Natural Resources
FORUM

Natural Resources Forum 30 (2006) 272–279

Greenhouse gas emission reductions in the post-Kyoto period: Emission intensity changes required under the 'contraction and convergence' approach

E. Kuntsi-Reunanen and J. Luukkanen

Abstract

Various approaches have been proposed for allocating commitments to countries regarding the mitigation of greenhouse gas emissions. One of these methods is the 'contraction and convergence' approach, which defines emission permits on the basis of converging per capita emissions under a contracting global emission profile. The approach is unique in its simplicity. Only two major issues need to be negotiated and agreed upon: the target atmospheric concentration of CO_2 and the date when the entitlements are to converge at equal per capita allocations. According to the contraction and convergence approach, developing countries can continue their current emission trends, whereas industrialized countries should reduce their emissions quite dramatically. This regime represents a shift away from the current approach towards defining commitments for all parties and their evolution over the long term. This article analyses how allocation schemes determined by the contraction and convergence approach might affect certain OECD and non-OECD countries. Results for eleven countries selected for analysis (United States, United Kingdom, Germany, France, Japan, China, Venezuela, Thailand, Brazil, India and Indonesia) reveal that trends observed in the past few decades in most industrialized countries will lead to the contraction and convergence target.

Keywords: CO_2 emissions; Contraction and convergence; Emission intensities.

1. Introduction

The Kyoto Protocol, which entered into force on the 16th of February 2005, allocates reduction commitments of greenhouse gases (GHGs) only to industrialized countries (Annex I Parties). In fact, a key feature of the Protocol is that it includes legally binding GHG emission targets for Annex I Parties for a total reduction of 5.2% from 1990 levels by 2008–2012 (UNFCCC, 1997).

Under the current scheme, developing countries do not have binding commitments to reduce GHG emissions. However, one of the key policy issues in the evolution of the United Nations Framework Convention on Climate Change (UNFCCC) is the involvement of developing countries (non-Annex I Parties). While the current contribution of developing countries to global GHG emissions is not as significant as that of industrialized countries, it is expected that within one or two decades their emissions will surpass those of the industrialized countries. Annual emissions of developing countries are growing so rapidly that even if industrialized countries meet their Kyoto targets, global annual emissions are projected to increase in the next two decades (IEA, 2002).

Developing countries contend that, given historical emissions, industrialized countries bear the primary responsibility for the climate change problem and should therefore be the first to act. This sentiment was formally recognised in the UNFCCC in 1992, which states that developing and developed countries have "common but differentiated responsibilities". While this principle is well established, it is clear that the ultimate objective of the UNFCCC can only be met if all countries eventually participate.

There is increasing pressure on developing countries to adopt some kind of target, even if it is of a different type and in a post-Kyoto period. A key discussion point is the nature of targets that are to be set for developing countries, and how these are to be determined (see Halsnæs and Olhoff, 2005).

Various alternatives for determining targets — such as fixed, dynamic, non-binding and dual targets (Philibert and Pershing, 2001) — have been put forward to meet the ultimate objective of the climate change convention by all

Eeva Kuntsi-Reunanen is at the Finland Futures Research Centre, Turku School of Economics, Finland. E-mail: eeva.kuntsi@tse.fi. Jyrki Luukkanen is also at the Finland Futures Research Centre. E-mail: jyrki.luukkanen@tse.fi.

Published by Blackwell Publishing Ltd., 9600 Garsington Road, Oxford, OX4 2DQ, UK and 350 Main Street, Malden MA 02148, USA.

countries. Equity and efficiency are important considerations in the evaluation of burden-sharing models that determine emission commitments for different countries. In this context, different approaches (Berk and den Elzen, 2001; den Elzen, 2002; den Elzen *et al*., 2005; Höhne *et al*., 2004; Torvanger and Godal, 2004; Metz *et al*., 2002) to assign commitments with respect to climate mitigation to different countries have been proposed (Kuntsi-Reunanen and Luukkanen, 2006).

