Carbon Leakage Under the European Union Emissions Trading Scheme: Is It a Major Policy Concern?

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The specter of carbon leakage is the most prominent objection to expansion of the European Union Emissions Trading System. This Article first provides a brief background on the European Union Emissions Trading System and the concept of carbon leakage. Next, it explores which industry sectors are most susceptible to leakage. Finally, it explains why fears of carbon leakage may be exaggerated and why, from an economic perspective, leakage may not represent a significant policy concern.

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I. INTRODUCTION

The goal of this Article is to evaluate whether there is a significant risk of carbon leakage from the European Union Emissions Trading System. The Article will first provide a brief background on the European Union Emissions Trading System and the concept of carbon leakage. Next, it will explore which industry sectors are most susceptible to leakage. Finally, it will explain why fears of carbon leakage may be exaggerated and, why, from an economic perspective,[1] leakage may not represent a significant policy concern.

II. GREENHOUSE GAS EMISSIONS REDUCTIONS AND THE EUROPEAN UNION EMISSIONS TRADING SYSTEM (EU ETS)

The Kyoto Protocol was ratified by 141 nations and entered into force in 2005,[2] setting binding greenhouse gas (GHG) emissions

1. It should be noted that this Article does not delve into the political ramifications of carbon leakage policies and whether politicians should acquiesce to certain groups with disproportionate political influence who are seeking government carbon emissions credits/allowances under the pretext of carbon leakage.

2. Shankar Vedantam, *Kyoto Treaty Takes Effect Today; Impact on Global Warming May Be Largely Symbolic*, WASH. POST, Feb. 16, 2005, at A04; *see also* U.N. Framework Convention on Climate Change [UNFCCC], Kyoto Protocol, http://unfccc.int/kyoto_protocol/items/2830.php (last visited Aug. 30, 2009).

reduction targets for 37 industrialized countries and the European community. Because the vast majority (approximately 80%) of greenhouse gas emissions are composed of carbon dioxide (CO_2),[3] greenhouse gas emissions are often called "carbon emissions."[4] Developing countries were exempted from these emissions reduction targets under the theory that the limits would impede their economic development.[5]

Greenhouse gases change the earth's climate by "prevent[ing] heat [in the earth's atmosphere] from escaping to space, somewhat like the glass panels of a greenhouse."[6] "Most of the warming in recent decades is very likely the result of [emissions from] human activities" created by "the burning of fossil fuels, such as coal and oil, and deforestation."[7] The Intergovernmental Panel on Climate Change (IPCC), a nongovernmental organization established by the United Nations Environmental Programme and the World Meteorological Organization, projects that a failure to slow climate change by reducing greenhouse gas emissions will lead to increased drought, potential extinction of up to 30% of plant and animal species, flooding of coastal areas inhabited by millions, and increased deaths, disease, and injury due to heat waves, floods, storms, fires, droughts, and higher concentrations of ground-level ozone.[8]

The European Union (EU) signed the Kyoto Protocol "collectively as a bubble or aggregate commitment, retaining the right to allocate national responsibility for the reductions among themselves."[9] To comply with the Protocol, the EU capped greenhouse gas emissions for certain sectors of the economy and launched an Emissions Trading Scheme (the EU ETS) beginning in January 2005.[10] The EU ETS "is the

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3. U.S. CLIMATE CHANGE TECH. PROGRAM, RESEARCH AND CURRENT ACTIVITIES 21 (Nov. 2003), *available at* http://www.climatetechnology.gov/library/2003/currentactivities/car24nov03.pdf.

4. For this reason, this Article will use the phrase "greenhouse gas emission" and "carbon emission" interchangeably; however, any reference to carbon emissions is intended to also encompass non-CO_2 greenhouse gas emissions.

5. Vedantam, *supra* note 2.

6. U.S. EPA, Climate Change: Basic Information, http://www.epa.gov/climatechange/basicinfo.html (last visited Aug. 30, 2009).

