*Climate Change Research: Evaluation and Policy Implications*
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## ASSESSMENT REPORT ON NRP SUBTHEME

# "INTERNATIONAL INSTRUMENTS FOR CLIMATE CHANGE POLICY"

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## Contents

## ABSTRACT

The projects implemented in the Dutch National Research Programme on Global Air Pollution and Climate Change are organised in several themes and subthemes. Within the theme on Sustainable Solutions five projects are grouped under the heading International Instruments for Climate Change Policy. These five projects deal primarily with issues concerning the position of developing countries in the debate on limiting global $CO_2$-emissions. They cover a broad spectrum of topics: international negotiation strategies, tropical deforestation, industrial energy conservation, national energy scenarios, emission guidelines. This contribution presents an overview of the objectives, methodologies and results of the projects and includes a critical evaluation of the potential relevance of the work for policy makers.

## 1. INTRODUCTION

### 1.1 International climate change policy in The Netherlands

International climate change policy arrived on the Dutch political agenda in the late 1980's, particularly after the establishment of the Intergovernmental Panel on Climate Change (IPCC) and the Toronto Conference on the Changing Atmosphere, where a 20% reduction target for $CO_2$ by the year 2005 was recommended. Although no firm national commitments were considered at that time, the Ministry of Environment opted in favour of precautionary measures in case of international consensus. International environmental diplomacy should pave the way for a leap forwards in domestic environmental policies. The 1989 Noordwijk Conference on Atmospheric Pollution and Climate Change was intended to secure such international consensus for a precautionary approach. The belief that precautionary measures were only possible in case of international consensus prevailed until the publication of the first National Environmental Policy Plan in 1989, when climate change policies began to influence domestic environmental policies in a major way. Political parties began to view climate change as an election issue and the emphasis shifted from international diplomacy to domestic policy formulation. The national goal of stabilization by 2000 was reformulated and a new "plus" version of the National Environmental Policy Plan was adopted in 1990 with a 3%-5% reduction target by 2000. Interministerial debates on actual domestic policies, particularly regarding energy efficiency, replaced the earlier concentration on international environmental diplomacy. At the time of the 1992 Rio Conference on Development and Environment, the Netherlands had already established targets exceeding the stabilization goal of the Framework Convention on Climate Change. The Ministry of Economic Affairs, responsible for energy policies, had established an ambitious programme for promoting energy efficiency and discussions on the feasibility of unilateral domestic tax measures caused considerable controversy among policy makers.

After 1990 the earlier optimism on international consensus decreased.and domestic implementation bottlenecks required close attention. Gradually the implications of moving ahead out of line with international climate change policy progression became clear. Insistence on the 5% domestic target became unfashionable, when reaching the 3% target appeared difficult. Moreover, attention

shifted away from the political complexities of reaching international consensus on reduction targets among industrial nations to the role and position of developing nations in the climate change debate.

The second National Environmental Policy Plan appeared in 1993, but it did not introduce any new domestic measures. Instead, it showed renewed interest for the role of international environmental diplomacy. The potential role of international implementation instruments rather than specific targets for reduction now obtained attention. The deliberations of the Internationale Negotiation Committee (INC) in the wake of the Rio Framework Convention formed an important focus for the debate on Joint Implementation (JI) and other mechanisms for financial and technological transfer. The 1994 Groningen Conference on Joint Implementation is symptomatic for this renewed international interest. In the European context the Netherlands also increased the diplomatic pressure to reach consensus on imposing energy taxes for climate change purposes. The effort was unsuccessful and a unilateral national tax for small-scale energy users may be imposed by 1996.

### 1.2 North-South relations as research priority

The First Phase of the Dutch National Research Programme on Global Air Pollution and Climate Change (NRP-I) was initiated in 1991 to stimulate scientific research on climate change. NRP-I covers five different research themes. Out of a total budget of Dfl 63 million Dfl 9 million were earmarked for Theme "Sustainable Solutions". The projects considered in this section were grouped as a subtheme under the heading "international instruments for climate change policy".

From the start of NRP-I there has been increasing awareness of the importance of North-South relations in solving climate change problems. The Programming Group for Theme Sustainable Solutions commissioned a separate study on establishing priorities for policy research on climate change and developing countries. This emphasis on North-South relations is also apparent from the list of projects committed in the area of international climate change policies. Of the five projects approved and implemented four concern primarily developing countries.

The success of the Framework Convention on Climate Change depends in many ways on the evolution of North-South relations during its implementation. Research on international climate change policies should not just focus on the environmental obligations of the North, but also on the development rights of the South and the mechanisms for financial and technological transfers from the North to the South. To establish an effective international climate change policy regime the views and preoccupations of the different national interest groups in developing and industrial countries are of eminent importance in order to link priority issues strategically. This is the purpose of the first project on international negotiation strategies. To prepare possible strategies for solutions three types of questions are of eminent importance for any kind of transfer mechanism between developing and industrial nations: how to tackle deforestation taking into due consideration the interests of the third world actors involved; how to reach an energy-efficient path for optimal industrial growth in the South, and how to limit the potentially disastrous global warming effects of a coal-dominated energy development road for the world's most populous countries. These three questions

are addressed in three separate projects. Finally, an international comparison between energy efficiencies seemed useful to estimate the scope for improvements and potential pitfalls in interpreting energy efficiency figures across nations. This is the topic of the fifth project in this subtheme.

