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INTERNATIONAL TRADE POLICY IN THE CONTEXT OF CLIMATE CHANGE IMPERATIVES

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IN THE CONTEXT OF

CLIMATE CHANGE IMPERATIVES

Abstract

The relationship between trade and climate remains highly controversial. Rising trade flows can affect greenhouse gas emissions by increasing the availability of environmentally friendly goods, services, and technologies.

Additionally, trade relies on transport, itself a major and rapidly rising source of emissions. Trade plays a critical role in the deployment of technologies vital to climate mitigation and adaptation. It can also facilitate adaptation efforts, depending on whether vulnerable communities can generate income from trade and have access to global markets. Flanking policies may be necessary to maximize these benefits.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

The nexus between trade and climate change remains highly controversial. Rising trade flows can affect greenhouse gas emissions by increasing economic output, changing the mix of countries' production factors, and increasing the availability of environmentally friendly goods, services, and technologies. Additionally, trade relies on transport, itself a major and rapidly rising source of emissions. Accounting for the carbon emissions due to trade is a challenging task involving complex interactions; ultimately, trade liberalization can both create pressures to increase or decrease emissions, with the former generally more pronounced in developing countries, and the latter more apparent in industrialized economies.

Trade plays a critical role in the deployment of technologies vital to climate mitigation and adaptation. It can also facilitate adaptation efforts, depending on whether vulnerable communities can generate income from trade and have access to global markets, for instance during food shortages. Flanking policies may be necessary to maximize these benefits, as are efforts to build capacity.

In the short run, policies adopted to mitigate the threat of climate change tend to increase production costs and can thus have an impact on the competitiveness of certain industries in the global market. While politically attractive, measures to offset such competitive disadvantages face a number of challenges. This applies, in particular, to border adjustment measures such as tariffs or other compliance obligations imposed on carbon-intensive imports. Given their nature as potential restrictions on international trade, border adjustments risk sparking a trade dispute before the World Trade Organization. Their benefits, in turn, have been widely questioned, and their implementation in ways that would help avoid a legal challenge is technically and administratively complex.

At the same time as many industrialized economies consider trade measures to prevent carbon leakage, a parallel discussion has been addressing the role of tariffs on climate technologies. Such tariffs tend to be higher in developing than in developed countries. Reducing them could support the diffusion of technologies needed to reduce emissions, yet would also curtail an important source of public revenue in developing countries and may affect domestic industries negatively. An obstacle to reform is the classification of goods under the WTO, which does not contain a separate category of environmentally friendly goods. Various solutions with different advantages and disadvantages have been proposed, and strong divisions about the most viable approach remain.

Finally, intellectual property rights, in particular patents, have become a major issue in the debate on climate change. Developing countries fear that patents will prove an obstacle for the transfer of climate technologies to their countries, while many industrialised countries and some business associations maintain that intellectual property rights are a pre-condition for investments in foreign markets. Empirical research suggests that intellectual property is not a significant obstacle to the transfer of climate technologies to developing countries currently. Accordingly, the debate may be reflective of broader divisions between the developing and developed world, to which no easy solutions exist. Only an open and evidence-based debate can help overcome these divisions.

INTERNATIONAL TRADE POLICY IN THE CONTEXT OF CLIMATE CHANGE IMPERATIVES[1]

1 INTRODUCTION

A scientific consensus has emerged that substantial cuts in greenhouse gas (GHG) emissions in the range of 50% by 2050 (compared to 1990) will be necessary to keep the increase in global mean temperature below critical levels. Achieving GHG emission reductions at such scale will require mitigation efforts in all economic sectors, with far-reaching effects for nearly all economic activities, including international trade. Not only has trade itself become a growing source of GHG emissions in a globalized world, but the goods being traded and their production are increasingly subject to policies aimed at limiting carbon intensity and climate impact. In addition, a carbon-restricted world will affect trade flows and patterns through its differential incentives and disincentives on various economic sectors and consumers. In the light of this insight, the relationship of trade and climate policy has received a rising amount of political attention in the past few years.

Such attention has been evident at the highest levels. For instance, a meeting of trade ministers convened in parallel with the 13th Conference of the Parties to the UN Framework Convention on Climate Change (UNFCCC) in Bali in 2007, discussing the linkages between trade and climate change.[2] The nexus between trade and climate change has also been addressed in two major reports, one by the World Bank[3] and another issued jointly by UNEP and the WTO.[4] A wide range of issues is commonly discussed under the heading of trade and climate change,[5] including the reduction of harmful subsidies for fossil fuels, technical standards and labelling, the reduction of tariffs and non-tariff measures on environmental goods and services, border adjustment measures on imports or exports, and technology transfer While some of these issues are the subject of negotiations at the WTO, many others have so far been only discussed at the national or EU level.

In addition, discussions on the use and further development of market-based mechanisms, such as emissions trading, are part of the international climate change negotiations, Market-based mechanisms in climate politics are related to trade in two ways. On the one hand, emissions trading involves the trading of a particular commodity – emission rights. On the other hand, developed countries are allowed to achieve some of their emission reductions through projects in other countries, notably through the clean development mechanism (CDM); this may foster international trade in those goods, which are needed to implement such projects.

The present policy brief summarises the current state of the debate on some of the most salient issues and provides recommendations in the area of trade policies. After a section that addresses what impact trade may have on GHG emissions and also what role it may play in climate change mitigation and adaptation, the brief identifies risks and potentials of carbon-related competition measures as well as

[1] The authors wish to thank Dirk Willem te Velde (ODI) for useful comments. Responsibility for potential shortcomings remains with the authors.

[2] For a report see ICTSD, Climate change and trade at Bali and beyond, http://ictsd.org/i/news/bioresreview/10611/.

[3] World Bank, *International Trade and Climate Change*, Washington D.C., 2008.

[4] WTO/UNEP, *Trade and Climate Change*, Geneva, 2009.

[5] See for an overview Cosbey, A. (ed.), *Trade and Climate Change – Issues in Perspective,* IISD, Winnipeg, 2008; Meyer-Ohlendorf, N./ Gerstetter, C., *Trade and Climate Change - Triggers or Barriers for Climate Friendly Technology Transfer and Development?* Dialogue on Globalization Occasional Papers No 41, Friedrich Ebert Foundation, Berlin, 2009.

the legal framework for policies based on climate-related process and production methods. Further sections discuss the reduction of tariffs on mitigation and adaptation technologies and the role of intellectual property rights in the climate field. Finally, the concluding section formulates recommendations for policy makers.

