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Linking Tradable Permit Systems: A Key Element of Emerging International Climate Policy Architecture

Judson Jaffe, Matthew Ranson & Robert N. Stavins[*]

This Article analyzes the role that linkage between emission trading systems could play in a future international climate policy architecture. Cap-and-trade systems, regional, national, and international in scope, are emerging as a preferred instrument for addressing global climate change throughout the industrialized world, and the Clean Development Mechanism—an emission-reduction-credit system—has also developed a significant constituency. Because links between tradable permit systems can reduce

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compliance costs and improve market liquidity, the possibility of linking cap-and-trade systems to each other and to emission-reduction-credit systems such as the Clean Development Mechanism has generated considerable interest. We consider whether linkage could pave the way for a future international agreement, play a role as part of a future agreement, or substitute for an agreement. We argue that linkage could promote the near-term goals of participation and cost-effectiveness, while helping to build the foundation for a more comprehensive future agreement to address global climate change.

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INTRODUCTION

Tradable permit systems are emerging as a preferred instrument for reducing greenhouse gas (GHG) emissions. Two of the most significant institutions for reducing GHG emissions implemented to date—the European Union Emission Trading Scheme (EU ETS) and the Clean Development Mechanism (CDM)—are tradable permit systems. Further, Australia, Canada, Japan, and the United States, among other countries, are considering tradable

permit systems as a primary policy instrument for reducing GHG emissions.[1] As these systems grow in prominence and number, attention has increasingly focused on whether and how to link them.

Linking occurs when a tradable permit system's regulatory authority allows regulated entities to use emission allowances or emission reduction credits from another system in order to meet compliance obligations.[2] Linking thereby allows these entities to take advantage of the cost savings from international trade in allowances or credits.

In this Article, we analyze how linkages between tradable permit systems could influence the form of a future international climate agreement. In particular, we consider how a set of linkages might function in three roles: (1) as a de facto, bottom-up climate architecture; (2) as a step in the evolution of a coherent, top-down architecture; and (3) as a component of a larger climate architecture. We begin our analysis by describing some of the existing and proposed tradable permit systems, and the links that are developing between them. We then explain the major types of linkages and discuss their implications. Finally, we evaluate the various roles that linkages might play in a future climate architecture, and discuss how near-term policy negotiations could facilitate the growth of linkages.

I. TRADABLE PERMIT SYSTEMS

Although there are only a limited number of existing GHG tradable permit systems, as described below, several other systems are likely to emerge in the coming years.[3] The increasing number and prominence of such systems, and the economic and political incentives to link them, provide the motivation for our analysis of linkage as a potential element of the post-2012, post-Kyoto international policy architecture. Because the implications of linking depend on the type of tradable permit systems that are linked, distinguishing between two categories of systems—cap-and-trade systems and emission-reduction-credit systems—is essential.

A. Cap-and-Trade Systems

A cap-and-trade system constrains the aggregate emissions of regulated sources by creating a limited number of tradable emission allowances, which emission sources must secure and surrender in number equal to their emissions.

1. *See supra* notes 14–24 and accompanying text.

2. Such linkage of domestic tradable permit systems is different from the state-to-state trading envisaged under Article 17 of the Kyoto Protocol, whereby signatories to the Protocol can trade their "assigned amounts." *See* Kyoto Protocol to the U.N. Framework Convention on Climate Change, Dec. 10, 1997, U.N. DOC. FCCC/CP/1997/7/Add.1, 2303 U.N.T.S. 148, *at* 4-15 (entered into force Feb. 16, 2005), *available at* http://unfccc.int/resource/docs/convkp/kpeng.pdf.

3. *See supra* notes 14–24 and accompanying text; *see also* Matthew Carr, *Seven Carbon Markets May Replace Kyoto, Barclays Says (Update1)*, BLOOMBERG.COM, Oct. 16, 2009, http://www.bloomberg.com/apps/news?pid=20601072&sid=aZSZ4h_uXTzw.

As long as trading costs are low and allowance markets are sufficiently competitive, trading will lead firms to use allowances to cover those emissions that are most costly to reduce, regardless of how allowances are initially distributed.[4] Thus, trading will result in the least-cost combination of emission reduction measures necessary to reach the system-wide cap.

In developing a cap-and-trade system, policy makers must decide on several design elements.[5] Policy makers must define the level of the system's cap by determining how many allowances to issue. They also must determine the scope of the cap's coverage, or what emission sources and types of GHG emissions will be subjected to the overall cap. An associated decision relates to the system's point of regulation. A cap on energy-related carbon dioxide (CO_2) emissions can be enforced by requiring fossil fuel suppliers, such as refineries, to surrender allowances for the carbon content of their fuel sales ("upstream regulation"), or by requiring final emitters, such as factories, to surrender allowances for their emissions ("downstream regulation"). Policy makers also must determine how to distribute allowances. Allowances can be freely distributed or auctioned, or a combination of these approaches can be used. If allowances are freely distributed, methods for determining who receives them and how many allowances each recipient receives are limitless.

Much attention has been given to the possibility of including "cost-containment" measures in cap-and-trade systems, such as offset provisions, allowance banking and borrowing, and safety-valve provisions. An offset provision allows regulated entities to offset some of their emissions with credits from emission reduction measures that are outside the cap-and-trade system's scope of coverage. Banking allows firms to save unused allowances for use in future years. Borrowing allows firms to use allowances that will be issued in future years to demonstrate compliance in an earlier year. A safety valve puts an upper bound on the compliance costs that firms will incur by offering them the option of paying a predetermined fee (the safety-valve "trigger price") to purchase additional allowances. These provisions all limit costs by enhancing the flexibility available to firms in meeting their emission reduction obligations.

The world's largest existing GHG cap-and-trade system is the EU ETS.[6] Phase I of the EU ETS, from 2005 to 2007, capped aggregate CO_2 emissions from more than 11,000 industrial facilities and electricity generators in twenty-

4. *See* Robert N. Stavins, *Transaction Costs and Tradeable Permits*, 29 J. ENVTL. ECON. & MGMT 133, 140 (1995); Robert W. Hahn, *Market Power and Transferable Property Rights*, 99 Q.J. ECON. 753, 754 (1984).