To provide a sound empirical base for possible solutions, the five NRP-1 projects funded to answer these questions all depended on a case study approach. Moreover, existing working relations between Dutch researchers and their counterparts in the South were used as far as possible.

### 1.3 Structure of the assessment

Given the diversity of topics in this subtheme and the lack of common ground between projects, the evaluation concentrates on the results of individual projects. Each project is covered in a separate paragraph. A list of the projects evaluated is presented in table 1.1 below. Only the concluding section of the assessment concerns general observations on programme effectiveness and scientific quality of the entire sub-theme and does not concern individual projects. Each project paragraph is divided into a number of sections. The first section deals with factual information on the stated goals and methodological approach of the project, while the last section deals with a normative evaluation of the project results in terms of scientific quality, effectiveness in relation to stated goals, relevance to policy makers and international embedding. The intermediate sections describe the project results. References to project publications are given in a final bibliography. An important caveat for this assessment concerns the fact, that at the time of writing this assessment insufficient material was available to evaluate projects thoroughly and definitely. In most cases final reports were not available.

Table 1.1
List of projects in the NRP subtheme "International Instruments for Climate Change Policy"

| Title | Project leader | Number |
|---|---|---|
| International policies to address the greenhouse effect | G.C.A. Junne | 853103 |
| Local actors and global tree cover policies | W.T. de Groot | 851056 |
| Strategies and instruments to promote energy efficiency developing countries | J.C. Jansen | 853101 |
| Compatibility of $CO_2$-emission reduction targets with long-term economic development in China | H. Folmer | 852064 |
| An international, statistical comparison of industrial energy efficiencies | K. Blok | 852084 |

## 2. INTERNATIONAL POLICIES TO ADDRESS THE GREENHOUSE EFFECT

### 2.1 An application of the theory of international regime formation

This project is a cooperative effort of the Department of International Relations and Public International Law of the University of Amsterdam (project leader: prof. dr. Gerd Junne; main researcher: drs. Richard van der Wurff) and the Institute for Environmental Studies of the Free University (main researcher: Joyeeta Gupta LL.M.). The project aims to provide an in-depth analysis of the political feasibility of different instruments and mechanisms to encourage developing countries to adopt national programmes for the limitation of their greenhouse gas emissions. The research provides background information on the position of important participants in international climate change policy negotiations.

The project approach is based on the theory of international regimes. Regime theory analyses conditions for the establishment of international regimes (stable sets of principles, norms, rules and procedures, that guide international cooperation). The approach is characterised by emphasis on the importance of domestic conditions within the countries concerned (perceived interests of different actors) and the catalytic role of issue-linkages. In particular, linking climate change issues with issues of development and industrialization may be important for international regime formation. The empirical material for the study is based on seven national case studies: four of which are developing nations (Indonesia, India, Kenya and Brazil) and three of which are industrial nations (Germany, UK, USA).

### 2.2 National case studies on existing climate change policies

It appears, that developing countries have a dual perception of climate change negotiations. In the light of their historical experience they fear that industrial countries will try to negotiate a reduction in their emissions regardless of the consequences for their economic development. On the other hand they hope, that they will be allowed a fair share of emission allowances in terms of per capita equity. Wavering between scenarios of Angst and Hope, the South views the issue of climate change as a test case for Northern sincerity in global partnership.

Several factors are threatening to alienate developing countries in this respect. First, they believe that industrial nations are making an artificial and unnecessary distinction between global environmental costs and benefits and local environmental costs and benefits. Moreover, the focus on cost-effectiveness in terms of incremental costs may lead to the externalisation of important social and local costs and consequently to non-optimal solutions from their point of view. Secondly, given their vulnerability to climate change the one-sided emphasis on mitigation options with the exclusion of adaptation measures prevalent in negotiation discussions appears unjustified. Thirdly, the extended discussion on Joint Implementation provoked by primarily industrial nations and the poor record of industrial nations so far in making available new and additional funds, make them sceptical about the seriousness with which the North is taking up responsibilities. Finally, developing countries receive contradictory messages from related international regimes. Such inconsistencies make them worried about the real motives of industrial nations.

From the case studies, it is also clear, that developing countries show little domestic support for or interest in climate change actions per se. The ratification of the FCCG is not viewed as a binding constraint on any kind of domestic policy, but a purely intellectually and morally correct thing to do in international relations. It reflects rhetorical paternalism in foreign policy rather than domestic commitment or social consensus.