2 TRADE AND GREENHOUSE GAS EMISSIONS

The literature on trade and environment that has emerged since the 1970s and, more recently, on trade and climate change is extensive and detailed. The main bifurcation that developed is between the assumptions that (i) globalization inevitably leads to environmental degradation[6] and that (ii) free trade can lead to development, higher incomes, and therefore environmental protection.[7] Numerous empirical studies on individual countries and regions have since been conducted within these two polarized conjectures, but the empirical evidence on the effects of trade on climate change remains ambiguous. Consensus seems to be growing that country-specific factors may be more important than either theory.[8]

The examination of the effects of trade policy on the environment and global climate is currently grappling with the need for a post-Kyoto global climate treaty[9] and the rapid globalization witnessed over the last two decades. More recent efforts to understand and frame the relationship of trade and the environment are generally taking positions between the straddling extremes of the 1990s, cut across disciplines, and employ more sophisticated tools such as life-cycle assessment, quantification of ecosystem services and general equilibrium models. However, the country- and sector-specific relationships between trade and GHG emissions remain disputed, i.e., are modulated through a myriad of other factors such as resource endowments and extent and rigour of environmental/climate policies.[10]

2.1 Trade, trade liberalisation and greenhouse gas emissions

The past 60 years have been characterized by an unprecedented expansion of industrial activity and international trade, the latter being particularly fueled by tremendous cost reductions in transport, logistics, and communication brought about by technological innovation and further aided by more open trade and investment policies. World gross domestic product (GDP) grew approximately eight times and international trade volume is now 32 times greater than in 1950.[11] The share of trade in global

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[6] Kahuthu, A. (2006), "Economic Growth and Environmental Degradation in a Global Context." *Environment, Development and Sustainability*, 8 (1): 1573-2975.

[7] Grossman, G. M./ Krueger, A. B., "Environmental impacts of a North American Free Trade Agreement." *National Bureau of Economic Research Working Paper 3914*, 1991

[8] Copeland B. R./ Scott Taylor, M. (2004), "Trade, Growth, and the Environment." *Journal of Economic Literature*, 42 (1): 7-71; McAusland, C. (2007), "Trade, politics, and the environment: Tailpipe vs. smokestack." *Journal of Environmental Economics and Management*, 8 (2): 52-71. Cf. also to section 2.1 for a theoretical framework aimed at disentangling the different effects of trade on the size and composition of an economy and how they play out differently across countries as, inter alia, a function of natural resource endowments.

[9] An analysis of the role of developing countries in international climate change negotiations and the influence of different potential negotiation outcomes on trade is beyond the scope of this policy brief.

[10] See World Bank, "International Trade and Climate Change: Economics, Legal, and Institutional Perspectives." Washington DC, 2007 for an informative overview. Brewer (2008) and Ha et al. (2009) examine the US case. Brewer, T. L., "U.S. Climate Change Policy and International Trade Policy Intersections: Issues Needing Innovation for a Rapidly Expanding Agenda", Georgetown University, Center for Business and Public Policy, February 12, 2008; Ha, S. J./Hewings, J./Turner, K., *An interregional input-output analysis of the pollution content of trade flows ad environment trade balances between five states in the US Mid-West*, Working Papers 09-20, University of Strathclyde Business School, Department of Economics, 2009. Thomassin/Mukhopadhyay (2008) show the differential impacts of liberalization in six East-Asian countries on GHG emissions and national welfare, Thomassin, P. J./Mukhopadhyay, K. (2008), "Impact of East-Asia Free Trade on Regional Greenhouse Gas Emissions." *Journal of International and Global Economic Studies*, 1(2): 57-83.

[11] UNEP-WTO (2009), op. cit., note 4.

GDP rose from 5.5% in 1950 to 21% in 2007.[12] The trade volumes of major developing countries grew even more strongly. For example, Chinese exports levels were more than four times as high in 2008 than in 2000, Indian exports more than doubled over the same period. EU and US exports, in contrast, grew only by about 50% and 20% respectively in the same time.[13]

At the same time, the International Energy Agency (IEA) estimates that global CO_2 emissions have roughly doubled since the early 1970s, and will continue to rise by 25-90% by 2030 compared to 2000 largely due to increased emissions from developing countries.[14] A nexus between international trade and GHG emissions exists, although it has proven complex and politically controversial.

The effects of trade and trade liberalisation on the environment have been studied extensively.[15] Trade economists have developed a conceptual framework that separates these effects into three independent types: scale, composition and technology. This framework can also be used to study the link between trade liberalisation and climate change.

- **Scale effects** measure the impact of GHG emissions from increased economic output. It is assumed that trade liberalisation will increase economic activity and hence (fossil) energy use, which in turns, all else being equal, leads to higher GHG emissions.16
- The **composition effect** refers to the trade-related change in the mix of countries' production factors towards products for which they have comparative advantages. This effectively translates to a more efficient allocation of resources (capital, labour, and natural resources). However, the effect on GHG emissions depends on whether the expanding sectors are more energy-intensive than the contracting sectors.17
- The **technology effect** consists of efficiency gains through increased availability and lower costs for environmentally friendly goods, services, and technologies through trade. It is, therefore, hypothesized to lead to reduced GHG emissions. This holds for both importers, for whom such goods, services and technologies are available more easily and at lower cost, and exporters who have access to new markets for such goods, services, and technologies.18

The three effects are not separate, but influence each other and potentially in opposing directions. For example, the scale effect through increased economic activity may increase GHG emissions while the availability of certain and/or new technologies may have an influence on the composition and resource efficiency of a country's economy thereby entailing the possibility for reductions in GHG emissions.

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[12] Ibid.

[13] The figures are taken from the WTO trade statistics, accessible at http://stat.wto.org/Home/WSDBHome.aspx?Language=E.

[14] International Energy Agency (IEA), *World Energy Outlook,* IEA, Paris, 2008.

[15] The UNEP-WTO report provides a comprehensive summary of the literature but see also, for example Wiedman (2007) on input-output models. Wiedmann, T. (2007), "Examining the global environmental impact of regional consumption activities - Part 2: Review of input-output models for the assessment of environmental impacts embodied in trade." *Ecological Economics*, 61: 15-26.

[16] IISD (2000), Trade and Environment: A Handbook, Chapter 4.2. http://www.iisd.org/trade/handbook/4_2.htm (last accessed 31 July 2010).