5. *See* Robert N. Stavins, *A Meaningful U.S. Cap-and-Trade System to Address Climate Change*, 32 HARV. ENVTL. L. REV. 293, 305 (2008).

6. A. Denny Ellerman & Barbara Buchner, *The European Union Emissions Trading Scheme: Origins, Allocation, and Early Results*, 1 REV. OF ENVTL. ECON. & POL'Y 66 (2007).

five European countries.[7] Those sources collectively emitted approximately two billion metric tons of CO_2 in 2005, about 45 percent of the European Union's CO_2 emissions.[8] The EU ETS cap has been tightened for Phase II, which runs from 2008 to 2012,[9] and its scope has been expanded to cover new sources in countries that participated in Phase I, and to include sources in Bulgaria and Romania, which acceded to the European Union in 2007.[10] Liechtenstein, Iceland, and Norway also joined the EU ETS in 2008, although sources in Iceland are not yet subject to an emissions cap.[11] The European Union plans to extend the EU ETS through at least 2020.[12]

In addition to the EU ETS, the Japanese Voluntary Emissions Trading System has operated since 2006,[13] and Norway operated its own emissions trading system for several years before joining the EU ETS in 2008.[14] Legislation to establish cap-and-trade systems is under debate in Australia[15] and the Canadian province of Ontario,[16] and Japan is also considering a compulsory emission trading system.[17]

In the United States, the Regional Greenhouse Gas Initiative (RGGI), a cap-and-trade system for electricity generators in ten northeastern states, came

7. EUROPEAN COMMISSION, EU ACTION AGAINST CLIMATE CHANGE: EU EMISSIONS TRADING 9 (2005), *available at* http://ec.europa.eu/environment/climat/pdf/emission_trading2_en.pdf.

8. *Id.*; Press Release, European Commission, Emissions Trading: EU-wide Cap for 2008–2012 Set at 2.08 Billion Allowances after Assessment of National Plans for Bulgaria (Oct. 26, 2007), *available at* http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/1614.

9. *See* EUROPEAN COMMISSION, *supra* note 7, at 9.

10. *See* Denny A. Ellerman, *The EU Emission Trading Scheme: A Prototype Global System?*, *in* HARVARD PROJECT ON INTERNATIONAL CLIMATE AGREEMENTS, at 3 (Belfer Ctr. for Sci. and Int'l Affairs at Harvard Univ. John F. Kennedy Sch. of Gov't, Discussion Papers 08-02, 2008), *available at* http://belfercenter.ksg.harvard.edu/publication/18488/eu_emission_trading_scheme.html. For an analysis of the performance of the EU ETS, see Symposium, *The European Union Emissions Trading Scheme*, 1 REV. ENVTL. ECON. & POL'Y 66 (2007).

11. Press Release, European Commission, Emissions Trading: EU ETS Emissions Fall 3% in 2008 (May 15, 2009), *available at* http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/794.

12. European Commission, Proposal for a Directive of the European Parliament and of the Council Amending Directive 2003/87/EC so as to Improve and Extend the Greenhouse Gas Emission Allowance Trading System of the Community, at 2, COM (2008) 16 final (Jan. 23, 2008).

13. Kyoto Mechanisms Information Platform, Japan's Voluntary Emissions Trading Scheme (J-VETS), http://www.kyomecha.org/e/info04.html.

14. Norway Ministry of the Environment, Act of 17 December 2004 No.99 relating to Greenhouse Gas Emission Allowance Trading and the Duty to Surrender Emission Allowances (amending 29 June 2007 No.93), *available at* http://www.regjeringen.no/en/doc/Laws/Acts/greenhouse-gas-emission-trading-act.html; *see also* Press Release, *supra* note 11.

15. Australian Climate Change Regulatory Authority Bill, 2009 (Austl.), *available at* http://parlinfo.aph.gov.au/parlInfo/search/display/display.w3p;query=Id:%22legislation/billhome/r4126%22.

16. Legislative Assembly of Ontario, Bill 185, An Act to Amend the Environmental Protection Act with respect to Greenhouse Gas Emissions Trading and Other Economic and Financial Instruments and Market-Based Approaches, 2009, *available at* http://www.ene.gov.on.ca/envision/env_reg/er/documents/2009/010-6467%202.pdf.

17. *Japan Eyes Mandatory Cap-and-Trade in 2011/12: Nikkei*, REUTERS, Sept. 19, 2009, http://www.reuters.com/article/environmentNews/idUSTRE58J03020090920.

into effect on January 1, 2009.[18] In addition to RGGI, other regional and state efforts to limit GHGs in the United States have begun. One of the most prominent is California's enactment of the Global Warming Solutions Act of 2006, which set a statewide GHG emissions limit for 2020 equal to California's 1990 emissions level.[19] In 2008, the California Air Resources Board proposed the use of a cap-and-trade program as a primary policy for achieving this target.[20] The cap initially would cover electric generators and large industrial facilities, and its scope would later be expanded to include smaller facilities and the transportation sector.[21] At the federal level, the U.S. House of Representatives passed the Waxman-Markey American Clean Energy and Security Act on June 26, 2009,[22] and President Obama has expressed support for this legislation.[23] If enacted, this bill would establish an economy-wide cap-and-trade system that would come into force in 2012.[24]

B. Emission-Reduction-Credit Systems

Emission-reduction-credit systems are the second major type of tradable permit system. These systems bring about emission reductions by awarding tradable credits to unregulated entities for certified emission reductions. Entities in other cap-and-trade systems can then purchase these credits and use them to meet their own compliance obligations. The credits that are awarded to a particular project are based on an estimate of how much the project reduces emissions from some agreed upon baseline level of what emissions would have been if the project had not been carried out. Thus, it is necessary to estimate what baseline emissions would have been absent the credited action. For example, if an energy company that was planning to build a coal-fired power plant decides instead to build a solar power plant, it can receive and then sell credits equal to the net difference in its emissions—but only if it can prove that

18. REGIONAL GREENHOUSE GAS INITIATIVE: AN INITIATIVE OF THE NORTHEAST AND MID-ATLANTIC STATES OF THE U.S. 1 (2009), *available at* http://www.rggi.org/docs/RGGI_Executive%20Summary_4.22.09.pdf; *see also* REGIONAL GREENHOUSE GAS INITIATIVE, MEMORANDUM OF UNDERSTANDING 2, *available at* http://rggi.org/docs/mou_final_12_20_05.pdf.