Industrial countries differ in their approach towards international climate change policies, ranging for a legalistic approach in the UK (we do what we are obliged to do, but nothing more) via a commercial approach in the USA (climate change will offer industry business opportunities) to a more development oriented approach in Germany (emphasising the development cooperation aspects and Joint Implementation). They share the same liberal economic outlook and a preference for involving market forces. This explains their emphasis on cost-effective solutions.

**2.3 Strategic choices for international negotiations**

From a strategic point of view the study concludes, that three elements are necessary for successful negotiations. In the first place, global priorities such as climate change should be matched with local priorities within developing countries. Without such matching international climate change policies will never become a priority for developing countries. Secondly, industrial countries should demonstrate conclusively, that they are making explicit sacrifices to bring emissions down. The evidence for such sacrifices so far is not considered very convincing. Finally, more efforts should be devoted to making existing regimes consistent and to establish issue-linkages.

With these strategic elements in mind, a number of recommendations regarding existing instruments of international climate change policies follow. The Global Environmental Facility should focus much more on capacity building and promoting appropriate domestic institutions. This avoids the counterproductive focus on global versus local costs and benefits and the sensitive and unpopular debate on incremental costs. Joint Implementation should be pursued under the concept of dual commitments; thus demonstrating the willingness of industrial countries to make domestic sacrifices. Development cooperation policies, that have an indirect effect on climate change policies such as population policies, poverty abatement, mass transit systems or energy policies should be strengthened, not weakened as part of environmental policy. In terms of strategic alliances agreements on the basis of similar problems and solutions between small groups of nations should receive more attention. Examples are regional groups of big emitters, nations affected by desertification or deforestations or island and coastal nations threatened by sea-level rise.

In international negotiations nations can follow three types of progressively more complex and pervasive strategies for consensus building, which are termed respectively Pragmatic Dialogue, Pragmatic Synergy and Cultural Synergy. The Pragmatic Dialogue strategy is based on an issue-specific approach with emphasis on no regret options. It is a strategy, that does not attempt to change existing power relations and economic conditions. The underlying reasons why different actors support the same policy are unimportant and may even be very different.

The goal is to adopt simple and easy options. The Pragmatic Synergy strategy follows a least regret approach and requires some changes in existing power relations and economic conditions. Acceleration measures with respect to related policies and technological innovations are actively pursued. The Cultural Synergy strategy requires much more fundamental changes in attitudes and goals and is only feasible through shared ideologies and perceptions. It requires cross-cultural understanding and institutional changes. It uses the very diversity of people to enhance problem solving by combined action and it requires the abolition of parochial, ethnocentric negotiation attitudes, that are presently often apparent.

**2.4 Evaluation of project results**

Regime theory has been widely used in analyzing international environmental policies. In addition, climate change policies are obviously linked with development issues in general. This makes regime theory with its emphasis on domestic factors and issue-linkages a convincing point of departure. However, the connection between the theoretical concepts of regime formation and the empirical evidence gathered in the case studies is rather weak. Although the terminology is shared and a definite attempt has been made to follow an outline according to concepts from regime theory, the strength of the case studies lies in providing a descriptive overview of domestic situations rather than in answering specific empirical questions generated by the theory or providing insight in potentially important issue-linkages.

The case studies on developing countries are very instructive for those with an overly optimistic view on continuing progress in the field of international climate change policies. As to positive linkages with development in general the views expressed in the case studies can be characterized as pessimistic, in particularly concerning the clash between the vested interest of the North in any type of aid commitment and the growing needs of the South. These case studies provide important lessons in this respect.

Regime theory makes a distinction between the substantive and the procedural elements of regime formation. It also classifies different types of linkages. Since the project intents to come up with practical recommendations regarding climate change negotiations, one would expect more recommendations regarding the importance of substantive versus procedural elements and the relative weight of the different types of linkages. In fact, many concerns of developing nations appear to be addressed to the procedural rather than the substantive elements of a climate change regime; with organizational linkages rather than material linkages as is clear from the intense debates on the Global Environmental Facility and Joint Implementation.

One bottleneck for successful negotiations is insufficient synergy between the goals and actions of the Ministries of Environment and International Cooperation in industrial nations, in particular regarding the relative importance of issues and linkages. Domestic actors in industrial countries can have conflicting views on such questions. Moreover, worries of developing countries of having additional environmental strings attached to aid funds and of simple rerouting of aid funds through climate change oriented channels are not without foundation and should be treated in the case studies.

The project provides an interesting theoretical approach to problems of international negotiation. The project reports demonstrate considerable awareness of the issues at stake in actual negotiations, both in preparation of and in following up the FCCC through the INC process and GEF-related dialogues. The case studies on developing countries provide an objective and well-organized assessment of the domestic background for climate change politics in the developing world, although the connection between these case studies and the theoretical framework can be considerably improved. The case studies on industrial countries are lacking in focus with respect to the major goal of the project. Overall, the recommendations on specific instruments make sense.