The burden-sharing proposals that seek to use objectively-defined criteria for differentiation and to factor in equity are briefly mentioned below. The only one under consideration by the UNFCCC is the Brazilian proposal that allocates emission reductions to Annex I Parties based on the regional contribution of these countries to temperature increase based on historical emissions (since 1890). The burden is shared between industrialized countries on the basis of the cumulative temperature change they have caused, i.e., effective emissions (UNFCCC, 1997). The American Pew Center has devised criteria (responsibility, standard of living, opportunity) to group countries into three tiers (high, middle, low) according to the level of action required (‘must act now’, ‘should act now, but differently’, ‘could act now’) (Claussen and McNeilly, 1998). In this multi-stage approach, a gradual increase in the number of parties involved and their level of commitment takes place according to participation and differentiation rules (den Elzen, 2002). Another burden sharing proposal uses the ‘triptych’ approach, which is a sector approach that accounts for differences in national circumstances, such as population size and growth, standard of living, economic structure and the fuel mix used for generating power (Phylipsen *et al*., 1998; Groenenberg *et al*., 2001). The ‘multi-sector convergence’ approach has many similarities with the region-oriented Triptych approach, but has a global coverage. It also contains more sectors than the Triptych, which makes it highly flexible and allows more country-specific circumstances to be taken into account (Sijm *et al*., 2001). A fair amount of attention has been given to the different models which revolve around the concepts of the environmental space and per capita entitlements. Of these ‘contraction and convergence’ is perhaps one of the most comprehensive models devised so far.[1]

The National Institute of Public Health and the Environment (RIVM) in the Netherlands has developed an interactive analytical computational framework for linking the evaluation of different approaches for the differentiation of future commitments to global climate protection targets. The FAIR (‘framework to assess international regimes’) model can be used to quantitatively explore a wide range of climate policy options for international burden-sharing and to evaluate the consequences of various approaches to the differentiation of future commitments. The model includes approaches that have gained policy attention, such as the Brazilian proposal and the ‘emission intensity targets’ approach.

This article concentrates on the contraction and convergence (C&C) approach, which is based on equal per capita emission rights and concedes equal rights of individuals to pollution permits. The C&C approach defines emission permits on the basis of a convergence of per capita emissions under a contracting global emission profile (Meyer, 2000). Important variables in this approach are the level of contraction of global emissions, the convergence year, the rate of convergence and the extent to which population growth is accounted for.

2. The ‘contraction and convergence’ approach

The C&C approach is an interesting application of environmental space, with a long-term perspective on the distribution of rights and duties and their evolution over time. Therefore it is suitable for supporting long-term climate policy development. This approach was developed by the Global Commons Institute (GCI), an organization based in the UK, to avert the devastating CO_2 emission trends that are developing (Meyer, 2000). The C&C approach defines emission permits on the basis of a convergence of per capita emissions under a contracting global emission profile. All parties participate in the emission-control regime (in the post-Kyoto period), with per capita emission permits converging to equal per capita levels over time (den Elzen, 2002).

Instead of focusing on the question of how to share the emission reduction burden, the C&C approach starts from the assumption that the atmosphere is a global commons to which all are equally entitled (den Elzen, 2002). The differentiation in future commitments thus aims at the equitable allocation of emission rights or permits. By way of “compromise” between ideal and reality, the approach allows for a transition period, during which per capita emission allowances converge from a status quo to equal per capita levels. Key policy choices relate to the duration of the transition period and take population growth into account. A long transition period (late date of convergence) is to the disadvantage of developing countries, since it results in less (cumulative) emission permits over a defined period of time. This is particularly true when global emissions contract, making the “compromise” less fair (Berk and den Elzen, 2001).

Under the C&C approach, all countries would collectively agree on a target for a stable CO_2 concentration in the atmosphere, to be reviewed annually, and then work out the rate at which current emissions must contract in order to reach this target (Meyer, 2001). Once the concentration target is defined, a global carbon budget can be devised. To stay within the budget, emissions have to be reduced gradually. This is the contraction part of the model. Annual limits that decrease in stages up to the target year would be set for the global level of emissions (Meyer, 2000).

The aim of the gradual contraction is to avoid both unrealistically drastic annual reductions and excessive emissions in the beginning that would require temporary net negative

[1] For an analysis of the different models, see Luukkanen and Kuntsi 2003.

emissions in the future. Eventually, emissions will reach the required target (GCI, 1996).

The convergence part of the proposal means that each year's global emissions budget is shared amongst the nations of the world so that every country will converge on the same allocation per inhabitant by an agreed date (Meyer, 2000). Industrialized countries, in which emissions per capita are clearly above a sustainable level, would reduce their emissions, while developing countries currently under that level would be allowed to increase their emissions (GCI, 1996). Countries unable to remain within their share would be able to buy the unused portion of other countries' allocations. An international trading scheme would allow countries to buy and sell unused allocations.

Since developing countries have much lower per capita emissions than developed countries, convergence at equal per capita emissions rights would allow developing countries to sell their surplus emissions at a profit. This trading would spur the demand for clean technologies, especially in the South. The South would have an incentive to reinvest the proceeds of its permits sales into zero emissions technologies, since this would allow for the continued sale of permits. Businesses would benefit from a long-term framework that would allow them to effectively plan their capital investment in clean technology, which could become a vast growth sector. The C&C approach includes an important efficiency component since emission trading will encourage emissions to be reduced first in places where it is most economic.