19. Press Release, Office of the Governor of the State of California, Gov. Schwarzenegger Signs Landmark Legislation to Reduce Greenhouse Gas Emissions (Sept. 27, 2006), *available at* http://gov.ca.gov/press-release/4111. *See also* California Global Warming Solutions Act of 2006 (A.B. 32), CAL. HEALTH & SAFETY CODE § 38500 (West 2008), *available at* http://www.arb.ca.gov/cc/docs/ab32text.pdf.

20. STATE OF CALIFORNIA AIR RESOURCES BOARD, CLIMATE CHANGE SCOPING PLAN 31 (Dec. 2008), *available at* http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf.

21. *Id.*

22. American Clean Energy and Security Act of 2009 (Waxman-Markey), H.R. 2454, 111th Cong. (2009), *available at* http://www.govtrack.us/congress/billtext.xpd?bill=h111-2454.

23. *See* The White House Office of the Press Secretary, Weekly Address: President Obama Calls Energy Bill Passage Critical to Stronger American Economy (June 27, 2009), *available at* http://www.whitehouse.gov/the_press_office/UPDATED-and-FINAL-WEEKLY-ADDRESS-President-Obama-Calls-Energy-Bill-Passage-Critical-to-Stronger-American-Economy.

24. American Clean Energy and Security Act of 2009, *supra* note 22.

it would have built the coal-fired plant in the absence of the emission-reduction-credit system.

The most significant GHG emission-reduction-credit system to date is the Kyoto Protocol's CDM.[25] Under the CDM, certified emission reduction credits (CERs) are awarded for voluntary emission reduction projects in developing countries that ratified the Protocol, but are not among the Annex I countries subject to the Protocol's emission limitation commitments—also known as the Annex B countries.[26] While CERs can be used by the Annex I countries to meet their emission commitments, they can also be used for compliance purposes by entities covered by other cap-and-trade systems, including systems in countries that are not Parties to the Protocol, such as the United States.[27]

While emission-reduction-credit systems can be self-standing, as in the case of the CDM, governments can also establish them as elements of domestic cap-and-trade systems. These emission-reduction-credit systems—often referred to as offset programs—serve as a source of credits that can be used by regulated entities to meet compliance obligations under the cap-and-trade system. For example, RGGI includes an offset program that recognizes offsets from activities such as landfill methane capture and destruction, reductions in emissions of sulfur hexafluoride from the electric power sector, and afforestation.[28] Electricity generators covered by RGGI can use these offset credits to cover part of their emissions.[29] Cap-and-trade systems proposed in Australia and at the federal level in the United States also include offset programs.[30]

II. TYPES OF LINKAGES

Not all linkages are created equal: the type of linkage that is established has important implications for its effects. Direct linkages between systems can be one-way (unilateral) or two-way (bilateral or multilateral). Also, while direct links between systems can be established only as a result of explicit decisions to do so, direct links can lead to indirect links between systems even absent

25. *See* Kyoto Protocol, *supra* note 2.

26. *Id.* at art. 12. Like the CDM, Joint Implementation (JI) was established as a project-based flexibility mechanism under the Kyoto Protocol. Unlike the CDM, JI applies to emission reduction projects carried out in an Annex I country (the host country) that has a national emissions target under the Protocol. JI projects generate credits, referred to as emission reduction units (ERUs), which can be used to cover increased emissions in other countries. *See id.*

27. The Annex B Parties include thirty-seven industrialized countries and emerging market economies of central and eastern Europe. *See id.* at art. 12.

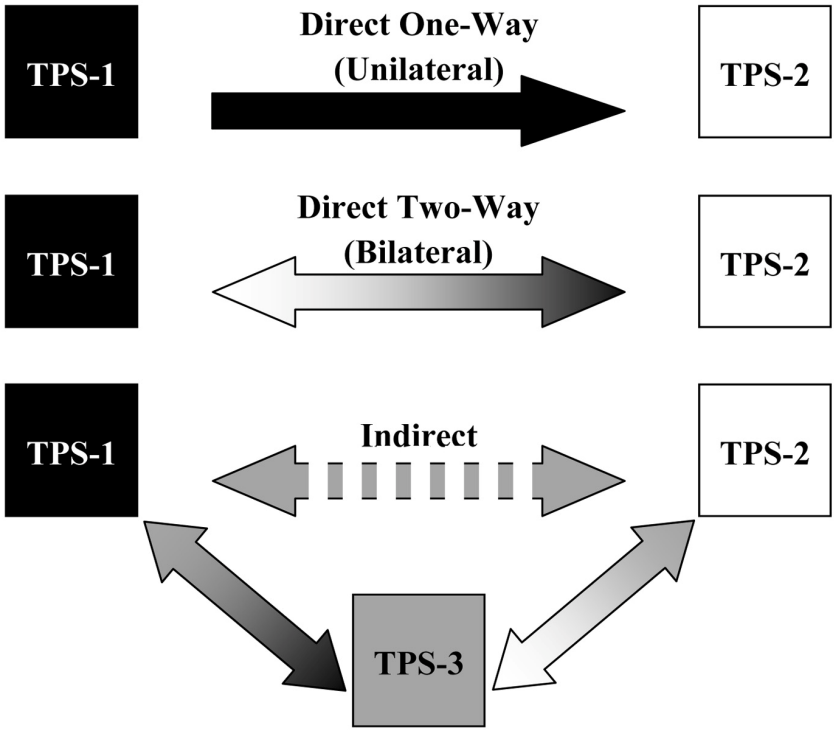
28. Regional Greenhouse Gas Initiative, Offset Project Categories, http://www.rggi.org/offsets/categories (last visited Oct. 29, 2009).

29. REGIONAL GREENHOUSE GAS INITIATIVE, AN INITIATIVE OF THE NORTHEAST AND MID-ATLANTIC STATES OF THE U.S., *supra* note 18.

30. *See supra* note 24.

explicit decisions to link them.[31] Figure 1 illustrates the various types of linkages.