## 3. LOCAL ACTORS AND GLOBAL TREE COVER POLICIES

### 3.1 Integrating micro-oriented, site-specific studies with macro-oriented political studies

The project is implemented by the Centre of Environmental Science of Leiden University (project leader prof. dr. Wouter T. de Groot; main researcher drs. Evelien M. Kamminga). Country specialists were involved in the case studies. The project objectives are twofold: to assess and integrate existing scattered knowledge concerning protecting and restoring tree cover through understanding local people's motivation and to compile this information in a format, which makes it useful for global climate change policy making.

The project approach is based on the principles of the action-in-context theory. This is a method of social science research of environmental problems developed by the Centre of Environmental Science. The method starts with an analysis of the available options and motivational factors of primary actors, who are directly involved in the problem. In the next step it looks at the secondary actors, which influence the availability of options and the strengths of motivational factors for primary actors; thus establishing a network of power relations between primary and secondary actors. Following this procedure at higher levels of action finally generates a so-called actors field for the problem of deforestation. The action-in-context method tries to integrate the strength of purely micro-oriented local deforestation studies with the insights from macro-oriented political-economic studies.

The empirical material for the study is based on three regional case studies: the Cagayan Valley region in the Philippines, the Southern forest region in Cameroon and the North-eastern Amazon region in Ecuador. The case studies are based on literature research and short field missions.

### 3.2. National case studies on deforestation processes

The three case studies are located on different continents and demonstrate the diversity of deforestation in practice. The deforestation process in the Sierra Madre region of Luzon in the Philippines (Cagayan Valley) has operated in the past through an interactive mechanism of corporate loggers opening up the forest with logging roads and local people moving in as migrant farmers with little interest to improve their land holdings. Provincial politicians played a facilitating role in the sense that the existing patronage system encouraged the buying of votes and the

use of forest resources for immediate cash. The present situation is however much more diffused. Logging permits are cancelled, road construction is under scrutiny, protection funds are available and tenure is obtainable. The future is now dependent upon the evolving practice of small-scale logging for the regional furniture industry and the pace of transition from slash-and-burn agriculture towards more sustainable forms.

Although the process of deforestation in the Southern forest region of Cameroon is also started by corporate loggers, no migrant farmers follow in their tracks because of lack of population pressure. Timber operations however tend to be very wasteful and are not kept in check by any countervailing forces, because the local elite are involved through small-scale licenses and are generally inclined to sell their regulatory power. Although NGO's and the World Bank are gradually moving in as an intermediary force which could keep the logging companies better in check, the threat of timber certification, which would discriminate against timber harvested under unsustainable conditions, is stimulating intensified operations in the short term.

In contrast to the Philippines and Cameroon deforestation in the North-Eastern Province of Ecuador has not started because of corporate loggers, but because of corporate oil exploration and exploitation. Farmers stimulated by the government move in along access roads; first starting subsistence farming, but gradually moving towards cash crops on additional land and finally reverting to extensive cattle ranching on large plots. Although the rate of colonization has slowed down recently because of environmental pressures on oil companies and opposition from indigenous people, the future is highly uncertain given the lack of legislative action to protect forest resources.

**3.3 Emphasis on transition towards sustainable agricultural development**

Deforestation studies tend to be of two types: the micro-oriented, site-specific studies, which usually follow an ecological or anthropological approach and the macro-oriented, aggregate studies, based on statistical analysis of correlation between data on forest cover and data on population, GDP, etc. Both types of studies are not particularly helpful in implementing solutions to stop deforestation. The first type of study tends to focus on the descriptive and physical aspects of the problem, thus addressing the proximate causes of deforestation. Such studies do not consider forest protection policies in a consistent national framework. The second type of studies tends to focus on the underlying forces driving deforestation. Statistical studies however leave too many open questions regarding the direction of causality and explanatory factors on the macro level such as population growth or foreign debt can not be viewed as directly instrumental in terms of forestry protection purposes. The present study tries to avoid this dual dilemma by avoiding broad statistical inferences, yet derive recommendations on the macro level from detailed case studies.

The major conclusion is, that forest protection policies should primarily be aimed at influencing the decisions of migrant farmers towards sustainability involving intensification of agricultural practices. Such policies are most important at the national level. International policies should be targeted towards enhancing national capabilities and motivations towards this goal. National policies in the area of land

use and agriculture such as extension services, credit schemes, tenure regulation and product market stabilization seem more important in this respect than forest policies per se. From this perspective developments in the international timber trade appear less crucial than is often suggested in the literature. In terms of popular slogans fair aid, for instance through a Global Forest Fund, is considered better than fair trade. With regard to population policies it is important not only to slow the rural exodus from agricultural areas towards city and forest fringes, but also to shift the "modal split" between these two choices away from forest fringes.

Instead of a project by project approach in forestry sector funding as exemplified by World Bank practices the creation of a Global Forest Fund is preferred, from which payments are made on the basis of actual national achievements in forest protection. This is a choice for broad programmatic support and output-oriented financing on the national level rather than narrow input-oriented financing on a bankable project base. Such an approach also avoids the substantial controversies regarding sovereignty and compliance and simplifies performance measurements, since relatively objective remote sensing data could be used.