[17] Ibid., Chapter 4.3.

[18] Gawande, K./Islas-Camargo, A., Trade Liberalization and the Porter Effect: Theory and (Preliminary) Evidence from Mexico. Prepared for the Commission for Economic Cooperation (CEC) for the Third North American Symposium on Assessing the Environmental Effects of Trade, Montreal, Canada, 30 November – 1 December 2005.

In addition, it is sometimes assumed that trade, ay increase incomes.[19] There is some evidence that people with higher incomes, in turn, push for better overall environmental quality and to behave more environmentally friendly themselves.[20] Both would ideally lead to reduced GHG emissions. However, additional measures, e.g., with respect to income distribution, may be needed to ensure socially and geographically balanced benefits from trade.

Another avenue through which trade affects GHG emissions is transport. More affordable and efficient transportation services and the increasing specialization of countries in an ever more globalized world have been major factors favouring a sharp increase in international trade. International trade expansion is likely to lead to increased use of transportation services, and because of the current reliance of transportation on fossil fuel energy, to increased GHG emissions. According to the IEA, 95% of the total energy used by world transport comes from petroleum; in 2004 transport was responsible for 23% of world energy-related GHG emissions.[21] Different modes of transport are responsible for different amounts of emissions, with 74% of transport-related CO_2 coming from road transport and 12% from aviation. At the same time, approximately 90% of international merchandise trade is transported via sea routes (8.6% of GHG emissions in the transport sector globally).[22] Road transport does not – at least globally – constitute a major contributor to global GHG emissions. This is not true, however, at the country level where climate change effects of transport vary widely. Especially trade-intensive and landlocked countries saw the share of emissions from road transport continue increase 1997-2007.[23] So-called "food-miles" or "carbon-mileage" are an emerging concept in measuring the carbon footprint of international transportation. However, local production and consumption is not always less carbon-intensive, because full carbon accounting must take into account complex interactions between local production methods, product life cycles, climatic conditions, and consumer behaviour.[24]

Another important point to note about the relationship between GHG emissions and trade is that GHG emissions are, according to internationally accepted guidelines, attributed to the country where they were physically caused, not to the country where a product is ultimately consumed. GHG accounting is based on production, not on consumption. Countries with a high share of imports thus have, on paper, less GHG emissions than are actually caused in the production of goods that these countries consume. The opposite is true for export-oriented countries. There is evidence that the developed countries

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[19] Thomassin/Mukhopadhyay (2008), op. cit., note 10; Grossman/Krueger (1991), op. cit., note 7.

[20] See Kennett, M. /Steenblik, R., *Trade and Environment: Environmental Goods and Services - A Synthesis of Country Studies*, Working Paper No. 2005-03, OECD Joint Working Party on Trade and Environment, Paris, OM/ENV/TD(2004)10/FINAL, (2005), p. 8.

[21] IEA, *CO_2 Emissions from Fuel Combustion: 1971-2005*, IEA, Paris, 2007.

[22] Ibid.

[23] Eurostat, *Greenhouse gas emissions from transport* (series tsdtr410), 1997-2007, http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsdtr410 (last accessed 31 July 2010). Examples of countries that will likely gain in the transport sector from climate change are Russia and Canada due to the anticipated year-long opening of the Bering Strait. At the same time, permanent thawing of permafrost areas will open up great areas for development, but will also require building new transport infrastructure since "ice roads" will no longer be viable. On the other hand, Australia is one of the countries (and continents) most at risk of climate change (Preston/Preston 2006; Pittock 2003), inter alia, due to its negative effects on transportation routes in close proximity to the coast. For example, sea level rise of up to 10m would severely interrupt several rail lines and submerge bridges in Melbourne and completely inundate the Gold Coast and Brisbane. Preston, B. L./Preston, R. N., *Climate Change Impacts on Australia and the Benefits of Early Action to Reduce Global Greenhouse Gas Emissions*, CSIRO, 2006; Pittock, B. (ed.), *Climate Change: An Australian Guide to the Science and Potential Impacts. Commonwealth of Australia*, Australian Greenhouse Gas Office, 2003.

[24] See, for example, a report by Lincoln University on the carbon footprint of New Zealand dairy products at http://www.lincoln.ac.nz/News--Events/News/Archive/2007/New-food-miles-report-shows-NZ-dairying-still-more-efficient-than-UK-greenhouse-gases-included.

mentioned in Annex B of the Kyoto Protocol, which includes most EU member states, are net importers of embedded GHG emissions, while China, India, South Africa and Indonesia are exporters.[25] However, sound methodologies for calculating embedded emissions are still missing.

When analyzing trade effects as above, it becomes clear that trade liberalization creates synergistic and opposing pressures on GHG emissions, e.g., the scale and technology effects tend to work in opposite directions and the GHG balance of the composition effects depends on the country's comparative advantage(s). The sum total of the trade-GHG emission link depends on the magnitude of each component and cannot easily be quantified in advance but may differ for developed and developing countries, the former noting an improvement in GHG emissions and the latter showing an increase due to systematic differences in the strength of the three effects.[26]

2.2 Trade and its contribution to mitigation and adaptation

Technological innovation and the transfer of climate-friendly technologies will be central to climate change mitigation and adaptation.[27] Trade plays a critical role in creating innovation pressures and in the development, diffusion, and use of such technologies. Economic theory assumes that the composition effect of trade leads to more efficient allocation of resources and increased specialization as countries and firms exploit their comparative advantages. In addition gains from trade may arise from trade through technology transfer, competition, and economies of scale. According to theory, trade opening propagates the first through an increased pool of available technologies accessible at lower prices.[28] The effect can be further boosted by complementary policies on education, R&D spending, licensing, etc. Technological innovation may also be influenced through increased competition, which forces companies to seek more efficient solutions and innovative products to maintain or expand market share.[29]

Concerning mitigation, the main positive effects of trade on GHG emission reductions are expected to arise through the transfer and trade in technologies dealing with energy generation, including renewable energy, energy efficiency, fuel transition, and environmentally friendly waste management and disposal.[30]

In addition, trade and trade rules in specific sectors have a significant impact on climate change. For example, forests are a significant sink for CO_2 emissions at the global level; still, forestry accounted for approximately 17% of global GHG emissions in 2004, according to the Intergovernmental Panel on

[25] See Kejun, J./Cosbey, A./Murphy, D., Embedded Carbon in Trade in Goods, ICSTDS/IISD/GMF, Geneva, 2008, http://www.um.dk/NR/rdonlyres/4A793C0A-4397-46C0-AF09-F227BB77DE2A/0/EmbeddedCarboninTradedGoods.pdf

[26] UNEP-WTO, op. cit., note 4, p. 54, cites studies that concluded that for OECD countries the GHG reducing technology effect dominated while for non-OECD countries the scale and composition effects exerted the main and negative influence on GHG emissions.