Figure 1. Types of Linkages between Tradable Permit Systems
(Arrows denote the flow of credits or allowances between systems)



A. Direct Linkages

To establish a direct linkage between two systems, either one or both systems must accept the other's allowances or credits as valid for use in demonstrating compliance in its own system.

In a direct link between a cap-and-trade system and a credit system, the cap-and-trade system chooses to recognize emission reduction credits from the credit system. This linkage is necessarily one-way if the credit system does not place requirements on entities to surrender credits or allowances. If the price of credits is lower than that of emission allowances, then regulated firms in the

31. *See* UNFCCC, *IETA Report on Linking GHG Emissions Trading Systems*, at 13, U.N. Doc. COP13/CMP3 (Nov. 2007) (*prepared by* Judson Jaffe & Robert Stavins).

cap-and-trade system have an incentive to purchase credits. This will reduce the price of allowances in the cap-and-trade system and increase the price of credits in the credit system until the two prices converge.[32]

Direct linkages can also occur between two cap-and-trade systems. The linkage can be one-way or two-way, depending on whether the recognition is mutual. In an unrestricted one-way link in which System *A* recognizes System *B*'s allowances, if *A*'s allowance price is higher than *B*'s, participants in *A* will buy allowances from participants in *B*. These purchases will reduce *A*'s allowance price and increase *B*'s price until the prices converge.[33] Such trading will increase emissions in *A* and decrease emissions in *B* by an equal amount, but will lead to overall cost savings, as higher cost emission reductions in *A* are avoided and replaced by lower cost reductions in *B*. However, if *A*'s allowance price is lower than *B*'s, no trading will result from the one-way link. Hence, a one-way link in which *A* recognizes *B*'s allowances will ensure that *A*'s allowance price never exceeds *B*'s price.[34]

In a two-way direct link, both cap-and-trade systems recognize each other's allowances, making it possible for allowances to flow in either direction. Two-way links can be bilateral or multilateral. As the result of a two-way linkage, any difference between the systems' allowance prices will lead to sales of allowances from the lower price system to the higher price system until the systems' allowance prices converge at an intermediate level, leading to an increase in emissions in the higher price system and an offsetting reduction in emissions in the lower price system.[35]

If governments place limits on inter-system trading, allowance price convergence may not be complete.[36] A government may limit the quantity of allowances from another system that can be used to demonstrate compliance in its own system. Alternatively, participants in a system may be allowed unrestricted use of another system's allowances, but an "exchange rate" might be applied to their use. Such a requirement might be used to reconcile differences in the denomination of different systems' allowances (such as metric tons versus short tons), to reduce inter-system trading, or if there is a

32. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, IPCC THIRD ASSESSMENT REPORT: CLIMATE CHANGE 2001, WORKING GROUP III: MITIGATION 425 (2001), *available at* http://www.ipcc.ch/ipccreports/tar/wg3/pdf/6.pdf; Peter Bohm, *International Greenhouse Gas Emission Trading—With Special Reference to the Kyoto Protocol*, *in* EFFICIENCY AND EQUITY IN CLIMATE CHANGE POLICY (Carlo Carrero ed., 2000); ALAN S. MANNE & RICHARD G. RICHELS, THE KYOTO PROTOCOL: A COST-EFFECTIVE STRATEGY FOR MEETING ENVIRONMENTAL OBJECTIVES? 1–24 (1998), *available at* http://www.oecd.org/dataoecd/38/53/1923159.pdf.

33. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 32; Bohm, *supra* note 32; MANNE & RICHELS, *supra* note 32.

34. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 32; Bohm, *supra* note 32; MANNE & RICHELS, *supra* note 32.

35. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 32; Bohm, *supra* note 32; MANNE & RICHELS, *supra* note 32.

36. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 32; Bohm, *supra* note 32; MANNE & RICHELS, *supra* note 32.

desire, to require that trading with other systems lead to a net reduction in emissions.

B. Indirect Linkages

Even if neither system recognizes the other's allowances, two systems can become indirectly linked through direct links with a common third system. As a result of trading between each of the two systems and the common system, developments in one of the indirectly linked systems can affect the supply and demand for allowances in the other system. Hence, changes in the allowance price and emissions level in one system can affect the allowance price and emissions level in a system with which it is indirectly linked.

Indirect links can be created between two cap-and-trade systems if both have one-way links with a common credit system. As a result of such one-way links, the two indirectly linked systems will compete for credits from the third system. This indirect linkage will reduce the difference between the two cap-and-trade systems' allowance prices, as credits will flow to the system with the higher price. If there is a sufficient supply of credits at a price below the two cap-and-trade systems' pre-link allowance prices, and if there are no constraints on the use of these credits in either system, then prices in the three systems will converge fully.[37]

A series of bilateral links among several systems can also create indirect links among those systems. This kind of indirect linkage is identical in its effects to a direct multilateral link among all of the systems involved. For example, if System *A* has a two-way link with System *B*, which has a two-way link with System *C*, then trading will lead allowance prices to converge across all three systems even though *A* and *C* are not directly linked.[38]

C. Examples of Existing Linkages

Some linkages have already been established among tradable GHG permit systems, reflecting the strong economic incentives that governments face to establish these connections. The EU ETS itself can be viewed as a multilateral linkage among the Member States' own systems, where a central authority enforces the harmonization of certain characteristics of each system, and where allowances issued by any Member State are recognized by all other Member States.[39] Also, through its Linking Directive, the European Commission has allowed EU ETS participants to use CDM CERs to meet compliance

37. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 32; Bohm, *supra* note 32; MANNE & RICHELS, *supra* note 32.

38. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 32; Bohm, *supra* note 32; MANNE & RICHELS, *supra* note 32.