The need for a specific concentration target to be set is absolutely critical. The Global Commons Institute set out to define a tolerable level of climate change. Based on the reports of the Intergovernmental Panel on Climate Change (IPCC), GCI arrived at a target concentration level of 450 ppmv for CO_2 to be achieved by 2100. The Institute's estimates also indicate the rate of change required to reach the global C&C target of 1.8 tons of CO_2 per capita by the year 2040 (GCI, 1998). Indeed, there should be a clear global trajectory towards a specific level of CO_2 in the atmosphere.

3. Quantitative analysis of the C&C approach in selected countries

The data used for the analysis were taken from IEA statistics (IEA, 2003). The GDP data were compiled for individual countries at market prices in local currency and annual rates. The data were scaled up or down to the price levels of 1995 and then converted to US dollars using the yearly average 1995 purchasing power parities.

The IEA sectoral approach contains the total CO_2 emissions from fuel combustion as calculated using the IPCC sectoral approach. This approach includes only emissions from fuel that has actually been combusted. The analysis is limited to CO_2 emissions because of the availability and reliability of a long-term time series. The main source of the 1970 to 2001 population data is the OECD (IEA, 2003). The population growth rates with a medium variant from 2002 to 2050 are from the United Nations (UN, 2003). Future economic growth rates are estimated on the basis of a joint study of the different regions in the world by the International Institute for Applied System Analysis's (IIASA) and the World Energy Council (WEC) (Nakićenović *et al.*, 1998). Estimated future economic growth rates are given in Table 1.

Table 1. Economic growth rates from 2002 to 2050, in percentages per year, for different regions in the world

Region	2002 to 2020	2020 to 2050
North America	2.0%	1.3%
Western Europe	1.9%	1.3%
Centrally planned Asia and China	5.0%	4.0%
South Asia	3.5%	3.5%
Pacific OECD	1.5%	0.9%
Latin America and the Caribbean	3.0%	2.8%

Source: Based on 'middle scenario B' (Nakićenović *et al.*, 1998).

This article seeks to establish what changes are required in countries' current emission intensities to achieve the contraction and convergence targets. For the purposes of this analysis, eleven countries were selected: United States, United Kingdom, Germany, France, Japan, China, Venezuela, Thailand, Brazil, India and Indonesia. Preliminary results indicate that trends observed in the past few decades in most industrialized countries will lead to the desired targets under the contraction and convergence scheme.

The intensity of CO_2 emissions in an economy describes how many tons of CO_2 emissions are emitted for each dollar of economic output of the nation, measured as GDP (CO_2/GDP). Reductions in emission intensity can be achieved by improvements in energy efficiency, which can be accomplished through technological changes in energy and production systems, changes in the relative share of fuels used (such as a shift from coal to gas) and changes in the economic production structure (for instance, a shift towards a more service-oriented economy). The change in emission intensity needed for achieving the C&C target requires certain corresponding structural changes in the production system. Hence, certain difficulties may be encountered in achieving the target. Decreasing energy intensity means that less CO_2 is being emitted for the same economic output. In most industrialized countries, emission intensities have already been declining for some time. Figure 1 shows the development in the USA.

Future CO_2 emissions, estimated by the Global Commons Institute (2003), for different countries are presented in Figures 2–5. The estimates indicate the rate of change required to reach the C&C target of 1.8 tons of CO_2 per capita by 2040, based on the target concentration level of 450 ppmv of CO_2 by 2100 (GCI, 1998). The 'jumps' in the intensities of some countries between 2001 and 2002 are due to slight differences in the data from the IEA and GCI regarding past CO_2 emissions.

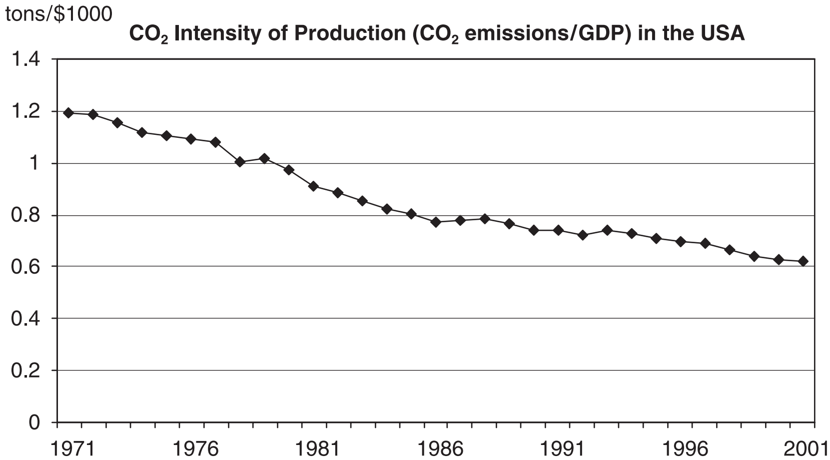

Figure 1. The change in intensity of CO_2 emission of production (CO_2 emissions/GDP) in the USA from 1971 to 2001. *Source*: IEA (2003).