7. *Id.*

8. M.L. Parry et al., *Summary for Policymakers*, *in* CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY: CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 7-22 (2007).

9. SONIA LABATT & RODNEY R. WHITE, CARBON FINANCE: THE FINANCIAL IMPLICATIONS OF CLIMATE CHANGE 141 (2007).

10. *Id.* at 17.

largest multicountry, multisector GHG emissions trading scheme in the world, covering 11,000 installations in 25 countries."[11]

The EU ETS is particularly worthy of study because emissions regulations in Japan, Canada, and New Zealand, "are nowhere close to the same kind of detail and comprehensiveness as required in the EU."[12] The EU ETS traded US$50 billion (€37 billion) in greenhouse gas emission allowances and derivative contracts in 2007, making it, according to the World Bank, "the major carbon market, by far" and "the laboratory . . . of the global carbon market."[13]

III. CARBON LEAKAGE

The regulation of greenhouse gas emissions may have significant competitive and financial consequences for business.[14] More than 70% of EU ETS participant companies factor the cost of carbon in their investment decisions,[15] possibly leading to carbon leakage.

Carbon "leakage"[16] occurs when efforts to control emissions in one place cause the emissions-producing activity to shift to a location not subject to the emissions control policy.[17] If "rules, regulations, and incentives for action affect only"[18] EU companies, then some of these companies may "be forced to move operations outside the EU" lest "industries operating in countries with fewer restrictions on CO_2 emissions . . . have an unfair advantage."[19] A recent survey indicates that 17% of EU ETS participant companies considered relocating as a result of the greenhouse gas emissions cap imposed by the EU.[20] As a result,

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11. *Id.*

12. *Id.* at 150.

13. KAREN CAPOOR & PHILIPPE AMBROSI, THE WORLD BANK STATE AND TRENDS OF THE CARBON MARKET 2008, at 2, 7 (2008).

14. LABATT & WHITE, *supra* note 9, at 17.

15. POINT CARBON, CARBON 2008: POST-2012 IS NOW 16 (2008), http://www.pointcarbon.com/polopoly_fs/1.912721!Carbon_2008_dfgrt.pdf.

16. As with the term "carbon emissions," the term "carbon leakage" is intended to refer to leakage of non-CO_2 greenhouse gases as well.

17. Brian C. Murray, *Leakage from an Avoided Deforestation Compensation Policy: Concepts, Empirical Evidence, and Corrective Policy Options* 7 (Nicholas Inst. for Envtl. Policy Solutions at Duke Univ., Working Paper No. 08-02, 2008).

18. *Id.*

19. EurActiv.com, Industry Deal Key to EU Climate Efforts, Says Commission (May 16, 2008), http://www.euractiv.com/en/climate-change/industry-deal-key-eu-climate-efforts-commission/article-172432 [hereinafter EurActiv.com (May 16, 2008)]; *see also* EurActiv.com, EU Heads Towards 'Carbon Leakage' Clash (Sept. 3, 2008), http://www.euractiv.com/en/climate-change/eu-heads-carbon-leakage-clash/article-173427 [hereinafter EurActiv.com (Sept. 3, 2008)].

20. POINT CARBON, *supra* note 15, at 16.

"[t]he 'leakage' problem has become a political flash point in the debate over how to combat climate change."[21]

Carbon leakage has multiple potential impacts. First, the EU may lose jobs[22] and corporate profits to countries with less or no regulation of carbon emissions. Second, emissions abated in the EU will merely be redistributed to less regulated locales, akin to stepping on a bump under the carpet that merely shifts location rather than flattening out.[23] Third, dirtier production methods may be used outside the EU, creating more per-unit emissions for each manufactured good.[24] In essence, the bump under the carpet gets bigger. Fourth, the transport of goods produced abroad back to the EU will create additional emissions.[25]