39. *See* Ellerman, *supra* note 10, at 1, 15–16 (making this point, as well as a broader one, namely that the EU ETS provides a range of valuable lessons for the development of the post-2012 international policy architecture).

obligations beginning in 2005, and Joint Implementation Emission Reduction Units (ERUs) beginning in 2008.[40] As a result of these linkages, EU ETS allowance prices are considered a major factor influencing CER prices, and—to a lesser extent—ERU prices.[41] However, the Directive places restrictions on these linkages. CERs and emission reduction units generated from nuclear facilities, land use change, and forestry activities are not recognized,[42] and quantitative limits are placed on the use of CERs and ERUs.[43]

In the United States, the Model Rule governing the implementation of RGGI creates several types of one-way links. Covered sources may use emission reduction credits from qualified domestic offset projects, subject to quantitative limits that depend on the prevailing RGGI allowance price.[44] When the RGGI allowance price exceeds a specific threshold, which increases over time, sources have the additional option to use CERs and allowances from other countries' cap-and-trade systems, such as the EU ETS, in meeting their compliance obligations.[45]

III. IMPLICATIONS OF LINKING

Linking tradable permit systems leads to diverse effects that need to be considered in assessing both the merits of particular linkages and the merits of linkage as a major design element of a post-2012 international policy architecture.[46]

A. Benefits of and Concerns about Linkage

The most significant benefit of linking is the opportunity to lower the costs of achieving emission reduction goals by shifting reductions between linked systems in a manner that minimizes total emission reduction costs.[47] In particular, if systems face very different marginal abatement costs, then linking

40. Council Directive 2004/101/EC, art. 5, 2004 O.J. (L 338) 18.

41. *See, e.g.*, *CER Market Steadies After Price Hit*, CARBONPOSITIVE, Nov. 10, 2008, http://www.carbonpositive.net/viewarticle.aspx?articleID=1335; *CER Prices Ease with EU Carbon*, CARBONPOSITIVE, Feb. 15, 2007, http://www.carbonpositive.net/viewarticle.aspx?articleID=670; POINT CARBON ADVISORY SERVICES, NEW ZEALAND EMISSIONS TRADIGIN GROUP, ISSUES IN THE INTERNATIONAL CARBON MARKET, 2008-2012 AND BEYOND 3–4 (2007), *available at* http://www.mfe.govt.nz/publications/climate/issues-international-carbon-market-oct07/issues-international-carbon-market-07.pdf.

42. EUROPEAN COMMISSION, *supra* note 7, at 17.

43. *Commission Decision of August 31, 2007 Concerning the National Allocation Plan for the Allocation of Greenhouse Gas Emission Allowances Notified by Denmark in Accordance with Directive 2003/87/EC of the European Parliament and of the Council*, at 4, COM (2005) 2515/6 final (Aug. 31, 2007).

44. REGIONAL GREENHOUSE GAS INITIATIVE, MODEL RULE 63 (2007), *available at* http://rggi.org/docs/model_rule_corrected_1_5_07.pdf.

45. *See id.* at 105–106.

46. While these effects are briefly discussed below, see UNFCCC, *supra* note 31, for a more complete discussion of the benefits and concerns regarding linking.

47. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 32, at 425.

can substantially improve the overall cost-effectiveness of GHG reduction programs.[48] Additionally, by broadening the market for allowances and credits, linking can improve market liquidity, reduce price volatility,[49] and lessen market power concerns.[50] Finally, through its effects on allowance prices in the linked systems, under certain circumstances, linking can decrease global emissions by reducing emissions leakage.[51] For example, linking can lead to a net reduction in leakage if the link between two systems reduces allowance prices—and hence individual firms' compliance costs—in the system that is more susceptible to leakage, while increasing allowance prices in the system that is less susceptible to leakage.[52]

Although linking can sometimes reduce global emissions, it can also have the opposite effect. For example, any cap-and-trade system that establishes a one-way linkage with a credit system must confront the problem of "additionality": some emission reduction credits offered by a credit system may not represent truly additional emission reductions because of the difficulty of establishing a baseline against which reductions are measured. As a result, to the extent that entities covered by the cap-and-trade system purchase such credits instead of reducing emissions within the cap-and-trade system, the increase in emissions in the cap-and-trade system may not fully be offset by real reductions under the credit system. In addition, although linking can reduce overall emissions leakage under certain circumstances through its effects on prices in each system, these price effects can increase leakage if prices increase instead in the system that is more susceptible to leakage.

The distributional implications of linking can also be a source of concern. Impacts on any firm participating in one of the linked systems depend on linkage's effect on the allowance price that the firm faces, and on whether that firm is a net allowance buyer or seller. For example, net sellers in a system with a low price will be better off after a link to a system with a higher price, because they will be able to sell their allowances at the higher equilibrium

48. Because marginal abatement costs depend on the stringency of a country's targets, the cost savings from linking will also depend on the relative stringency of the targets of the countries involved.

49. Of course, linking also exposes participants to new sources of price volatility from other linked systems. *See* Warwick J. McKibbin & Peter Wilcoxen, *A Credible Foundation for Long Term International Cooperation on Climate Change*, *in* ARCHITECTURES FOR AGREEMENT: ADDRESSING GLOBAL CLIMATE CHANGE IN THE POST-KYOTO WORLD 201–02 (Joseph Aldy & Robert Stavins, eds., 2007).

50. Market liquidity refers to whether there is sufficient depth in a market such that an individual participant can buy and sell without adversely affecting prices. Price volatility is a measure of the degree to which prices fluctuate over time. Market power refers to the ability of large buyers and sellers to influence market prices through their actions in that market.

51. Emissions leakage occurs when regulations to reduce emissions in one region causally lead to increased emissions in another region that is outside the scope of those regulations. For example, a regulation that increases manufacturing costs in a regulated region may cause a shift in manufacturing activity to unregulated regions, thereby leading to increased emissions in those unregulated regions.

52. A system's susceptibility to leakage depends on whether, and how easily, affected economic activity in a regulated region can be shifted to unregulated jurisdictions.

price. However, net buyers in the lower price system will be worse off after linking, because they will have to pay a higher price for allowances. Thus, while yielding overall cost savings, linking can create both winners and losers.