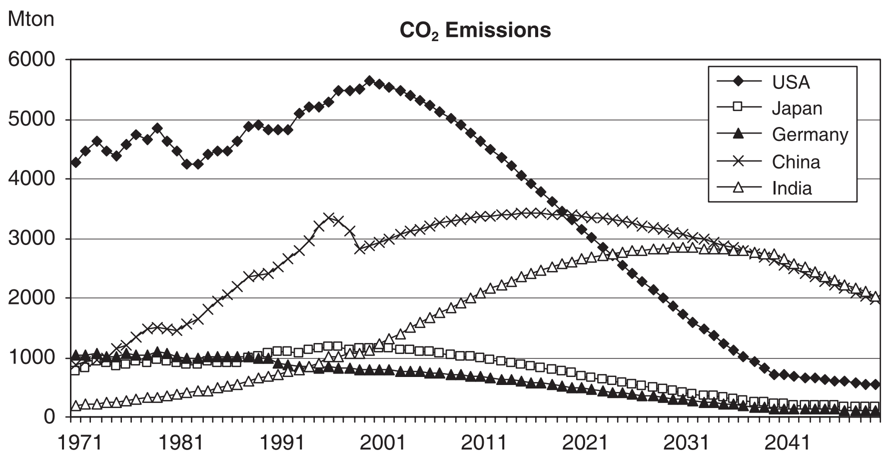

Figure 2. CO_2 emission in the USA, Japan, Germany, China and India from 1971–2050 according to GCI estimates. *Source*: Global Commons Institute (2003).

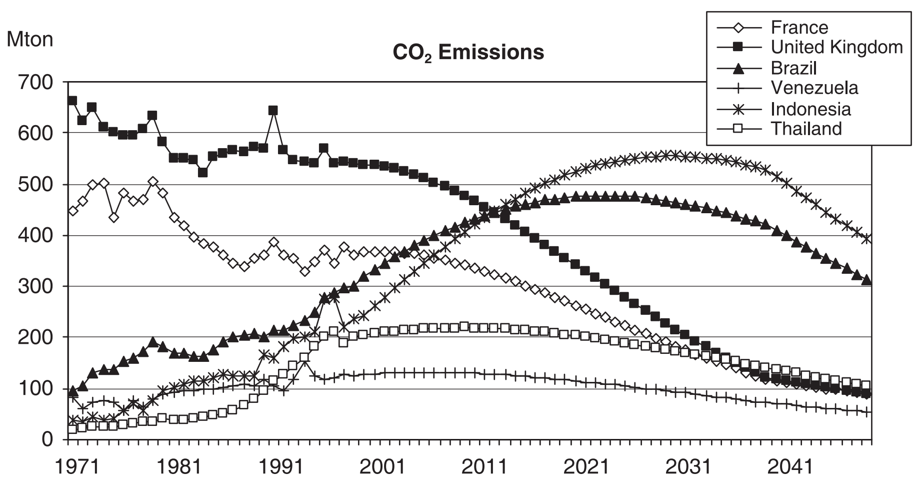

Figure 3. CO_2 emission in France, UK, Brazil, Venezuela, Indonesia and Thailand from 1971–2050 according to GCI estimates. *Source*: Global Commons Institute (2003).

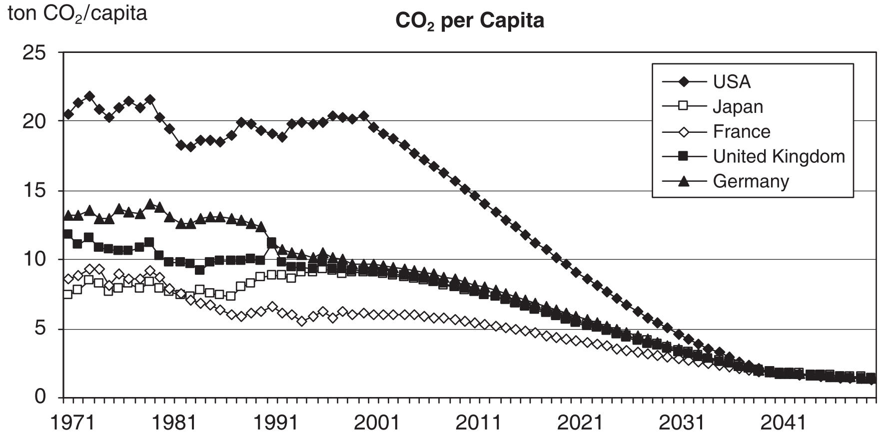

Figure 4. Changes in the CO_2 emission per capita of the economies of USA, Japan, France, UK and Germany from 1971–2001 and the required development from 2002–2050 in order to reach the C&C target.
Source: IEA (2003).