[27] UNEP-WTO (2009) op. cit., note 4; Intergovernmental Panel on Climate Change (IPCC), *Methodological and technological issues in technology transfer*, A special report of the IPCC Working Group III, Cambridge University Press, Cambridge, 2000; Philibert, C., *Technology, Innovation, Development and Diffusion*, OECD and IEA Information Paper, COM/ENV/ EPOC/IEA/SLT (2003) 4.

[28] A study by Mann (2003) cited in a recent OECD paper estimates that the price gain in the IT sector in the US was about 10-30% below domestic prices, OECD Global Forum on Trade, Innovation and Growth., Discussion Paper on Trade, Innovation and Growth prepared by the OECD Secretariat 2007, Paris.

[29] The OECD paper, note 28, offers a discussion of the different – sometimes counter-acting – pressures on innovation and growth arising from trade. For example, despite complete removal of trade barriers, path dependencies may lock a country into low-growth sectors and prevent it from developing high-end, high-value sectors.

[30] UNEP-WTO, op. cit., note 4.

Climate Change.[31] Encouraging the use of timber,[32] while ensuring, through appropriate trade policies, that timber is produced in a sustainable manner (e.g. labelling schemes or tariff cuts for timber from sustainable production), could thus make a contribution to mitigating climate change.[33] Another sector of particular relevance is agriculture which contributes about 13% of the global GHG emissions in 2004 according to the IPCC.[34] Thus, taking into account climate change implications is important when setting and reforming the rules of international agricultural trade, for example through agreeing on preferential treatment at WTO level for agricultural products produced in a climate-friendly way.

The link between trade and adaptation has received much less attention than the trade-mitigation nexus so far. In principle, trade can also serve as a means to facilitate climate change adaptation by helping to off-set sudden and longer-term shortages in food, means of production, and other requirements for economic activity and human sustenance. However, acquiring such goods requires monetary resources. These are typically scarce in developing countries, which will likely be hit hardest by the impacts of climate change. In this respect, creating specific programmes and policies to help create income from trade for particularly vulnerable communities may enhance those communities' capacity to adapt to climate change. "Aid-for-Trade", i.e. assistance to help poor communities build the capacity and infrastructure they need to benefit from trade, is mentioned as a positive example in this regard.[35]

However, it has also been noted that climate change is likely to affect, in particular, some of the sectors where developing countries have a comparative advantage and could thus benefit from trade. This is likely to hold particularly true for the agricultural sector (e.g. in Africa[36]), despite significant uncertainties on the precise impacts of climate change in different regions world.[37] It has also been pointed out that small-scale farmers' knowledge on farming practices and agricultural varieties is important for enhancing the resilience of agriculture vis-á-vis climate change.[38] Protecting this knowledge may require specific trade rules in favour of small-scale farmers who live mostly in developing countries.[39] In sum, the extent to which vulnerable communities and countries may generate an income from trade, the availability of funds, and the response of markets to shortages in terms of price signals will influence the efficiency with which trade can operate as a buffer to climate change.

Moreover, trade can also positively influence climate change mitigation and adaptation efforts through knowledge exchange associated with technology transfer, in particular to developing countries. Technology transfer is often accompanied by knowledge transfer due to maintenance requirements of

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[31] IPCC, *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, IPCC, Geneva, Switzerland, 2007, Fig. 2.1

[32] A 2004 study finds that the main factor behind loss of natural, in particular tropical forests, is the conversion of forests into agricultural lands. Thus, global demand for timber should, in principle, be supported, while at the same time ensuring that the timber traded comes from sustainable forestry, see Reid, H. et al. (2004), Using wood products to mitigate climate change: a review of evidence and key issues for sustainable development, IIED, London, p. 28.

[33] ICTSD, *Climate Change on the Road to Copenhagen*, Geneva, pp. 11-12

[34] IPCC (2007), op. cit., note 31.

[35] ICTSD, op. cit., note 33, p. 17.

[36] Parry, M. L. et al. (eds), *Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, 2007, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, Sec. 9.4.4

[37] ICTSD, op. cit., note 33.

[38] See notably the findings of the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) (2009), Summary for Decision Makers of the Global Report, p. 6

[39] ICTSD, op. cit., note 33, p. 19.

infrastructure. The demand for knowledge transfer and diffusion is pressing since more than 95% of international spending on research and development comes from a very small group of countries.[40] However, research shows that the pathways by which such exchange and transfer occur play a critical role in the quality and sustainability of the transfer process.[41]

[40] UNEP-WTO, op. cit., note 4, p.43.

[41] Bennett, D., *Innovative Technology Transfer Framework Linked to Trade for UNIDO Action,* United Nations Industrial Development Organization (UNIDO), Vienna, 2002; Barreto, L./ Klaassen, G. (2004), "Emissions Trading and the Role of Learning-by-doing Spillovers in the 'Bottom-up' Energy-Systems ERIS Model", *International Journal of Energy Technology and Policy* 2 (1-2): 70-95; Acharya, R. C./Keller, W., *Technology Transfer through Imports,* CEPR Discussion Paper 6296, CEPR, London 2007; Andersen, S. O./Sarma, K. M./Taddonio, K., *Technology Transfer for the Ozone Layer: Lessons for Climate Change*, Earthscan Publications, London 2007; Dechezleprêtre, A. et al., *Invention and Transfer of Climate Change Mitigation Technologies on a Global Scale: A Study Drawing on Patent Data,* CERNA Research Programme on Technology Transfer and Climate Change, Final Report, 2008; Copenhagen Economics/IPR Company, *Are IPR a barrier to the transfer of climate change technology?*, Report commissioned by the European Commission (DG Trade), Copenhagen, 2009.