An additional concern related to linkage is that it can reduce national control over the design and impacts of a domestic tradable permit system.[53] Once a system establishes links, the system's allowance price and effect on emissions are influenced by developments in the linked system(s), including decisions made by the government(s) overseeing the linked system(s). A prominent example of this is the fact that a two-way link between two cap-and-trade systems will lead to the propagation of any cost-containment measures—such as banking, borrowing, offsets, or safety-valve provisions—from one system to the other.[54]

A final concern about linkage is that it can alter the incentives that countries face with respect to setting their future caps.[55] In particular, by changing allowance prices in each of the linked systems, a linkage alters the tradeoff that a government faces between the value it can create by issuing additional allowances, and the marginal environmental damage that arises from issuing additional allowances. Moreover, by expanding the scope of the allowance market, linkages reduce the impact that the issuance of additional allowances has on allowance prices, and therefore on the value of existing allowances.[56]

B. Implications of Different Types of Linkages

The degree of control that a government can retain over its system depends in part on whether linkage is one-way or two-way. For example, two-way linkages can increase *or* decrease domestic allowance prices.[57] As described above, two-way linkages also lead to complete propagation of cost-containment measures across the linked systems.[58] In contrast, one-way linkages can only decrease the price of allowances in the system that establishes the link. One-way linkages therefore will only lead to propagation

53. *See* CHRISTIAN FLACHSLAND ET AL., POTSDAM INSTITUTE FOR CLIMATE IMPACT RESEARCH, DEVELOPING THE INTERNATIONAL CARBON MARKET: LINKING OPTIONS FOR THE EU ETS 16–19 (2008), *available at* http://www.pik-potsdam.de/members/flachs/publikationen/developing-the-international-carbon-market/at_download/file.

54. *See id*. at 16, 18–19.

55. *See* Carsten Helm, *International Emissions Trading with Endogenous Allowance Choices*, 87 J. PUB. ECON. 2737, 2738 (2003); Bjart J. Holtsmark & Dag Einar Sommervoll, *International Emissions Trading in a Non-cooperative Equilibrium*, at 4, (Research Department of Statistics Norway, Discussion Papers No. 542, 2008), *available at* http://www.ssb.no/publikasjoner/DP/pdf/dp542.pdf.

56. By allowing nations with high domestic emission reduction costs to purchase less expensive emission reductions from other systems, however, linking can also reduce the costs that such nations would face in committing to more stringent caps, thereby partially offsetting some of these concerns.

57. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 32, at 425.

58. *See* FLACHSLAND ET AL., *supra* note 53, at 13.

of cost-containment measures in one direction—from the system with which a link is established to the system that establishes the link.

The effects of a linkage also depend on whether it connects two cap-and-trade systems or a cap-and-trade system and an emission-reduction-credit system. For example, linkage that involves an emission-reduction-credit system raises the issue of additionality. On the other hand, in a link between two cap-and-trade systems, the increase in allowance prices in one may have more far-reaching economic consequences—such as increasing domestic energy prices—than would the increase in credit prices resulting from a link between a cap-and-trade system and a credit system. In a credit system, entities are not required to meet any emission targets and thus can only benefit from the opportunity to sell credits for higher prices.

IV. THE POTENTIAL ROLE OF LINKAGE IN AN INTERNATIONAL CLIMATE POLICY ARCHITECTURE

The near-term and long-term role that linkage could play in an international policy architecture is limited by political and institutional factors. In particular, establishing direct linkages between cap-and-trade systems may require mutual recognition of emission targets, harmonization of certain design elements, and agreement on procedures for making future adjustments to the linked systems, including setting future emission caps. Therefore, the role of linkages likely will evolve over time as some direct links will initially be less attractive and more difficult to establish than others.

A. Near-Term Role

Links among existing tradable permit systems are already part of the international policy architecture to address global climate change, and new connections among existing and emerging tradable permit systems will undoubtedly be established in the future. Pairs or groups of nations, particularly those that are important trading partners, will likely establish direct two-way links between their respective cap-and-trade systems. However, it may take more time to establish direct links between other cap-and-trade systems, particularly those that use differing cost-containment measures. At the same time, many of these cap-and-trade systems may nonetheless become indirectly linked through direct links with a common credit system, such as the CDM or some alternative future protocol for issuing credits for emission reductions in developing countries. These direct and indirect linkages are currently serving as key operational elements of the de facto global climate policy architecture.

An important feature of such anticipated near-term linkage is that most cap-and-trade systems may be connected with one another only through indirect links via a common emission-reduction-credit system. Although a near-term web of mostly indirect links may not result in a fully cost-effective global market for GHG emission reductions, these indirect links still may yield

much of the cost savings and other advantages of a comprehensive system of direct linkages without raising some of the concerns that may impede the development of direct linkages. As a result, indirect linkage via an emission-reduction-credit system such as the CDM could become an important part of the near-term international climate policy architecture. The efficacy of this scenario depends heavily on the widespread acceptance and effectiveness of an international credit system such as the CDM.[59]

B. Long-Term Role

In the long term, linkage could play several different roles. First, it is possible that a comprehensive set of linkages, combined with unilateral emission reduction commitments by many nations, could function as a stand-alone climate architecture. Such a bottom-up architecture could emerge as more countries establish national cap-and-trade systems and begin to seek the gains from linking with other systems. These countries also might use the prospect of linkages as a means of providing incentives to developing countries to participate in an international agreement.

A second long-term possibility is that a collection of bottom-up linkages might serve as a natural starting point in negotiations leading to a top-down agreement. An existing system of linkages may help to develop the experience and mutual trust necessary for global negotiations to succeed. Furthermore, as we discuss below, any future agreement is likely to be heavily influenced by the status quo system of existing linkages and institutional investments.

A third possibility—not mutually exclusive with the second—is that linkage could become an element of a larger global policy architecture. Because the trade-related cost savings available to linked systems may grow as countries adopt increasingly stringent targets, there are strong economic reasons for policy makers to favor linking. Thus, a future global architecture—perhaps based on a negotiated global agreement that specifies timetables and emissions targets—could incorporate a set of direct links among domestic cap-and-trade systems as a key design element.

V. EVALUATION OF THE ROLE OF LINKAGE IN AN INTERNATIONAL POLICY ARCHITECTURE

As described above, linkages are likely to play a long-term role in an international climate architecture. In this Part, we assess three ways in which linkage can contribute to a future climate policy architecture: as an independent, bottom-up architecture; as a transition to a top-down architecture; and as an element of a larger climate architecture.

59. For a discussion of the performance of, and concerns about, the CDM to date, see *Options for Reforming the Clean Development Mechanism*, *in* HARVARD PROJECT ON INTERNATIONAL CLIMATE AGREEMENTS, at 1 (Belfer Ctr. for Sci. and Int'l Affairs at Harvard Univ. John F. Kennedy Sch. of Gov't, Policy Brief 2009-1, 2009), *available at* http://belfercenter.ksg.harvard.edu/files/Issue_Brief_1_Final_4.pdf.