It is a policy goal of EU member states "to ensure that . . . costs related to reducing industrial CO_2 emissions do not drive Europe's heavy industries to take their operations, jobs, and emissions outside of the EU's borders to countries where production and pollution are cheaper."[26] However, Daniel Cloquet, director of Industrial Affairs at lobbying group BusinessEurope, argues that "[c]arbon leakage is already happening."[27] Moreover, "manufacturers of products like chemicals and aluminium . . . are facing stiff competition from firms operating in countries like Saudi Arabia, where access to cheap energy is abundant."[28]

Leakage does have natural limits. Only industries facing competition from nonregulated countries are threatened by carbon leakage. For example, the energy sector (including transportation) produces 80% of

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21. William Pentland, *Cooking the Carbon Books*, FORBES.COM, Oct. 13, 2008, http://www.forbes.com/business/energy/2008/10/13/carbon-kyoto-europe-biz-energy-cx_wp_1013kyoto.html.

22. *See, e.g.*, Mark Scott, *Is Europe Leading or Losing on CO_2 Emissions?*, BUS. WK., Aug. 4, 2008, at 16 ("The extra financial burden eventually could send European jobs overseas and increase costs there.").

23. Corrado di Maria & Edwin van der Werf, *Carbon Leakage Revisited: Unilateral Climate Policy with Directed Technical Change*, 39 ENVTL. & RESOURCE ECON. 55, 56 (2008).

24. EurActiv.com (May 16, 2008), *supra* note 19.

25. *See, e.g.*, John Vidal, *Shipping Boom Fuels Rising Tide of Global CO_2 Emissions*, GUARDIAN, Feb. 13, 2008, *available at* http://www.guardian.co.uk/environment/2008/feb/13/climatechange.pollution1 ("The world's burgeoning shipping fleet currently emits 1.21bn tonnes a year . . . constituting nearly 4.5% of world emissions.").

26. EurActiv.com, EU Summit To Balance Climate Goals and Economy (Oct. 14, 2008), http://www.euractiv.com/en/climate-change/eu-summit-balance-climate-goals-economy/article-176330.

27. EurActiv.com (May 16, 2008), *supra* note 19.

28. EurActiv.com, Eurogypsum: Carbon Leakage 'Already Happening' (Nov. 27, 2008), http://www.euractiv.com/eu/sustainability/eurogypsum-carbon-leakage-happening/article-177581.

the EU's total carbon emissions;[29] however, it is largely impervious to carbon leakage because most EU member states are geographically isolated from unregulated countries close enough to import power from abroad. Thus, the power generation industry can pass through its increased costs to consumers without a fear of substitutes from an unregulated offshore locale.[30] This Article will next examine which EU industries are most susceptible to such leakage and whether such leakage is significant enough to influence EU emissions policy.

IV. POTENTIAL SOURCES OF CARBON LEAKAGE IN THE EUROPEAN UNION

Some greenhouse gas emissions are generated by industry processes that rely on the combustion of fossil fuels[31] during the manufacturing process. Industries that consume large amounts of power are also indirectly responsible for emissions because, at the margin, most electricity is generated by burning coal, which "needs many [emissions] allowances."[32]

A. Energy Intensive Industries

Products that are the result of an energy-intensive process can be more easily shipped from abroad, thereby increasing competition for EU producers. At present, the two largest greenhouse gas emitters in the world are the United States and China, and "[n]either . . . [has] ratified the 1997 Kyoto Protocol setting limits on greenhouse gas emissions."[33] Because products with a high energy content from these two countries would face lower emissions costs than similar products produced in the EU,[34] there is a risk of carbon leakage.

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29. EUROPEAN ENV'T AGENCY, THE EUROPEAN COMMUNITY'S INITIAL REPORT UNDER THE KYOTO PROTOCOL: ANNEX 1—EC GHG INVENTORY REPORT 2006, at 14 (Technical Report No. 10/2006, Dec. 2006).