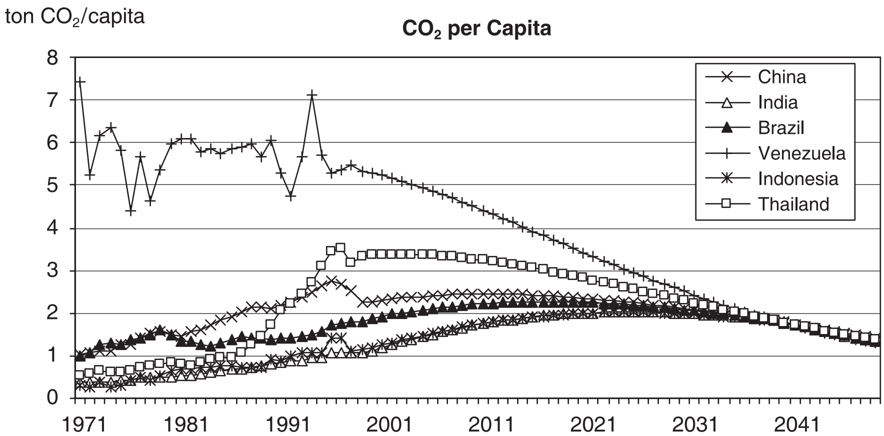

Figure 5. Changes in the CO_2 emission per capita of the economies of China, India, Brazil, Venezuela, Indonesia and Thailand from 1971–2001 and the required development from 2002–2050 in order to reach the C&C target.
Source: IEA (2003).

Required future trends of CO_2 intensities presented in this article were calculated by dividing the future emissions, produced with the C&C model, by the estimated future GDP, arrived at on the basis of the World Energy Council middle scenario (Nakićenović *et al*., 1998). The calculation of the required changes in the emission intensities to achieve the contraction and convergence target gives interesting results. For most of the industrialized countries, a business as usual development, or a continuation of past development trends seems to be sufficient to achieve the target (see Figure 6).

Figure 6 shows the required evolution in emission intensity development for some industrialized countries under the C&C model, assuming the GCI S450 basic scenario.[2] This scenario shows that in a world that aims at contraction and convergence, the emission intensities of some of the industrialized countries can basically follow their current trends. In this context, industrialized countries will achieve the vast reductions required in emissions mainly through shifts towards lighter economic production structures. A structural change in the production system seems to be more effective in reducing emission intensity than improvements in energy technology.[3] This structural change relies partly on relocating heavy and polluting industries to developing countries — which does not contribute to an overall reduction in global emissions. In any case, a globalizing economy makes it difficult to achieve an equitable allocation of emission entitlements on a national basis.

For developing countries the situation is different. For example, the targets set for Venezuela and Thailand seem difficult to achieve (see Figure 7).

As indicated by the increasing emission intensity, the economies of Venezuela and Thailand are still in the

[2] The S450 scenario is based on concentration target level of 450 ppmv for CO_2 by 2100. It assumes a linear convergence of per capita emissions by 2030, a business-as-usual growth rate of emissions of 1.5% in 2000, concentrations continuing up to 2100, and finds total emissions over 110 years to be 590 GtC.

[3] For further details, see Luukkanen *et al*., 2005.