A. Linkage as a Bottom-Up International Policy Architecture

Bilateral linkages are likely to continue to evolve among national and regional cap-and-trade systems and the CDM (or its successor). Could such a set of linkages, established without central coordination, function as an effective, stand-alone, bottom-up international policy architecture?

Although such an architecture would need to include other design elements, including emission reduction commitments and participation incentives, its distinguishing feature would be that it would grow organically from direct and indirect linkages. The degree to which a system of bottom-up linkages could achieve meaningful environmental performance depends on whether participants set sufficient environmental targets, a sufficient number of key countries participate, and participants comply.

With regard to whether participants will set meaningful environmental targets, commitments to reduce emissions in an architecture of bottom-up linkages would result from unilateral decisions by individual nations, or from negotiations among small groups of nations. In developed countries, internal political support would probably be the driving force behind adoption of more stringent emission caps,[60] whereas adoption of emission caps by developing nations may depend upon incentives provided by committed developed countries.[61] To address the possibility that linking may create incentives for some countries to adopt less stringent future caps, countries could negotiate cap trajectories as a condition for linking.[62] On the other hand, a system of linkages may actually allow some countries to adopt more aggressive targets than they otherwise would.

With respect to whether an architecture of bottom-up linkages would generate participation from a sufficient number of key countries, industrialized country participation is likely to be high. Participation by developing countries, on the other hand, will most likely be conditional on participation incentives provided by industrialized countries.[63] Positive participation incentives ("carrots") could take at least three forms: access to demand for emission reduction credits, potential gain from becoming a net seller of allowances, or side payments in the form of technical or development assistance. Negative

60. *See* Robert Keohane & Kal Raustiala, *Toward a Post-Kyoto Climate Change Architecture: A Political Analysis*, *in* HARVARD PROJECT ON INTERNATIONAL CLIMATE AGREEMENTS, at 9 (Belfer Ctr. for Sci. and Int'l Affairs at Harvard Univ. John F. Kennedy Sch. of Gov't, Discussion Papers 08-01, 2008), *available at* http://belfercenter.ksg.harvard.edu/files/KeohaneFinalWebRevised4_09.pdf.

61. *See* Ramgopal Agarwala, Towards a Global Compact for Managing Climate Change, *in* HARVARD PROJECT ON INTERNATIONAL CLIMATE AGREEMENTS, at 1–2 (Belfer Ctr. for Sci. and Int'l Affairs at Harvard Univ. John F. Kennedy Sch. of Gov't, Discussion Papers 08-15, 2008), *available at* http://belfercenter.ksg.harvard.edu/files/AgarwalaWeb.pdf.

62. *See* FLACHSLAND ET AL., *supra* note 53, at 25–26.

63. *See* Daniel S. Hall et al., *Policies for Developing Country Engagement*, *in* HARVARD PROJECT ON INTERNATIONAL CLIMATE AGREEMENTS, at 20–21 (Belfer Ctr. for Sci. and Int'l Affairs at Harvard Univ. John F. Kennedy Sch. of Gov't, Discussion Papers 08-15, 2008), *available at* http://belfercenter.ksg.harvard.edu/publication/18649/policies_for_developing_country_engagement.html.

participation incentives ("sticks") could take at least two forms: industrialized countries could establish border carbon taxes and/or import allowance requirements,[64] or industrialized countries could impose participation and graduation requirements as conditions of allowing continued access to international permit markets.

With respect to whether participants would be likely to comply in an architecture of bottom-up linkage, the picture is no worse—and perhaps better—for some top-down, centralized architectures. This is the case because a bottom-up system only includes industrialized nations where domestic institutions are sufficient to enforce compliance, and only developing nations where the value of the various carrots and sticks employed to encourage participation outweigh the costs of participating.

Links among cap-and-trade systems create gains from trade for the participating countries. Therefore, such an architecture has the potential to be cost-effective if the bottom-up system includes a sufficient set of direct two-way links, or if the system relies primarily on indirect links through a common credit system that has an adequate supply of low-cost credits to bring about allowance price convergence.[65]

A bottom-up system of linkage is already evolving, and could function well in the near-term in the absence of a top-down post-2012 international policy architecture. However, for a bottom-up system to achieve meaningful long-term environmental performance and a high degree of participation, it would require the major emitters—the United States, the European Union, Russia, Japan, China, India, and other key countries—to reach an implicit agreement regarding emissions targets and incentives for participation. Whether this would be possible without centralized negotiations is an open question.

B. Bottom-Up Linkage as a Step towards a Top-Down Architecture

A collection of linkages among cap-and-trade and emission-reduction-credit systems could serve as the foundation for a top-down climate agreement. Indeed, a bottom-up system could evolve into a coherent top-down climate architecture, much as the General Agreement on Tariffs and

64. *See* Jeffrey Frankel, *Global Environmental Policy and Global Trade Policy*, *in* HARVARD PROJECT ON INTERNATIONAL CLIMATE AGREEMENTS, at 12 (Belfer Ctr. for Sci. and Int'l Affairs at Harvard Univ. John F. Kennedy Sch. of Gov't, Discussion Papers 08-14, 2008), *available at* http://belfercenter.ksg.harvard.edu/files/Frankel2Web2.pdf; TREVOR HOUSER ET AL., PETER G. PETERSON INSTITUTE FOR INTERNATIONAL ECONOMICS, LEVELING THE CARBON PLAYING FIELD: INTERNATIONAL COMPETITION AND US CLIMATE POLICY DESIGN 29–30 (2008), *available at* http://pdf.wri.org/leveling_the_carbon_playing_field.pdf.

65. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 32; Bohm, *supra* note 32; MANNE & RICHELS, *supra* note 32.

Trade paved the way for the World Trade Organization.[66] Any pre-existing direct or indirect links are likely to influence the evolution of a new top-down international agreement because existing links will function as the status-quo framework. An existing set of links can also foster incentives for countries to participate in a future international agreement. Links will create constituencies within some developing countries who will favor participation if continued demand for emission reduction credits is conditioned on movement toward such an international agreement.