### 3.4 Evaluation of project results

From an analytical point of view the appeal of the action-in-context perspective as an intermediate and integrating approach between the site-specific case study perspective and the aggregate political-economic perspective is evident. Yet the analytical concepts such as available options, motivational factors, action fields etc. are not used in a systematic and interconnected way in the case studies; the theory seems to offer no more than a way of classifying information about different actors. Conclusions from the case studies do not depend in a major way on the actual use of action-in-context theory.

The regional case studies provide an excellent overview of how and why local, national and international actors are involved in the process of deforestation in totally different parts of the world. They illustrate well how little generalization is possible on the proximate causes of deforestation and the motivations of local actors. Policy makers in the field of climate change are already wary of the complexities of slowing down deforestation or stimulating reforestation in terms of the national sovereignty issues at stake. This study will tend to reinforce their views with arguments from the local level.

The study results point out, that a smooth transition of farming systems to more intensified and permanent land-use is the most important prerequisite for forest conservation on the local level. On the national level, attempts should be made to delink the historical connection between population pressure, economic growth and the process of deforestation. These results are useful from a diagnostic perspective in the sense, that they stress the importance of an integrated approach, where actions on each level of policy making and between different fields of policy making reinforce each other. But the step between analytical diagnosis and practical remedy is much harder to conceive than suggested. In a way the focus of implementation bottlenecks is shifted from forestry and timber issues towards land-use and agricultural issues, which pose their own set of constraints.
The report is optimistic about the potential merits of a Global Forest Fund. Although this recommendation appears to be unrelated to the actual case studies

and the action-in-context theory, it contains interesting material for policy makers in the climate change debate, since it addresses the important issues of sovereignty and principles of fund financing and disbursement, that pervade all discussions about financial and technological transfers to the third world. A strong preference for output-oriented national financing through annual transfers is indicated (based on hectares of non-degraded tropical forest). Input-oriented project financing through a long-term capital fund is considered less attractive. There is the implicit assumption, that national governments are somehow better equipped to produce ultimate results than the forestry experts from international development banks with their emphasis on bankable projects. Given the right incentive this might be the case, but it is uncertain if the limited contributions of a Global Forest Fund will be able to change relatively powerless, corrupted and short-term oriented governments as exemplified in the case studies in a fundamental way.

## 4. STRATEGIES AND INSTRUMENTS TO PROMOTE ENERGY EFFICIENCY IN DEVELOPING COUNTRIES

### 4.1 Survey of experiences and strategies for efficiency improvement

The project concerns a cooperative effort by ECN-Policy Studies (project leader: drs. J.C. Jansen) and three institutes in developing countries: Tata Energy Research Institute (TERI, New Delhi; main researcher: Sharmila Barathan), Environnement et Développement du Tiers-Monde (ENDA, Dakar; main researcher: dr. Souleymane Diallo) and Instituto de Economia Industrial, Universidade Federal do Rio de Janeiro (IEI/UFRJ, Rio de Janeiro; main researcher: Prof. dr. Joao Lizardo R.H. de Araujo). Regional and sectoral specialists from these four research centres were involved in the case studies.

The project objectives are threefold. The first goal is to provide a detailed analysis of the relation between industrialization, energy use and conservation efforts in the three major developing regions of the world. The major regional bottlenecks for energy efficiency improvements in the manufacturing sector are identified. Finally, strategies and actions to be followed for effective transfer of resources and technology from the North to the South with respect to industrial energy saving technology are recommended.

The project approach is not based on a specific theoretical perspective from the field of economic or political science. It follows a pragmatic approach, in which the participating regional institutes collect specified data on industrial development and energy consumption for a limited number of nations and sectors, comment on the evolution of energy policies and recommend strategies and actions based on their regional observations. The leading institute provides background materials and a synthesis report. The case studies focus on India, Bangladesh, Thailand and South-Korea in Asia, on Tunisia, Senegal, Cameroon and Zimbabwe in Africa and on Brazil, Bolivia, Costa Rica and Mexico in Latin America. In addition, the studies concentrate on the energy-intensive subsectors of iron and steel, aluminum, chemicals, cement, paper and board.

### 4.2 Regional case studies on industrial energy conservation policies

As could be expected the regional case studies show, that industrial energy conservation experiences in different countries and in different subsectors have been quite divergent and to a great extent related to the general economic and technological conditions prevalent. The case studies contain numerous country- and sector-specific details, that cannot be summarised easily.