3 RISKS AND POTENTIALS OF CARBON-RELATED COMPETITIVENESS MEASURES

A frequently voiced concern in jurisdictions which have adopted, or are considering adoption, of stringent climate policies is that such efforts will place domestic industries at a disadvantage relative to competitors in jurisdictions with less ambitious climate efforts.[42] Such fears have prompted consideration of measures to avert undesired impacts on competitiveness, including various forms of restrictions on international trade. Originally an idea developed in Europe,[43] the notion of carbon-related competitiveness measures has become an important feature in the climate policy debate of other jurisdictions such as the United States, where several legislative bills under consideration in the U.S. Congress have embraced relevant provisions.

Although various measures can help safeguard competitiveness, political concern has largely centred on proposals to introduce carbon-related border adjustments (BAs), which can collectively be defined as "measures that penalise imports from countries which do not take comparable action".[44] In their most basic form, such adjustments take the form of a tariff or any other fiscal measure which enables "imported products sold to consumers to be charged with some or all of the tax charged in the importing country in respect of similar domestic products."[45] Conversely, border adjustments may also be applied to products destined for export, most commonly through some form of tax relief or other economic benefits calculated to offset any competitive disadvantages resulting from domestic climate policies.[46] Another option that is lately attracting increased attention, moreover, is the extension of domestic emissions trading obligations to imported carbon-intensive goods: by requiring importers to purchase and surrender allowances, this measure imposes the same economic burden on imported products as it does on domestic industries.[47]

In the United States, for instance, every major proposal for federal climate legislation encompassing an emissions trading system has included a provision extending compliance requirements to importers of affected products.[48] Designated an 'International Reserve Allowance Program' in the legislative text, this mechanism requires importers of affected goods to acquire emission allowances when the share of imports from countries without comparable climate policies exceeds a certain threshold in specified

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[42] See, generally, Kraemer R. A. *et al.*, *What Contribution Can Trade Policy Make Towards Combating Climate Change?* Brussels: European Parliament, 2007.

[43] See European Parliament Resolution on "Winning the Battle Against Global Climate Change" (2005/2049(INI)) of 16 November 2005, Parl. Doc. P6_TA(2005)0433, para 37; "France Proposes Carbon Tax on EU Imports", ENDS Europe DAILY Nr. 2204 of 14 November 2006.

[44] See Hufbauer, G. C./Kim, J., *The World Trade Organization and Climate Change: Challenges and Options*, Washington DC, Peterson Institute for International Economics, 2009, p. 6.

[45] GATT Working Party Report on Border Tax Adjustments, BISD 18S/97, GATT Doc. L/3464 of 2 December 1970, para. 4, available at http://www.worldtradelaw.net/reports/gattpanels/bordertax.pdf.

[46] See, e.g., Brewer, T.L. (2004), "WTO and the Kyoto Protocol: Interaction Issues", *Climate Policy*, 4: 3-12; Zhang, Z., /Assunção, L. (2004), "Domestic Climate Policies and the WTO", *The World Economy*, 27: 361.

[47] An option not further discussed here would be to render market access for imported goods conditional on compliance with energy efficiency or other product standards and labelling requirements, see, e.g., Verrill, C. O. (2008), "Maximum Carbon Intensity Limitations and the Agreement on Technical Barriers to Trade", *Carbon & Climate Law Review*, 2:43-53.

[48] The idea was originally introduced into the political debate by the International Brotherhood of Electrical Workers (IBEW) and American Electric Power (AEP), see Morris, M. G./Hill, E. D., 'Trade is the Key to Climate Change', *Energy Daily*, 20 February 2007.

sectors, usually from 2020 onwards.[49] Judging by the legislative debate, such measures are primarily targeted at imports from China and other developing countries with a low-cost manufacturing base.[50] Although the prospects for passage of comprehensive climate legislation appear doubtful in the current Congress, it is likely that no future bill will garner sufficient political support without such trade restrictions.

While these measures all differ in concept and implementation, their assessment tends to rely on a number of shared considerations. Given their nature as potential restrictions on international trade, border adjustments have to be measured against applicable trade disciplines, notably the legal regime administered by the World Trade Organisation. Indeed, legal challenges have been threatened by a number of developing countries, which strongly oppose any environmentally motivated import restrictions on grounds that these constitute a disguised attempt at trade protectionism.[51] Accordingly, the discussion has recently extended to a careful assessment of the admissibility of border adjustments and other trade measures adopted to offset negative impacts of climate policies (see below, Section 4). A trade dispute is, hence, a risk to consider in the discussion about carbon-related competitiveness measures.

In terms of potential benefits, much analysis has gone into assessing the economic and environmental implications of border adjustment measures. While relevant studies generally acknowledge that border adjustments can help alleviate competitive pressures arising from stringent climate policies, the extent of such benefits is very much under discussion. For instance, the effectiveness of import restrictions has been questioned because these 'only affect the relative price of domestic and foreign goods in the home country'.[52] Also, the scope and design of such measures are clearly important for their functioning. As one author has stated, unless such measures 'are set on a plant-by-plant basis, rebate exports and cover indirect emissions, it is not clear that they would level the CO_2 playing field to the point where competitiveness levels are restored and leakage is avoided'.[53] Also, primary goods – such as steel and cement – represent only a relatively small share of emissions embodied in imports, whereas emissions associated with final goods assembled from parts manufactured by various producers in different countries are extremely difficult to quantify.[54]

Absent actual experience on the environmental and economic impact of border adjustments, it is difficult to predict how effective this mechanism will be in alleviating competitiveness concerns for affected sectors. More importantly, it is as yet unclear how serious such concerns will be. In the European Union, at least, the evidence to date points to a marginal impact at best of existing climate

[49] See, for instance, Sections 411-415 of the only bill to pass a plenary vote in the House of Representatives, the "American Clean Energy and Security Act of 2009 (ACESA)", sponsored by Congressmen Henry A. Waxman and Edward J. Markey.

[50] Studies suggest, however, that trade flows of carbon-intensive goods from developing countries to the U.S. are too low to render such a measure effective, see Houser, T. et al., *Levelling the Carbon Playing Field*, Peterson Institute for International Economics, Washington DC, 2008, pp. 53-5. Ironically, earlier European proposals for carbon tariffs were primarily targeted at the United States, which had failed to ratify the Kyoto Protocol.

[51] TWN Bonn News Update 'Unilateral Trade Measures to Protect Climate Change Violate Climate Treaty—Say Developing Countries', 13 August 2009.

[52] Fischer, C./Fox, A. K., *Comparing Policies to Combat Emissions Leakage: Border Tax Adjustments versus Rebates*, Resources for the Future, Washington DC, 2009, p. 25.