30. *See, e.g.*, MICHAEL PORTER, COMPETITIVE STRATEGY 3-4 (1980) (discussing substitutes as a key method of diluting an industries' market power).

31. *See* 1 Select Comm. on Econ. Affairs, House of Lords, *The Economics of Climate Change* 11 (HL Paper 12-I, 2005).

32. Centre for European Policy Studies, Can the EU CO2 Emissions Trading Scheme Succeed? (Feb. 19, 2007), http://ceps01.link.be/Article.php?article_id=400.

33. Mitchell Landsberg, *China May Lead in Greenhouse Gases*, L.A. TIMES, June 21, 2007, at A-3.

34. However, in the trial phase of the EU ETS, many companies were given free emission permits based on recent historical emissions. *See, e.g.*, FRANK CONVERY, DENNY ELLERMAN & CHRISTIAN DE PERTHUIS, THE EUROPEAN CARBON MARKET IN ACTION: LESSONS FROM THE FIRST

The European Commission has not yet determined the precise definition of what constitutes an "energy intensive" industry;[35] however, it surely encompasses the production of certain ferrous (for example, steel) and nonferrous (e.g., aluminium) metals,[36] cement, chemicals, and paper. Leakage from any of these sectors may be "significant in terms of emissions," due to their high emission intensity.[37]

This Part examines the energy-intensive industries of steel, aluminium, and chemicals and their prospects for carbon leakage.

Energy-Intensive Industries and Their Prospects for Carbon Leakage

Industry	Percent of GHG Emissions	Chief Source of Emissions	Local Market Pricing Power/ Susceptibility to Foreign Competition	Possible Financial Impact of Purchasing Emissions Allowances
Steel	15% to 27% of all manufacturing emissions and 3.2% to 5% of worldwide emissions	70% of emissions due to energy consumption during production	shipped and sold worldwide; Dutch study suggests 50% of increased costs can be passed through to consumers	between 3.1% and 17% cost increase, and between 6% and 66% of new costs passed through to consumer
Aluminium	0.8% of worldwide emissions	energy consumption during production	sold at world market price; transportable via ship, truck and rail	possible 6% to 11% cost increase

TRADING PERIOD 11 (Mar. 2008), http://web.mit.edu/globalchange/www/ECM_InterimRpt_March08.pdf.

35. EurActiv.com (May 16, 2008), *supra* note 19.

36. *See, e.g.*, ENDS Europe Daily, EU Offers First Analysis of Carbon Leakage Risk no. 2617 (Sept. 18, 2008), http://www.endseurope.com/15524 ("Primary aluminium, blast furnace-produced steel and clinker 'would likely be strongly affected [by carbon leakage].'" (alteration in original) (quoting the European Commission)); *see also* EurActiv.com, EU Considers Industries Exposed to 'Carbon Leakage' (Sept. 22, 2008), http://www.euractiv.com/en/climate-change/eu-considers-industries-exposed-carbon-leakage/article-175583 ("The European Commission is drawing up a methodology to determine which industries could obtain free emission rights when the EU's carbon market is re-launched in 2013. Aluminium, steel, iron and cement producers are likely to benefit from exemptions.").

37. Karsten Neuhoff & Felix Matthes, *The Role of Auctions for Emissions Trading*, CLIMATE STRATEGIES, Sept. 17, 2008, http://www.climatestrategies.org/reportfiles/executive_summary_final.pdf.