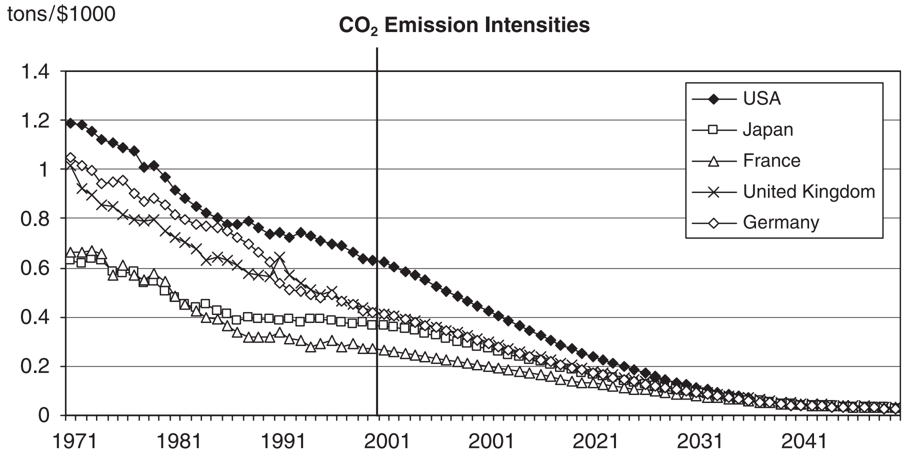

Figure 6. CO_2 intensity of production (CO_2 emissions/GDP) in USA, Japan, France, UK and Germany.
Sources: The CO_2 emissions per GDP allocated to industrialized countries, 1970–2050, were calculated on the basis of the C&C model and WEC and IIASA estimates of economic growth (Nakićenović *et al*., 1998).

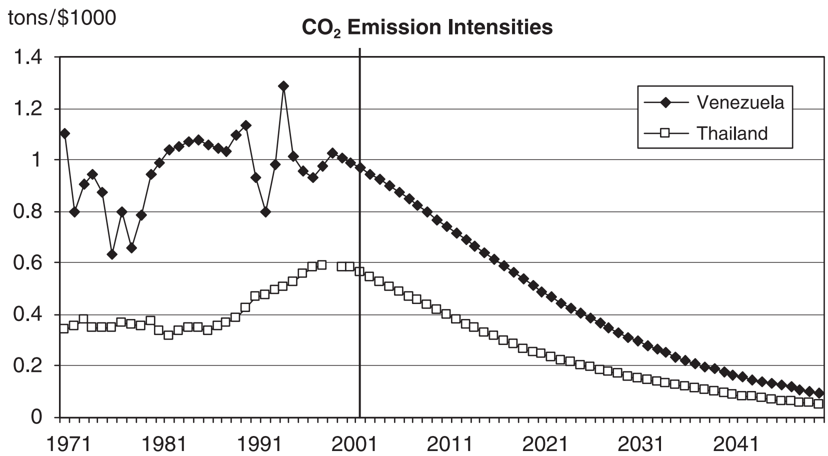

Figure 7. CO_2 intensity of production (CO_2 emissions/GDP) in Venezuela and Thailand 1971–2050 according to the C&C model.
Sources: 1971–2001, IEA 2003; future figures, UN and IIASA.

industrializing phase. According to the C&C model, emission intensities in these countries should not grow any further, but should have declined rapidly after 2001. The analysis indicates that industrialization based on a rapid increase in the use of fossil fuels and fast economic growth will not work in the C&C model, especially in countries with relatively high per capita emissions, such as Venezuela and Thailand.

Figure 8 shows emission intensities for India, Brazil and Indonesia. According to the C&C model, emission intensities in India and Indonesia are allowed to increase up until 2011 and 2007, respectively. This is due to the low current level of CO_2 per capita emissions. These countries may increase emissions from their present very low level while still remaining within the convergence path. The entitlements of CO_2 per capita emissions for India and Indonesia can grow until 2026, although their emission intensity should start decreasing at a much earlier date. Brazil's decline in intensity should have started earlier, perhaps in 2004, since per capita emissions there were already higher than in India and Indonesia.

Figure 9 indicates that the present rapid decrease in emission intensity in China can slow down, although some improvement in intensity needs to continue. According to the C&C model, actual emissions can grow until 2015, but the emission intensity must decline. China has an especially high emission intensity of production. However, if China's per capita emissions are kept low, the required pace of intensity decline will remain relatively slow, and will materialize through the efficiency improvements and structural change of the economy that are already ongoing.

4. Conclusion

Even if the targets of the Kyoto Protocol are met, global emissions will continue to rise mainly due to a continued

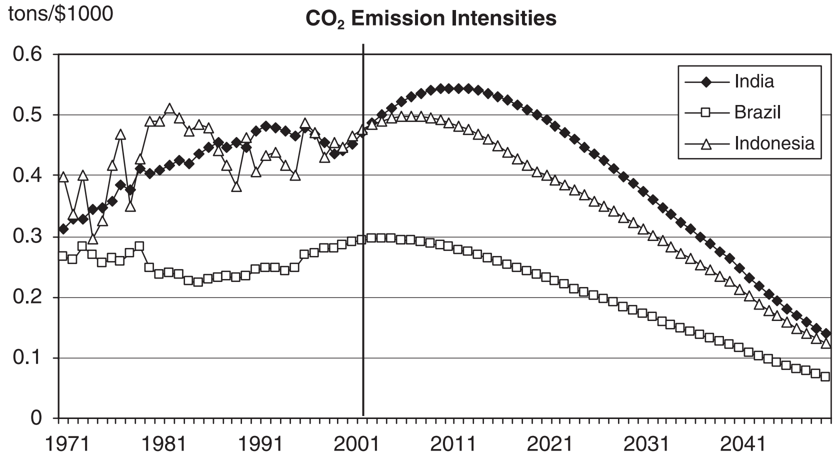

Figure 8. CO_2 intensity of production (CO_2 emissions/GDP) in India, Brazil and Indonesia 1971–2050 according to the C&C model. *Sources*: 1971–2001, IEA 2003; future figures, UN and IIASA.