[53] Reinaud, J., *Issues Behind Competitiveness and Leakage: Focus on Heavy Industry*, International Energy Agency, Paris, 2008, p. 96.

[54] Reinaud, op. cit., note 53; Houser, T. et al., *Levelling the Carbon Playing Field: International Competition and US Climate Policy Design,* Peterson Institute for International Economics and World Resources Institute, Washington DC, 2008.

policies on the competitiveness of domestic industry.[55] It may appear surprising, therefore, that border adjustments continue to receive so much attention. Judging by the public debate on these measures, the attraction of border adjustments may be more political than technical in nature: for important constituencies, the notion of a tariff or compliance obligations imposed on competitors is attractive on principle and may be key in overcoming resistance to stringent climate policies. Proponents also argue that the mere threat of such measures may incentivise developing countries to accelerate deployment of robust domestic climate policies so as to avert border adjustments on their exported goods. Resistance on the part of developing countries may, however, be so great that such threats would ultimately undermine multilateral climate cooperation and prompt a surge in unilateralism. Hence, it remains doubtful whether climate-related trade measures can be justified on environmental grounds, given that many more effective (and cost-efficient) policy instruments are available. But the political debate is unlikely to be swayed by such concerns. In the long run, therefore, stronger coordination between the international trade and climate regimes will be inevitable.

[55] Kenber, M. et al., *The Effect of EU Climate Legislation on Business Competitiveness: Survey and Analysis*, German Marshall Fund of the United States, Washington DC, 2009; Grubb, M. et al., *Climate Policy and Industrial Competitiveness: Ten Insights from Europe on the EU Emissions Trading System*, German Marshall Fund of the United States, Washington DC, 2009.

4 CLIMATE CHANGE, TRADE AND PROCESS AND PRODUCTION MEASURES

As outlined in the previous section, a number of trade-related measures are conceivable to reduce the risk of leakage and address competitive distortions which may follow from the introduction of domestic or regional climate policies. Subjecting imports of certain goods to additional requirements, such as payment of a tariff, a duty to purchase and surrender allowances or compliance with energy efficiency standards, will however have a direct bearing on the flow of trade across borders. Accordingly, such measures have the potential to infringe upon central tenets of international trade law, including the WTO doctrines about process and production methods as legitimate criteria for product differentiation.[56]

Measures affecting international trade in goods are commonly governed by the General Agreement on Tariffs and Trade (GATT). Art. III:4 GATT sets out the principle of national treatment, requiring equal treatment of *like* foreign and domestic products 'in respect of all laws, regulations and requirements affecting their internal sale, offering for sale, purchase, transportation, distribution or use.' Measures such as those listed in the preceding section are based on energy consumed or carbon emitted in the production process, either in making the product or in terms of inputs to the product; they are not based on the product itself. By way of example, steel produced in a carbon-intensive process will perform like steel manufactured in a modern, highly efficient process. Traditionally, differences in the production process were not considered sufficiently relevant to justify a distinction in terms of tariffs or other trade-related measures.[57]

So far, the WTO dispute settlement bodies have not had to decide on trade measures taken by WTO members in pursuit of climate change objectives. Judging by recent WTO case law on the application of Art. III GATT, however, it is likely that even inputs which are not incorporated into the final product can serve as the basis for trade-related climate policies.[58] A sufficient nexus between the product and the relevant trade measure needs to be established.[59] As long as a measure is applied uniformly to domestic and imported products and is clearly based on measurable and transparent environmental criteria, not the country of origin, it may meet the conditions set out by the Appellate Body in its jurisprudence for the WTO consistency of trade measures.[60] A further important factor in the legal assessment of trade-related climate policies will likely be the method used for their calculation, which needs to avoid any discrimination based on country of origin. Past case law of the WTO dispute settlement mechanism suggests that such calculation should ideally be based on the actual greenhouse gas intensity or energy

[56] See generally Mehling, M. et al., "International Trade Policy in a World of Different Carbon Prices." In European Parliament (ed.), *Competitive Distortions and Leakage in a World of Different Carbon Prices: Trade, Competitiveness and Employment Challenges when Meeting the Post-2012 Climate Commitments in the European Union*. Strasbourg: European Parliament, 2008, pp. 23 ff.

[57] Such was the approach chosen, for instance, in *United States – Restrictions on Imports of Tuna*, Report of the Panel, DS21/R, 3 September 1991, BISD 39S/155, para. 5.13.

[58] See Kraemer et al., op. cit., note 42, pp. 42-3, pointing to the decisions in *United States – Taxes on Petroleum and Certain Imported Substances* (Superfund Case), Report of the Panel, 17 June 1987, BISD 34S/136, and United States – Taxes on Automobiles, Report of the Panel, 29 September 1994 (not adopted) DS31/R.

[59] On this view see Pauwelyn, J., *US Federal Climate Policy and Competitiveness Concerns: The Limits and Options of International Trade Law*, Nicholas Institute for Environmental Policy Solutions, Durham, NC, 2007, p. 20.

[60] See, e.g., *EC – Measures Affecting Asbestos and Asbestos-Containing Products*, Report of the Appellate Body, WT/DS135/AB/R, 12 March 2001, para. 100; for an overview, see Pauwelyn, op. cit., note 59, p. 30.

input of the imported product.[61] In the absence of reliable data, however, a benchmark or average value may suffice, although distinctions based on the origin of the product are, again, to be avoided.

[61] See e.g. *United States – Standards for Reformulated and Conventional Gasoline*, Report of the Appellate Body, WT/DS2/AB/R, 20 May 1996, 27.