Industry	Percent of GHG Emissions	Chief Source of Emissions	Local Market Pricing Power/ Susceptibility to Foreign Competition	Possible Financial Impact of Purchasing Emissions Allowances
Chemicals	5% of worldwide emissions	energy consumption during production	European chemical exports represented 45.6% of the world market in 2002	between 2.7 and 7.1% of gross value added at a carbon price of €20 per tonne[38]

1. Steel

Between 1.5[39] and "1.7 tonnes of carbon dioxide are emitted for every tonne of steel produced," and global steel production is responsible for 4% to 5% of worldwide CO_2 emissions.[40] Seventy percent of emissions created by steel production stem directly from the burning of fossil fuels.[41] The largest steel producing countries are:

Top steel-producing countries/regions in 2007[42]

Rank	Country/Region	Crude Steel Production (million metric tons)
1	China	489.2
2	European Union (27)	209.5
3	Japan	120.2
4	United States	98.2
5	Russia	72.4
6	India	53.1
7	South Korea	51.6
8	Ukraine	42.8

38. *See* FRESHFIELDS BRUCKHAUS DERINGER, EXTENDING THE EU ETS: IMPLICATIONS FOR THE EU PETROCHEMICALS INDUSTRY (June 2008), http://www.freshfields.com/go/pdfs/Implications-for-EU-petrochemicals-industry.pdf.

39. R. Carroll, *A Tale of Two Metals*, 2 TRADING CARBON, July/Aug. 2008, at 29.

40. WORLD STEEL ASS'N, SUSTAINABILITY REPORT OF THE WORLD STEEL INDUSTRY 2008, at 8 (Oct. 7, 2008), http://www.worldsteel.org/index.php?action=publicationdetail&id=78; *see also* John Llewellyn, *The Business of Climate Change: Challenges and Opportunities*, LEHMAN BROTHERS, Feb. 2007, at 105, *available at* http://www.lehman.com/press/pdf_2007/TheBusinessOfClimateChange.pdf ("The . . . BOF process . . . typically releases roughly two tonnes of greenhouse gas per tonne of liquid steel produced." The EAF process, which "recycle[s] steel scrap . . . release[s] roughly 0.64 tonne of greenhouse gas per tonne of steel.").

41. Elga Bartsch, *The Economics of Climate Change—a Primer*, MORGAN STANLEY RESEARCH EUR., Oct. 3, 2007, at 18.

42. WORLD STEEL ASS'N, *supra* note 40, at 7.

Rank	Country/Region	Crude Steel Production (million metric tons)
9	Brazil	33.8
10	Turkey	25.8

Together, China, the EU, Japan, the United States, and Russia account for 74% of worldwide production.[43] The steel industry has a large number of producers and the "market is characterised by . . . notorious overcapacity."[44] The top ten producers account for only 26% of global output.[45] In the EU, Basic Oxygen Furnace (BOF) steel production holds a 58% share of the market, while more energy-efficient Electric Arc Furnace (EAF) steel production holds a 34% share.[46]

Steel is a mobile commodity, "account[ing] for about 20% of world seaborne trade and close to 40% of the dry bulk [shipping] market."[47] China is the largest steel consumer. It used 34% of worldwide production (408 million metric tons) in 2007,[48] and its consumption was forecast to increase by 11.5% in 2008, compared to a 4.2% increase in the rest of the world.[49]

An analysis of the Dutch iron and steel industry suggested that the cost of carbon emissions would raise steel production costs by 6%;[50] however, the industry will be able to pass through roughly 50% of this cost increase on to the consumer.[51] An EU-wide study for the European

43. *Id.*

44. Lars Mathiesen & Ottar Mæstad, *Climate Policy and the Steel Industry: Achieving Global Emission Reductions by an Incomplete Climate Agreement*, 25 ENERGY J. 91-114 (2004).

45. Armin Mayer, *Sector Agreements: Big Emitters Facing Carbon Limits*, CLIMATECHANGECORP: CLIMATE NEWS FOR BUSINESS, Oct. 8, 2008, http://www.climatechangecorp.com/content.asp?ContentID=5693.

46. Mathiesen & Mæstad, *supra* note 44, at 94.

47. *Id.* at 97.

48. WORLD STEEL ASS'N, *supra* note 40, at 7.

49. *Id.* Note, however, that steel use in automotive applications, accounting for 15% of worldwide steel use, is declining because the use of lighter weight aluminium can improve fuel efficiency. *See, e.g.*, Llewellyn, *supra* note 40, at 105.