The African countries surveyed show few success stories except perhaps Tunisia. The Latin American experience is more diverse. Several countries such as Brazil and Mexico show substantial improvement in terms of specific energy use per physical unit, but the impacts on energy demand are cancelled by a pronounced structural shift towards energy-intensive industries. In Asia the outlook for continued improvement in industrial energy conservation is most promising. Countries like Korea and Thailand have large industrial energy conservation programmes operating with related legislative and institutional arrangements. The two industrial giants China and India are also making progress. In particular, the meteoric industrialization of China has fortunately not been matched by an equally strong growth of industrial energy demand. Looking at specific energy intensity differences by sector, it is generally true, that developing countries are not performing as well as developed countries. The differences are not the same across subsectors: they tend to be relatively small (<10%) for industries such as aluminum, but they tend to be relatively large for industries such as pulp and paper (>30%). These differences are a function of the scale of operations, the vintage of capital stock and the amount and quality of different feedstocks and products. Apart from such physical factors economic factors such as distorted energy prices and protected product markets account for lower energy efficiency levels.

### 4.3 Policy priorities for developing countries

Three types of policy action in the area of strengthening industrial conservation efforts can be distinguished: capacity building, financial incentives, and regulatory measures. Capacity building concerns the setting-up of a mission-oriented, coordinating agency which acts as a intermediate between industry and other parties and which can effectively administer information campaigns and training programmes. Such an agency should also facilitate the delivery of audit services through their own channels or through involvement of specialised engineering firms. Financial incentives should foremost address problems in reaching full-cost, market-oriented energy pricing. Credit programmes have proven less successful in the past, but their performance could possible ameliorate with proper design. Regulatory measures should concentrate on establishing a comprehensive legislative structure for an energy sector, that can operate relatively independent of pressing social and financial concerns of the government and in conformity with long-run marginal cost pricing and acceptable environmental standards. Regulatory action in the form of product labelling requirements and equipment efficiency standards are useful only, if compliance can be effectively enforced.

### 4.4 Evaluation of project results

The development of industrial energy demand in a global perspective is based on statistical analysis of structural shifts in energy demand over extended periods of time. This structural analysis is applied to projected aggregate energy demand in

order to derive the global share of industrial energy demand in the future. In principle, this is an interesting approach with solid roots in traditional development theory. The analysis however treats energy efficiency improvement on the aggregate level, not on the sector-specific level. This makes the separation of a structural component (due to changes in activity levels between sectors) and an efficiency component (due to changes in energy efficiency levels between sectors) impossible. Although this would create substantial problems of data availability and collection, one would like to see the top-down approach of the study complemented by a bottom-up approach in this respect.

The regional reports follow a uniform set-up and are well-conceived in terms of making the energy role and position of the diverse and fragmented industrial sector in widely different parts of the world accessible. As can be expected, industrial energy conservation opportunities and bottlenecks are very different not only for the three major global regions, but also for the different countries, that have been analyzed in detail within those regions. However, the success of the project in terms of describing this diversity clearly in the regional reports at the same time makes the overall project objective of coming up with general conclusions regarding industrial energy conservation policies in the third world more debatable.

The project has produced a wealth of empirical material on industrial energy use in developing countries. Unfortunately, it appears that the conclusions regarding the difficulties of energy conservation policy in developing countries are not specific to energy as a major factor of production. Developing countries are often inefficient in the use of all types of resources, not just energy, and many studies have been devoted to the generic causes of this phenomenon. One would expect more awareness of those general problems of efficiency and the policies usually recommended to alleviate them demonstrated in the study. The special place of energy as a factor of production within this general framework could than be made more clear.

Although the instrument of joint implementation became widely discussed only after the start of the project, the issue was considered of sufficient importance to merit separate attention. A case study for the cement sector, which is of central importance in many developing countries, was used as basic material for a paper on joint implementation in this sector. Such an approach appears very relevant for actual policy making, since it makes the opportunities and limitations of joint implementation much more transparent on the level, where decisions about pilot projects must be made. Negotiation discussions on joint implementation usually take place on a highly abstract level, while the real implementation problems can only be understood on a much more practical level, where the interests and motivations of the private sector agents ultimately involved in financial and technological transfers are clear.

The project has succeeded in providing a thorough analysis of industrialization and energy use in the third world including the potential regional bottlenecks. There is however at this time a lack of conclusions regarding the consequences of this analysis for financial and technological transfers from the industrialized North to the developing South. The policy relevance of the study for those involved in climate change related decision making is therefor not completely clear. An

important exception concerns the case study on the cement industry, which affords an actor-oriented view of the potentials and bottlenecks for Joint Implementation in the industrial sector. The international embedding of the work is well taken care off, because of the direct involvement of three leading research institutes from developing countries.

## 5. COMPATIBILITY OF $CO_2$-EMISSION REDUCTION TARGETS WITH LONG-TERM ECONOMIC DEVELOPMENT IN CHINA

### 5.1 Computable general equilibrium modelling and power capacity planning combined

This project concerns Ph.D. research at Wageningen Agricultural University (Promoters prof.dr. Henk Folmer and prof.dr. Paul van Beek; promovendus ZhongXiang Zhang). The project objectives are to develop a $CO_2$-emission trend analysis for China and to make a cost-effectiveness analysis of reduction options in the Chinese energy system. The project approach is based on developing two new national models for China: a Computable General Equilibrium (CGE)-Model and a power sector model based on linear programming. These models are to be used for analyzing the stated research questions. It should be noted, that at the time of this assessment insufficient materials were available to evaluate the project properly. Submitted papers are of an introductory nature, describing in a general way the state-of-the-art in economic modelling and instruments for climate change policy and the structure of the models to be applied.