5 TARIFFS AND TRADE IN CLIMATE TECHNOLOGIES

As developed countries consider trade measures to prevent carbon leakage, simultaneous discussions are taking place on whether an elimination of tariffs on climate technologies could facilitate the wider use of such technologies. Tariffs on environmental goods are generally higher in developing than in developed countries. For example, in the category of renewable energy goods, as currently discussed in WTO negotiations, current applied average tariff rates in developing countries are about 6 per cent, contrasted by about 10 per cent in least-developed countries and about 2 per cent in developed countries.[62]

A 2008 World Bank study states that if tariffs on certain clean technologies were completely abolished in developing countries with relatively high levels of GHG emissions, the volume of trade in these goods and countries could increase by more than 7%.[63] When looking at this figure, it should not be forgotten, however, that tariffs are a source of income for developing countries; moreover imports may harm domestic industries in some cases, in particular in developing countries.[64] Whether or not to reduce tariffs on environmental goods is thus a decision which requires a thorough assessment in each country, in the light of broader sustainable development considerations. Moreover, it also widely held that non-tariff measures relating to environmentally-friendly goods are a more important obstacle to trade than tariffs.[65]

Efforts to reduce tariffs on environmentally-friendly goods and services (EGS), including climate technologies, have been going on at the WTO since 2001 as part of Doha Round of negotiations.[66] The EGS negotiations deal with environmentally sound technologies in general, and are not restricted to climate technologies. However, mitigation technologies play an important role in the EGS negotiations.[67]

A lack of consensus on which goods to reduce tariffs or non-tariff measures has so far hampered progress in the negotiations. The underlying technical problem is that the system used by the WTO for the classification of goods,[68] which is the basis for tariff reductions, does not contain a separate category

[62] WTO/UNEP, op. cit., note 4, p. 81. Another study, looking at environmental goods more in general, finds that tariff levels applied by WTO members for a large basket of environmental goods are about 4 per cent on average for all countries, 2 per cent for all high-income countries and 8 per cent for low- and middle-income countries, Kennett/Steenblik, op. cit., note 20, p. 15.

[63] World Bank, op. cit., note 3, p. 53. The countries taken into account were Argentina, Bangladesh, Brazil, Chile, China, Colombia, Egypt, India, Indonesia, Kazakhstan, Malaysia, Mexico, Nigeria, Philippines, South Africa, Thailand, Venezuela, and Zambia; the technologies taken into account were clean coal, wind power, solar power and efficient lightning technologies.

[64] See on these aspects Claro, E. et al., *Trade in Environmental Goods and Services and Sustainable Development: Domestic Considerations and Strategies for WTO Negotiations*. ICTSD, Geneva, 2007, p. 64f.

[65] Cosbey, op. cit., note 5, p. 15.

[66] The EGS negotiations are based on Art. 31 (iii) of the 2001 Doha Declaration, see http://www.wto.org/english/thewto_e/minist_e/min01_e/mindecl_e.htm. All official negotiation documents are available at http://docsonline.wto.org.

[67] For example, the list of relevant environmental goods identified by individual WTO members so far and compiled in the most recent report of the chairman of the negotiations of the Committee of Trade and Environment in Special Session, contains a significant number of energy efficiency and renewable energy technologies as well as climate-friendly vehicles, see Committee on Trade and Environment in Special Session, Report by the Chairman to the Trade Negotiations Committee, 22 March 2010, Document TN/TE/19.

[68] The official name of the system is "Harmonized Commodity Description and Coding System". It was established by the World Customs Organization.

of environmentally friendly goods, and even less of climate technologies.[69] In addition, many goods may be used in an environmentally-friendly way, but could also for other purposes. This is problematic in particular with regard to adaptation technologies which serve human survival in changed environmental conditions (e.g. improved housing or flood protection), but no climate-related objective as such.

So far, essentially three different approaches have been suggested as a solution in the WTO negotiations:[70]

- *List-approach:* According to the list-approach, supported inter alia by the EU and the US, lists with environmental goods that would be subject to tariff reductions would need to be compiled. Among the disadvantages of this approach is that updating such a list in line with the latest technological developments would each time require potentially protracted negotiations among WTO members. In addition, lists could not include dual-use goods which can be used both for climate-friendly and other purposes.
- *Request-and-offer-approach:* According to this approach, proposed by Brazil, countries would request from each other bilaterally and subsequently grant tariff reductions on concrete products to be carried out within a certain period of time.
- *Project approach:* Under the project approach, proposed by India, tariffs would be lowered for those goods that are destined for use in environmental projects; criteria for environmental projects would be broadly defined by the WTO. This system poses some challenges in implementation; in addition, it is also unclear whether agreeing on criteria for environmental projects will be significantly easier than agreeing on a list of products.

WTO members so far have not been able to agree on any of these approaches. Moreover, developing countries have also raised the issue of special and differential treatment for them and requested that goods where they have a comparative advantage (e.g. biofuels) be included among the environmental products for which tariffs are cut.

While some observers have noticed some progress in the EGS negotiations recently, an agreement does not seem close.[71] Even if WTO members were to agree, in principle, on tariff reductions on EGS, an agreement would only be concluded as part of an overall deal on the various issues that are part of the Doha Round.[72] As the Doha Round includes negotiations on a wide range of other controversial topics, e.g. agriculture, such a deal is not likely to be adopted in the near future.

[69] For information on relevant technologies, see for example UNFCCC Subsidiary Body for Scientific and Technological Advice, *Synthesis report on technology needs identified by Parties not included in Annex I to the Convention, Bonn,* FCCC/SBSTA/2006/INF.1, 2006, p. 27.

[70] For a comprehensive overview of advantages and disadvantages of the different approaches Claro et al., op. cit., note 64, p. 14-16.

[71] Monkelbaan, J., "WTO update: Environmental goods talk focus on climate", *BioRes Review,* Volume 4, July 2010, 14.

[72] The Doha Declaration states in para. 45 that a Ministerial Conference of the WTO will be held once the results of the negotiations in all areas have been established.

6 INTELLECTUAL PROPERTY AND THE USE OF CLIMATE TECHNOLOGIES

Studies have identified a number of barriers to the transfer of technology in recipient countries. Some of the most relevant factors that have been identified are a lack of financial resources in recipient countries and a lack of information on available technologies.[73] Other important barriers identified are a lack of appropriate domestic regulation[74] or technological capacities[75] in the recipient country. In addition, adequate support from countries with a leading position in certain technologies, in particular in the form of funding for technology transfer, is crucial.

A factor that has received particular political attention in the recent climate debate is, however, the role of intellectual property rights, especially patents, in the transfer of climate mitigation and adaptation technologies. The implications of intellectual property for the transfer of technologies to developing countries are currently very much at the heart of the debate, although major developing countries are among the most important producers of certain climate-friendly technologies.[76]

Developing countries have raised the issue repeatedly in the negotiations on technology transfer under the United Nations Framework Convention on Climate Change.[77] They claim that patents are an obstacle for the transfer of climate technologies to their countries. They fear that the use of relevant technologies will either become significantly more expensive through patents, because licence fees must be paid for patented technologies, or is impossible where patent-holders from the developed world refuse licensing their technologies to developing countries' companies, for fear of competition. This position has been supported by several NGOs. By contrast, some of the developed countries as well as some business associations maintain that strong intellectual property rights are a pre-condition for investments in foreign markets, including in the clean energy sector, for example.