50. Sander de Bruyn, Impacts on Competitiveness of EU ETS: An Analysis of the Dutch Industry for Post-2012 EU ETS, Presentation at the Ad Hoc Meeting of the ECCP Working Group on Emissions Trading on Carbon Leakage (Sept. 26, 2008), *available at* http://ec.europa.eu/environment/climat/emission/2008_09_26_agenda.htm.

51. *Id.* An analysis of the potential cost increase accruing to the U.K. and German steel sectors from emissions pricing is projected to be roughly 25% and 18%, respectively; however, the analysis does not indicate the percentage of costs likely to be passed through to the consumer. *See* Susanne Dröge, Strategies To Address Leakage/Competitiveness Concerns, German Institute for International and Security Affairs Presentation at Symposium on Allocation and Leakage/Competitiveness Issues of Emissions Trading Schemes, Institute for Global Environmental Strategies, Tokyo slides 13-14 (Mar. 12, 2009), http://www.iges.or.jp/en/cdm/pdf/20090312et/4Droege090312ETseminar.pdf.

Commission Directorate General for Environment forecasts the cost of emissions permits will increase steel production costs by 17%; however, 6% of increases in BOF production and 66% of additional EAF production costs can be passed through to customers.[52]

A representative of the steel industry forecasts that emission permits "could cost the EU steel industry . . . up to €100 billion in the years from 2013 to 2020," unless it reduces its emissions by 55%.[53] Because such reductions are "scientifically not achievable," the industry "will ultimately . . . de-localis[e] steel production and emissions into countries outside the EU."[54] Likewise, a report for the European Commission suggests that "[t]he additional costs of about 17% on the marginal unit of [BOF] steel production may create an incentive to shift marginal production into regions without those costs."[55] While the EAF process is more energy-efficient and produces less emissions, it requires existing metal scraps as an input; thus, its adoption is hindered by a "current scarcity of scrap, which is expected to continue."[56]

2. Aluminium[57]

One of the most energy-intensive products that can be imported into the EU from unregulated countries is aluminium. While "[a]luminium is not yet covered by the EU ETS, . . . it is energy-intensive and vulnerable to the cost of CO_2 in power prices."[58] Even at current prices, electricity represents 30% to 40% of the production cost of aluminium.[59] For this reason, aluminium is sometimes called "canned electricity."[60] A simulation of higher electricity costs in the Netherlands, assuming carbon emission prices of €20 per ton of CO_2 and electricity prices at

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52. EUROPEAN COMM'N DIRECTORATE GEN. FOR Env't ET AL., EU ETS REVIEW: REPORT ON INTERNATIONAL COMPETITIVENESS 13 (Dec. 2006), http://ec.europa.eu/environment/climat/emission/pdf/etsreview/061222compreport.pdf.

53. Gordon Moffat, *The Failure of Parliament To Secure the Competitiveness of the EU Steel Industry*, 7 POINTCARBON NEWS: CARBON MARKET EUROPE, Oct. 10, 2008, at 7.

54. *Id.*

55. EUROPEAN COMM'N DIRECTORATE GEN. FOR ENV'T ET AL., *supra* note 52, at 5.

56. *Id.* at 7.

57. Because this is a report discussing the European Union, I have used the European spelling of "aluminium," as opposed to the American spelling.

58. Frank Convery, Denny Ellerman & Christian de Perthuis, *Lessons Learned*, 2 TRADING CARBON, June 2008, at 35.

59. EAA Warns Emissions Trading Could Hurt European Aluminium Sector (Oct. 8, 2008), http://www.worldal.com/news/20081008/9999.html.