### 5.2 Analysis of the Chinese energy system

In the debate about limiting global $CO_2$-emissions from energy sources, the future contribution of China occupies a central role. As the world's most populous and coal dependent region it is evidently of pivotal importance in any international greenhouse abatement strategy. The general description of the present situation and future prospects provided in this project underlines the daunting nature of the challenge; particularly since the alternatives to coal power in the field of hydro and nuclear create their own share of environmental problems. Although energy efficiency improvement in China has been more impressive than in other developing nations in the past decade, the energy intensity remains high both in economic and in physical terms. This is partially accounted for by the high share of industry in the national product and the high share of energy-intensive heavy subsectors within industry. Moreover, there are considerable measurement problems when it comes to economic comparisons because of difficulties of establishing relevant purchasing power parity conversion rates. Nevertheless very substantial improvements are likely, particularly when high industrialisation rates lead to fast replacement of old and small-scale processing equipment by modern, large scale, integrated plants.

### 5.3 Merits of different approaches to $CO_2$-emission reduction cost estimates

The project results available so far are limited to the methodological choices made in the project. Empirical results are not yet available. Available cost estimates in the literature are based on ad-hoc, technology-specific comparisons, dynamic optimization models of a sectoral nature, input-output or macroeconomic models

or general equilibrium models. It is concluded, that general equilibrium modelling is to be preferred, because effective $CO_2$-emission reduction policies require non-marginal shifts in the prices of production factors and consumer goods and services. The ultimate effects of the resulting structural changes cannot be captured adequately in an ad-hoc, sectoral or partial equilibrium framework. However, since such models cannot capture the technical details required for specific energy policy choices, a hybrid approach linking a general equilibrium model with a dynamic sectoral optimization model would be even better. The essential features of such a hybrid model construction for China are described.

### 5.4 Evaluation of project results

To develop two new advanced models inclusive of estimating empirical parameters and actual application for a huge and diverse economy such as China in the course of one Ph.D. thesis is indeed a very substantial challenge. The development and empirical use of just the CGE-model would really require a substantial team effort as would the development of a detailed power sector model. Therefore, the results of the project must be viewed primarily as a first and innovative effort to explore the potential of a hybrid model for climate change policy purposes.

Although CGE-models are in principle attractive to track the ultimate effects of climate change policy, the empirical requirements appear to be considerable in practice. Results tend to be very sensitive for chosen parameter values. So far, the major lessons to be learned from CGE-models are of a general nature: indicating the potential complexities of predicting the effects of applying specific economic instruments in the long run, but of limited relevance to actual policy making.

Although the required investments in power plants to sustain present economic growth rates in China are very high, it is unlikely that the capital requirement and electricity price differentials related to different power scenario's will be large enough to cause economy-wide effects, that are traceable within the already large margins of uncertainty attached to CGE-runs. The danger of spurious results is large. Moreover, to reach the original objective of estimating the cost-effectiveness of power plant options, a first order estimate based on a stand-alone power supply model would already be sufficient and interesting and would be helpful anyway in testing the performance of such a model.

## 6. EVALUATION OF GUIDELINES FOR SHARING OF INTERNATIONAL $CO_2$-EMISSION BUDGETS

### 6.1 An international, statistical comparison of industrial energy efficiencies

The project is implemented by the Department of Science, Technology and Society of Utrecht University (Project leader: dr. Kornelis Blok; main researchers: dr. Ernst Worrell and drs. Dian Phylipsen). The project objective is to evaluate potential guidelines for the determination of emission limits for $CO_2$ per country taking into account the present economic structure and the per sector level of energy efficiency. The project is limited to the determination of the comparative energy efficiency in the power and industrial sectors of primarily developed countries. The methodological approach is based on the collection and analysis of

standard statistical data on national energy consumption per sector. Actual activities are not aimed at the evaluation of guidelines for target setting in international negotiations, but at providing relevant data concerning energy conservation potentials.

### 6.2 Establishing a basis for emission reduction agreements

The discussion on an acceptable basis for emission reduction agreements has so far concentrated on an equitable formula for setting targets. Such a target-based discussion focuses on the ultimate goals of an agreement rather than the means by which such goals could be reached. Discussions along these lines are very dependent on basic assumptions on acceptable criteria for a just sharing of obligations. An alternative to this approach is to try to reach agreements on international efficiency standards, which when accepted would automatically lead to emission reductions. In a way such an approach emphasizes the common goal of efficiency, which perhaps would cause less controversy in international negotiations. Such efficiency standards would require more and more detailed information about the economic structure and sectoral energy efficiency performance. The latter approach towards emission reduction agreements forms the rationale behind the results of this project.