Only recently has the role of intellectual property in the transfer of technologies been the subject of empirical studies. The empirical research done so far lends support to the conclusion that intellectual property is currently not a major obstacle to the transfer of climate technologies to developing countries;[78] this preliminary conclusion is based both sector-specific research and a broader analysis of patent data. One study[79] concludes that patent protection for the most relevant climate-technologies (e.g. solar, geothermal and biomass technologies) is requested and registered only in a small number of developed countries, in particular the US, Germany, Japan, Austria and Spain. This suggests that patents for such technologies are not often filed and registered in developing countries. Existing patents are

[73] See UNFCCC Subsidiary Body for Scientific and Technological Advice, op. cit., note 69, p. 27.

[74] Andersen et al., op. cit., note 41, p.12.

[75] Dechezleprêtre et al., op. cit., note 41.

[76] For example, Mexico has been identified as a world leader in the export of solar heaters, and China as an important producer of wind and solar energy technologies, see Brewer T. L. (2008), "Climate change technology transfer: a new paradigm and policy agenda", *Climate Policy*, 8: 519.

[77] For an overview of positions in the UNFCCC negotiations see Gerstetter, C./ Marcellino, D. Technology Transfer in the International Climate Negotiations Assessment of Proposals and Discussion of Open Questions, Ecologic Institute, 2010, p. 14/15, http://ecologic.eu/download/projekte/8200-8249/8208/8208_Ecologic_Technology_Transfer_Final.pdf.

[78] Abbott, F., Innovation and Technology Transfer to Address Climate Change – Lessons from the Global Debate on Intellectual Property and Public Health, ICTSD, Geneva, (2009); Barton, J. , New Trends in Technology Transfer - Implications for National and International Policy, Intellectual Property and Sustainable Development Series, Issue Paper No. 18, ICTSD, Geneva, 2007; Copenhagen Economics/IPR Company, op. cit., note 41.

[79] Dechezleprêtre et al. (2008), op. cit., note 41.

thus unlikely to currently inhibit the use of climate-friendly technology in developing countries as they rarely exist in these countries. At the same time, this finding puts into doubt the claim that stricter rules on intellectual property are needed in developing countries – even the existing possibilities frequently do not seem to be used. Another study finds that a significant number of patents on carbon abatement technologies is held by firms from developing countries.[80]

However, there are some indications that patents are problematic in some cases. For example, it has been noted that developed country companies have in some cases refused to license certain technologies in certain markets or even withheld the technology as such from these markets.[81] In addition, the situation may change in the future if more climate-related technologies become market-ready.

Some proposals have been made to tackle the issue of intellectual property rights in the field of climate change. These include, for example, the use of compulsory licensing[82], the withdrawal of patents in case that relevant technologies are not licensed,[83] and patent pools.[84] None of these proposals is the subject of serious negotiations at the WTO or other international fora currently.

In relation to the scarce empirical evidence on negative or positive environmental effects of patents on climate technology, the political controversy on patents seems disproportionate. However, it is an expression of the more general controversy, in particular between developed and developing countries, on who should bear the costs of mitigating and adapting to climate change. Given that developed countries have advantages in most, even if not in all, climate technologies, but are also predominantly responsible for causing climate change, developing countries tend to insist that developed countries contribute to mitigating climate change by sharing existing technologies at low cost. While intellectual property is very likely not the most important factor inhibiting a wider use of climate technologies currently, it may nonetheless be necessary to tackle the issue at the international level.

[80] Copenhagen Economics/IPR Company, op. cit., note 41, p. 36.

[81] Shane Tomlinson, S./Zorlu, P./Langley, C., Innovation *and Technology Transfer - Framework for a Global Climate Deal*, E3G, London, 2008, p. 11.

[82] Tomlinson/Zorlu/Langley, op. cit., note 8181, p. 15.

[83] Global Climate Network, *Breaking through on technology – Overcoming the barriers to the development and wide deployment of low carbon technology*, London, 2009, p. 5.

[84] DanChurchAid, *Climate change and transfer of technology: are patents part of the problem or part of the solution?*, Copenhagen, 2008, p. 12.

Recommendations

As has been shown throughout this policy brief, the relationship of international trade and climate policies is a complex one, giving rise to deeply rooted political divisions. At the same time, initial empirical evidence in some of the areas sparking the greatest controversy, such as leakage and competitiveness impacts or intellectual property rights, suggest that concerns have been vastly exaggerated. EU policy makers are therefore advised to:

- seek empirically backed, transparent and, where possible, quantified information on the potential benefits and drawbacks of trade liberalization and trade-related climate policies;
- avoid generalizations and account for the divergent circumstances in individual regions by using a case-by-case approach;
- take into account potential climate change implications when reforming the rules of international trade, for instance through programmes to help vulnerable communities generate income from trade as a way of enhancing their capacity to adapt to climate change.

Concern over the potential impacts of rigorous mitigation policies has prompted a controversial debate, with important stakeholders demanding safeguards against any competitive disadvantages. Politically, such calls are difficult to ignore. EU policy makers should, however, ensure that any trade-related measures:

- be preceded by an impartial and, if possible, evidence-based assessment of the actual competitive impacts arising or expected from existing and planned climate policies;
- give honest consideration to the administrative and technical complexities – and hence the costs – involved in implementing such measures in a manner compatible with international trade rules, allowing for a more balanced cost-benefit analysis;
- is geared towards adoption of a measure which is applied uniformly to domestic and imported products and is clearly based on measurable and transparent environmental criteria, not the country of origin;
- take account of the concerns of developing countries.

International trade can also benefit climate change mitigation and adaptation efforts in developing countries through knowledge exchange and technology transfer. In order to overcome obstacles such as the current tariff system and maximize the benefits, future policy decisions should include:

- capacity building strategies, such as for highly skilled personnel in developing countries;
- increased knowledge transfer and diffusion, ensuring a wider distribution of support for research and development (which is currently concentrated in a very small group of countries);
- a differentiated assessment of the benefits and drawbacks of tariff reductions for clean technologies in developing countries, giving due account to the role of non-tariff measures, as a basis for improved consideration of the various proposals currently under discussion;
- an accurate and empirically founded assessment of whether intellectual property rights really pose obstacles to technology transfer, in which case numerous solutions have been proposed (e.g. covering the costs of licensing through international climate finance).

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