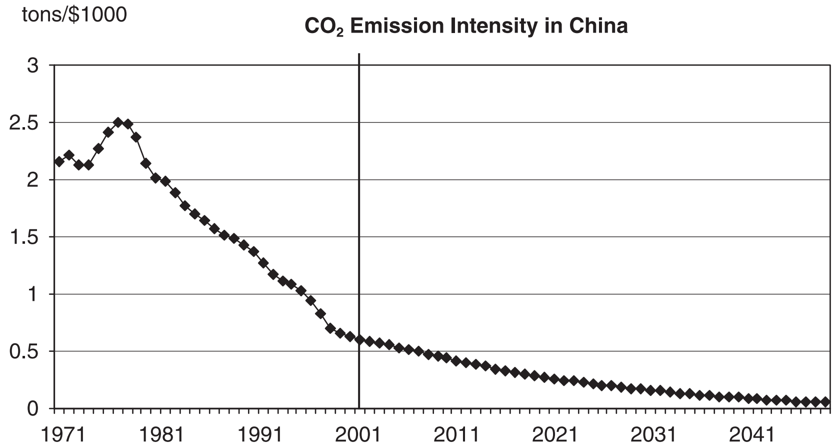

Figure 9. CO_2 intensity of production (CO_2 emissions/GDP) in China 1971–2050 according to C&C model. *Sources*: 1971–2001, IEA, 2003; future figures, UN and IIASA.

increase in emissions in developing countries. Therefore, a focus on the long-term objectives of the UNFCCC must not be postponed for too long. Developing countries have a prominent role to play in meeting these goals, both directly and indirectly.

An equal per capita allocation in schemes based on entitlements does not favour industrialized countries. Indeed, such an allocation scheme would call for the USA to reduce its present emissions by over 90%. In this respect, USA fares worse than other industrialized countries, which currently have lower per capita emissions.

A different result is obtained when considering entitlements modelled under the C&C approach, taking GDP into account. The C&C model requires a decline of emissions in all countries that are above the sustainability limit of 1.8 tons of CO_2 per capita. The required changes in emission intensities, which are decisive from the techno-economic point of view, are, however, different. Generally, industrialized countries have to follow their current downward trend, which can be achieved by continuous structural change in the production system. Economic growth has to continue its shift towards lighter sectors of the economy such as services and information and communications technology (ICT).

According to the C&C model, some developing countries, such as India and Indonesia, can still increase their emission intensities until 2015. After this date, their intensities would have to start decreasing. Since this model requires not only contraction, but also convergence of per capita emissions between countries, countries such as Venezuela and Thailand, with their relatively high per capita emissions, are required to start reducing their emission intensities immediately. A western type of industrialization, based on heavy industry, fossil fuel use and rapidly increasing motorized private transport, is not compatible with the contraction and convergence model. As the model does not support a development path for developing countries similar to that taken by many industrialized countries, in this sense, it does not fulfil the criteria of equity.

The C&C model has the potential to provide a framework for a genuine long-term solution to climate change, reducing political risk and offering businesses and investors the sort of predictable framework they prefer. The target provided by the model seems plausible for industrialized countries due to possibilities offered by structural change. Most developing countries can adjust their development policies to fit in the framework quite well. However, in practice, agreement is difficult to reach, as the present dominating development paradigm does not emphasize environmental aspects sufficiently.

To predict what will happen in the post-Kyoto period, after 2012, is a formidable challenge. Any new agreement must avoid causing economic hardship and must allow developing countries to rise out of poverty, while at the same time promising sharp, long-term reductions in global GHG levels — a ubiquitous by-product of industrialized societies. The C&C approach can be a valuable analytical tool to project the required development for different countries in a global differentiation scheme.

Acknowledgements

The authors would like to acknowledge the Academy of Finland for financial support of this study.

References

Berk, M.M., den Elzen, M.G.J., 2001. Options for differentiation of future commitments in climate policy: How to realise timely participation to meet stringent climate goals? *Climate Policy*, 1: 465–480.