### 6.3 Comparative analysis of efficiencies in electricity production and industrial sectors

A choice was made to analyze energy-intensive sectors, that are characterised by a relatively homogenous product and can be adequately described in terms of specific energy consumption (average energy use per physical unit of production). These sectors are electricity production, refineries, iron & steel, ammonia, pulp & paper, cement and petrochemicals. The electricity study indicates, that the potential for raising energy efficiency with commercially available technology is very high; from a purely technical perspective savings of 30-35% on a worldwide scale are feasible. This figure refers to efficiency improvements only; when fuel mix changes are included, the effect on $CO_2$-emission reduction would even be larger.
The studies on the manufacturing sector concentrate on Europe. Taking the best performer among countries in specific industrial subsectors as indicative of best available performance, it appears that substantial conservation potential exists and that the differences between countries are often large. For instance in Spain improvement potentials for subsectors range from 1% in the case of ammonia to 42% in the case of iron&steel. In the pulp & paper industry potentials range from 13% in the Netherlands to 55% in Denmark. Average conservation potentials per subsector in the European Union range from 13%-27%. Countries in Eastern Europe are often, but not always less efficient.

### 6.4 Evaluation of project results

The available reports provide excellent material on the nature and level of efficiency differences between countries and the problems of generating efficiency figures that are sufficiently comparable for policy purposes. From a methodological perspective these are important contributions.

There are however several important assumptions hidden in the idea, that comparative efficiency figures based on statistical evidence are useful for climate change policy. Most important is the assumption, that lower specific efficiencies

represent opportunities for cost-effective measures, that countries are keen to take up. The available statistical figures however do not account for generic causes for efficiency differentials such as the scale of operation, capacity utilization, plant vintages in manufacturing or the structure and level of energy pricing. The influence of such factors may be much more important than is often clear from statistical figures. They may therefor be a misleading guide for cost-effectiveness. Moreover, when analyzing industries in detail it is often very difficult to separate the structural effects of differences in feedstocks and product qualities from efficiency effects related to process type. Although avoiding controversial issues of equity evaluation in climate change negotiations, such an approach is bound to raise equally complicated questions of efficiency measurement. In fact, the conclusions of an approach based on efficiency standards instead of targets would lead to heavier burdens for poor and inefficient nations. It would tend to put additional pressure on Spain instead of Germany and thus put the equity issue in the limelight rather than avoiding it. Nevertheless, from a methodological point of view, the results provide important background information for a dialogue on guidelines.

## 7. GENERAL CONCLUSIONS

### 7.1 Programme effectiveness

If anything, the studies showed decisively, that the questions asked were the right ones. The future of international climate change policies will depend in large measure on the position and actions taken by developing nations as far as deforestation and industrialization is concerned. At the same time, it is clear that climate change is not at all a priority issue in developing countries. The studies underline the impressive problems facing the reconciliation of development and climate change goals at the domestic level, while at the same time indicating, that the scope for improvement is large and dependent upon international action. In terms of problem formulation and orientation this subtheme must be evaluated very positively.

The orientation of the work has been primarily diagnostic, describing the causes and consequences of anthropogenic $CO_2$-emissions in analytical terms. Although the studies also include some policy-oriented work (global forest fund, joint implementation in industry), this aspect is relatively weakly represented. In this sense, the direct policy relevance of the work is less than originally intended. Although this is partially a result of the rapidly changing international policy environment (the NRP-I programme dates from before the UNCED Rio Conference and the establishment of the FCCC), this can not be viewed as the only reason. Two other reasons must be mentioned in addition: the gap between scientific approaches and policy relevance remains wide and relatively unexplored and the lack of tools, that incorporate policy instruments as an integral part of the methodological approach.

### 7.2 Programme quality

It appears difficult to find the right kind of balance between theoretical rigour and empirical quality. Where a specific theoretical approach is proposed, there is often a limited influence on the empirical data gathering and analysis beyond a purely

organizational impact (action-in-context theory and regime theory). Sometimes there is a lack of empirical material (China) or theoretical backbone (industrial energy conservation). The work on guidelines has perhaps found the best balance between attention for methodology and emphasis on empirical data.

The strong dependence on a case study approach in most projects is very fortunate. The studies are excellent in drawing attention to the great diversity between developing countries and the dangers of coming up with universal solutions at the global level. From a scientific point of view this leaves little scope for drawing general conclusions. From a policy point of view however the studies may be viewed as supportive of the tendency to move away from grand solutions towards a phased approach in which pilot projects play a major initiating role for exploring the potential of instruments such as joint implementation. A case study approach clearly helps in bridging the widening gap between analytical problem descriptions of a general nature and the ad-hoc project-by-project approach emerging in today's international climate policy practice.

Particularly in the case of international climate change policies it appears imperative, that serious attempts are made to embed policy research internationally; both in terms of inputs and in terms of outputs. In this respect, this subtheme generally has succeeded well in diverse ways. Sometimes by linking up with other on-going international projects; sometimes by actually involving third-world scientists; sometimes by organizing seminal workshops. In addition, several projects have already published part of the results in the international literature.

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