There is another way in which linkage can induce participation in a broader international, if not global, regime. Consider a "leader nation," which can accomplish very little to solve the global problem of climate change were it to act on its own. Linkage provides a mechanism by which that nation's emission reduction activities can be extended more widely. Although shunning, shaming, or punishing non-participant nations is one potential route to trying to broaden the coalition,[67] linkage could offer another route. For example, as the EU ETS has evolved, the European Union (the "leader nation") is using market access—to both allowances markets and to markets for other goods and services—to induce participation and to foster a broader system.[68]

C. Linkage as an Element of an International Architecture

Linkage could also play a significant role as a component of a larger international climate policy architecture—a role that would not conflict with the potential near-term role of linkage as the basis for a future agreement. The overall architecture might be based, for example, on a negotiated global agreement that specifies targets and timetables for emissions reductions from each of the world's nations. Within this architecture, linkage could have distinct near-term and long-term roles. For example, in the near-term, a system of indirect linkages via a common credit system could provide important cost savings while minimizing negative distributional effects and preserving a high degree of national control over allowance markets. In the longer term, the system could transition to negotiated multilateral two-way linkages that would create a single, comprehensive market for allowances and credits. The distinguishing characteristic of this possibility is that the role played by linkage would be specified ahead of time, as part of the overall architecture. In contrast, in Part V.B, we describe how a collection of *independent* linkages could evolve into a broader, top-down agreement.

66. *See* Carlo Carraro, *Incentives and Institutions: A Bottom-Up Approach to Climate Policy*, *in* ARCHITECTURES FOR AGREEMENT: ADDRESSING GLOBAL CLIMATE CHANGE IN THE POST-KYOTO WORLD 165–66 (Joseph Aldy & Robert Stavins, eds., 2007).

67. *See* Keohane & Raustiala, *supra* note 60, at 6–7; Frankel, *supra* 64, at 18–19.

68. *See* Ellerman, *supra* note 10, at 1; Eivind Hoff, *Norway to make money from EU Emissions Trading System*, BELLONA.ORG, Oct. 27, 2007, http://www.bellona.org/articles/articles_2007/norway_emissions_trading_system.

VI. HOW WILL CLIMATE NEGOTIATIONS AFFECT BOTTOM-UP LINKAGES?

Given the potential advantages of linkages in a future international climate architecture, policy makers may want to take steps to facilitate future linkages among tradable permit systems. One way to do this is by choosing design features for a post-2012 international climate agreement that will encourage linkages. First, and perhaps most ambitiously, a post-2012 agreement could establish an agreed trajectory of emissions caps or allowance prices, specify a harmonized set of cost-containment measures, and establish a process for making future adjustments to the level of the emissions cap and other key design elements. Second, it could create an international clearinghouse for transaction records and allowance auctions.[69] Third, it could provide for the ongoing operation of the CDM or a successor, which could play a central role in indirectly linking existing and emerging tradable permit systems. Fourth, a post-2012 international climate agreement could help build capacity in developing countries that would permit and encourage their fuller participation through a system of bottom-up linkages.

If policy makers seek to encourage linkage among tradable permit systems in a post-2012 agreement, some design elements would best be avoided. Any global agreement that encourages strategic behavior in setting domestic emissions caps could impede the development of linkages. For example, an agreement that conditions future commitments on countries' emission levels over the coming years could undermine the ability of linkages to achieve a cost-effective distribution of emission reductions across linked systems. Also, depending on the stringency of such restrictions, an international agreement that imposes "supplementarity" restrictions—in which countries must achieve some specified percentage of emission reductions domestically—may limit the potential benefits of linkage by curtailing the amount of international trading that can occur. Although supplementarity restrictions can force firms in wealthier countries to achieve greater reductions in their own emissions (instead of simply purchasing permits on international markets), these restrictions increase the overall cost of achieving emissions reductions.

CONCLUSION

Cap-and-trade systems are emerging as a preferred domestic instrument for reducing GHG emissions in many parts of the world, and the CDM has developed a substantial constituency despite some concerns about its performance. Because of the considerable political and economic pressure to link these systems, linkage may be expected to play a de facto, if not de jure, role in any future international climate policy architecture.

69. *See* OTTMAR EDENHOFER, CHRISTIAN FLACHSLAND & ROBERT MARSCHINSKI, POTSDAM INSTITUTE FOR CLIMATE IMPACT RESEARCH, TOWARDS A GLOBAL CO2 MARKET: AN ECONOMIC ANALYSIS 29–31 (2007), *available at* http://www.pik-potsdam.de/news/press-releases/files/PIK_Linking_ETS_2007_engl.pdf.

In the short term, linkage will continue to grow in importance as a core element of a bottom-up, de facto international policy architecture. The EU ETS has already established direct links with systems in neighboring countries, and the CDM has emerged as a potential hub for indirect links among cap-and-trade systems worldwide. As new cap-and-trade systems emerge in countries such as Australia, Canada, and the United States, the global network of direct and indirect links will likely continue to spread.

In the longer term, linkage could play a variety of roles. One possibility is that a set of linkages, combined with unilateral emission reduction commitments by many nations, could function as a stand-alone climate architecture. A second long-term possibility is that a collection of bottom-up links may eventually evolve into a comprehensive, top-down agreement. A third long-term possibility is that linkage could play a significant role as a component of a larger international climate policy architecture. Because of the potential benefits of linkage, policy makers may wish to take steps to ensure that a post-2012 agreement includes design features that support the development of linkages.

There is a striking trade-off between direct linkages, which can require a high degree of harmonization and international cooperation, and indirect linkages via a common credit system, which raise concerns about additionality. This tradeoff may suggest a natural progression. In the near-term, indirect linkage of cap-and-trade systems via a common credit system (such as the CDM) could achieve some of the cost savings and risk diversification of direct linkage, but without the need for as much harmonization of emerging and existing cap-and-trade systems. Such indirect linkage would also limit potential distributional concerns and preserve a high degree of national control over allowance markets. In the longer term, international negotiations could establish shared expectations about environmental targets and emission reduction responsibilities that would serve as the basis for a broad set of multilateral, direct links among cap-and-trade systems. This progression could promote the near-term goals of participation and cost-effectiveness while helping to build the foundation for a more comprehensive future agreement.

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