Claussen, E., McNeilly, L., 1998. Equity and global climate change. The complex elements of global fairness. Pew Center on Global Climate Change, Arlington. Available at http://www.pewclimate.org/docUploads/pol%5Fequity%2Epdf.

den Elzen, M.G.J., 2002. Exploring climate regimes for differentiation of future commitments to stabilize greenhouse gas concentrations. *Integrated Assessment*, 3(4): 343–359.

den Elzen, M., Lucas, P., van Vuuren, D., 2005. Abatement costs of post-Kyoto climate regimes. *Energy Policy*, 33: 2138–2151.

Global Commons Institute (GCI), 1996. Draft Proposals for a Climate Change Protocol based on Contraction and Convergence. London, UK.

Global Commons Institute (GCI), 1998. Contraction and Convergence, a Global Solution to a Global Problem. Available at http://www.gci.org.uk/contconv/cc.html.

Global Commons Institute (GCI), 2003. Database and Version 8.5 of Contraction and Convergence Options model. Available at http://www.gci.org.uk/model/dl.html.

Groenenberg, H., Phylipsen, D., Blok, K., 2001. Differentiating commitments world wide: Global differentiation of GHG emissions reductions based on the Triptych approach — a preliminary assessment. *Energy Policy*, 29: 1007–1030.

Halsnæs, K. and Olhoff, A., 2005. International markets for greenhouse gas emission reduction policies — possibilities for integrating developing countries. *Energy Policy*, 33: 2313–2325.

Höhne, N., Phylipsen, D., Ullrich, S., Blok, K., 2004. Options for the second commitment period of the Kyoto Protocol. ECOFYS, Cologne, Germany.

IEA, 2002. Highlights, World Energy Outlook, International Energy Agency, Paris.

IEA, 2003. CO_2 emissions from fuel combustion, 1971–2001. CD-ROM Data Base.

Kuntsi-Reunanen, E., Luukkanen, J., forthcoming 2006. Target options of burden sharing in developing countries: Defining alternative models on global responsibility. *International Journal of Environmental, Cultural, Economic and Social Sustainability*.

Luukkanen, J. and Kuntsi, E., 2003. Post-Kyoto burden sharing. Moving forward with equity and efficiency. Proceedings of the Open Meeting of the Human Dimensions of Global Environmental Change, Montreal, Canada.

Luukkanen, J., Vehmas, J., Kinnunen, V., Kuntsi-Reunanen, E., Kaivo-oja, J., 2005. Converging CO_2 emission to equal per capita levels. Mission possible? FFRC-Publications 2/2005. Finland Futures Research Centre, Turku School of Economics and Business Administration, Turku, Finland.

Metz, B., Berk, M., den Elzen, M., de Vries, B., van Vuuren, D., 2002. Towards an equitable global climate change regime: Compatibility with Article 2 of the Climate Change Convention and the link with sustainable development. *Climate Policy*, 2: 211–227.

Meyer, A., 2000. *Contraction and Convergence. The Global Solution to Climate Change*. Green Books Ltd., Devon.

Meyer, A., 2001. Why contraction and convergence is the framework to solve global climate change. *Human Ecology*, October 2001.

Nakićenović, N., Grübler, A., McDonald, A. Eds., 1998. *Global Energy Perspectives*. Cambridge University Press, Cambridge, UK.

Philibert, C. and Pershing, J., 2001. Considering the options: Climate targets for all countries. *Climate Policy*, 1: 211–227.

Phylipsen, G.J.M., Bode, J.W., Blok, K., Merkus, H., Metz, B., 1998. A triptych sectoral approach to burden differentiation; GHG emissions in the European bubble. *Energy Policy*, 26(12): 929–943.

Ringius, L., Torvanger, A. and Underdal, A., 2002. Burden sharing and fairness principles in international climate policy. *International Environmental Agreements: Politics, Law and Economics*, 2(1): 1–22.

Sijm, J., Jansen, J., Torvanger, A., 2001. Differentiation of mitigation commitments: The multi-sector convergence approach. *Climate Policy*, 1: 481–497.

Torvanger, A., Godal, O., 2004. An evaluation of pre-Kyoto differentiation proposals for national greenhouse gas abatement targets, *International Environmental Agreements: Politics, Law and Economics*, 4: 65–91.

United Nations, 2003. World Population Prospects: The 2002 Revision Population Database. Population Division, Department of Economic and Social Affairs, United Nations, New York. Available at http://esa.un.org/unpp.

UNFCCC, 1992. United Nations Framework Convention on Climate Change. UNFCCC Secretariat, Bonn. Available at http://unfccc.int/resource/conv/index.html.

UNFCCC, 1997. The Kyoto Protocol to the Convention on Climate Change. UNFCCC Secretariat, Bonn. Available at http://unfccc.int/resource/docs/convkp/kpeng.html.