to have such targets imposed upon them until some later stage. On the one hand, there is widespread agreement that this disadvantage should be accepted so as to allow the developing countries to strengthen their economic base. However, problems may arise from an environmental point of view if production is relocated from the industrial countries to others which have lower environmental standards and if the net effect is to raise total world emissions.

It is still not clear how Joint Implementation would influence this "leakage effect". On the one hand, the projects would ease the cost burden for domestic firms, reducing international differentials in the costs of avoiding pollution.²³ On the other, and contrary to the true purpose of the concept, Joint Implementation is liable to amplify the leakage effect, as firms relocating production in association with JI projects would actually be rewarded for doing so by earning environmental credits. It is difficult to estimate

²¹ See, e.g., H.-H. Härtel, R. Jungnickel et al.: *Grenzüberschreitende Produktion und Strukturwandel – Globalisierung der deutschen Wirtschaft*, Forschungsauftrag des HWWA für das Bundesministerium für Wirtschaft im Rahmen der Strukturberichterstattung, Hamburg 1995, pp. 239 ff.; M. Hummel et al.: *Strukturbericht 1995*, Forschungsauftrag des ifo Instituts für Wirtschaftsforschung für das Bundesministerium für Wirtschaft im Rahmen der Strukturberichterstattung, Munich 1995, p. 169.

²² Cf., e.g., *Verband der Bayerischen Metall- und Elektro-Industrie: Investitionen im Ausland: Umfang, Richtung, Motive, Arbeitsplätze – Ergebnisse einer Unternehmensbefragung*, Munich 1995, p. 12.

²³ This is pointed out, for instance, by A. Michaelowa: *Internationale Kompensationsmöglichkeiten ...*, op. cit., p. 71.

beforehand which of these two conflicting effects is likely to have the upper hand when they are netted out.

The scale of the leakage effect ought to be small if the goods being produced are non-tradables. Many Joint Implementation projects are associated with electricity generation and supply; this is only tradable to a limited extent due to market regulation and other restraints. However, that could change if these markets are indeed opened up as currently intended. In cases in which the compensation projects are associated with tradable goods, the direct emission effects at production plants are liable to be markedly lower. On the other hand, indirect emission effects via the sources of energy supply for production plants can be quite significant. This is well demonstrated by the RWE/Bayernwerk project to modernize and renew the combined-heat-and-power plant at the VW/Skoda car factory.

On top of any cases of relocation occurring as part of the "leakage effect" triggered off by strict environmental standards in the home market, if production were located for any other reasons specific to individual companies' needs, they would be able to double-count their contribution towards the domestic emission-reduction target by participating in Joint Implementation. That is to say, the cutback in production at home would make a direct contribution to the emission-reduction "account", and the firms concerned could also reap an economic rent from the credits earned by establishing their foreign manufacturing facilities in a supposed compensation project.

Hence Joint Implementation would be likely to reinforce any trend for production to be relocated, and this highlights what could prove to be a serious design fault in the JI concept as it stands. The reference scenarios apply only to the recipients (or recipient countries), and completely ignore any effects on the donor (or donor country). The intention is to compare JI projects against a "business-as-usual" scenario for the recipient (country). This will virtually always turn up an apparent saving on greenhouse-gas emissions, as the hypothetical projects in the baseline scenarios, with no input from a JI project, are more or less bound to be more emission-intensive. Yet this reference-scenario procedure assumes that there will be no change in CO₂ emissions in the donor

country, i.e. it implicitly assumes that a donor will not make any changes in production facilities in its home country in connection with a Joint Implementation project. According to the theoretical concept, the donor's interest is solely one of fulfilling its obligations to reduce greenhouse-gas emissions more cost-effectively in another country. One is bound to ask whether this underlying assumption is in fact realistic. Strictly speaking, the baseline models ought to be taking donor as well as recipient countries into account.

Processes of relocating production can be spread over a substantial period of time, making them difficult to distinguish from other cutbacks or increases in output in specific countries, especially if a firm operates in a number of different fields. By rights, if any of the parties involved is a global player the "business-as-usual" scenario ought to be drawn up on a worldwide basis, to make sure that all of the firm's production facilities are covered. That, of course, would raise the cost of establishing the reference data to prohibitive levels. Yet if one seeks to avoid that by developing and later applying Joint Implementation on the basis of "relatively" more straightforward baseline scenarios referring solely to recipients or recipient countries, one will need to be prepared for the possibility that, if taken to an extreme, the induced relocation of production facilities will run counter to the basic environmental objectives of Joint Implementation by generating an increase rather than a reduction in worldwide CO₂ emissions. That is all the more likely to happen if Joint Implementation projects are permitted to be carried out by parent companies and their subsidiaries.²⁴

Conclusions

A considerable amount of hope is being pinned on Joint Implementation by the industrial countries, as this concept promises to offer them considerable cost savings in their efforts to combat the greenhouse effect. However, so far there has been a strong tendency to overlook the fact that the cost savings in reducing emissions will be offset by quite considerable transaction costs, particularly in establishing reference scenarios, and also by a number of pitfalls from the point of view of welfare economics. The Pilot Phase now agreed upon, which is only intended to run until the end of the decade, ought to be intensively used to deal with the issues still unresolved, and thus to create the conditions which will ensure that the way the concept is put into practice makes both ecological and economic sense.

²⁴ Sari has called for any emission reductions achieved as a result of relocating production not to be taken into account when monitoring the achievement of national reduction targets. Cf. A. P. Sari: Joint Implementation: Some Questions Still Unanswered, in: Joint Implementation Quarterly, Vol. 1 (1995), pp. 7-8.