60. K. MATSUSHITA & R. HELTEN, ENVIRONMENT IN THE 21ST CENTURY AND NEW DEVELOPMENT PATTERNS 40 (2001).

€14/MWh, suggests that higher electricity prices could lead to a 6% increase in the cost of producing aluminium.[61]

The "[g]reenhouse gas emissions of 990 kg of CO_{2e} (carbon dioxide equivalents) per metric tonne of alumina are generated primarily from fuel consumption and from energy consumed in producing . . . ancillary materials."[62] Secondarily, aluminium production also triggers emissions of potent greenhouse gases perfluoromethane (CF_4) and perfluoroethane (C_2F_6), for which emissions allowances would need to be purchased;[63] however, for the "European aluminium industry, . . . perfluorochemicals emissions with reference to the 1990 levels have [already] been cut by more than 80% in 2005."[64]

On a worldwide basis, aluminium production accounts for nearly 1% of the world's greenhouse gas emissions.[65] The industry is concentrated, due to its capital intensity, with the ten largest producers responsible for 54% of global output.[66] As a global industry, European aluminium prices are driven by the world market, as reflected on the London Metal Exchange.[67] To remain competitive, European aluminium producers need to be responsive to world pricing signals, despite any additional requirement that they may have to buy emission allowances as part of their production process. Accordingly, any cost increases stemming from the purchase of emissions allowances cannot be passed through to consumers unless all other aluminium producers in the world face similar costs.[68]

Despite its emission intensity, it is unlikely that demand for aluminium will abate. Due to aluminium's strength and relatively light weight, the transportation sector has become "the largest end market for aluminium, accounting for more than 31% of the western world demand for the metal."[69] Because one pound of aluminium can often replace

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61. De Bruyn, *supra* note 50.

62. *See* Int'l Aluminium Inst., Smelter Emissions, http://www.world-aluminium.org/?pg=101 (last visited Aug. 30, 2009).

63. House of Lords, *supra* note 31, at 11.

64. Platts, *supra* note 59.

65. Mayer, *supra* note 45.

66. *Id.*

67. Platts, *supra* note 59; *see also* Eurometaux, European Ass'n of Metals, EU Energy & Climate Change Policies: Post 2012 EU Emissions Trading Directive, Carbon Leakage & Financial Compensation 11 (Joint Study Groups' Seminar on Energy, Lisbon, Apr. 28, 2009), *available at* http://www.icsg.org/index.php?option=com_docman&task=doc_download&gid=163&Itemid=62.

68. EUROPEAN COMM'N DIRECTORATE GEN. FOR ENV'T ET AL., *supra* note 52, at 51.

69. Llewellyn, *supra* note 40, at 105.

more than two pounds of steel,[70] it can make "[l]ighter vehicles [that] are more fuel efficient and generate less greenhouse gas emissions than heavier vehicles."[71]

A study of the aluminium industry forecasts that higher energy prices will lower average cash flows of manufacturers from 19% to 7% "[i]f carbon prices increase to $55 per metric ton, from $25, but the price of aluminum doesn't increase to cover them."[72] Producers outside the EU, such as those in Asia, the Middle East, and North Africa, will maintain higher profit margins.[73] Notwithstanding the price of carbon emissions, the industry is already drawn to "countries with lower electricity cost and/or higher CO_2 efficiency, typically producing electricity from hydro or stranded gas, for example, Iceland or the Middle East."[74] Higher energy costs, a result of the cost of emission allowances, could accelerate this trend. On the other hand, this may be offset by the aluminium smelters' long-term power contracts, which lock in electricity pricing for many years.[75]

It should be noted that not all aluminium production, despite its energy intensity, necessarily yields significant carbon emissions. Iceland, which has enormous untapped reserves of non-CO_2 emitting geothermal energy, is developing multiple aluminium smelters in conjunction with foreign joint-venture partners.[76] Further, recycling existing aluminium "from scrap . . . requires less than 5% as much energy [as making new aluminium] and generates much less greenhouse gas than primary aluminium production,"[77] making it unlikely to be significantly impacted by carbon emission prices.

3. Chemicals

The manufacture of chemicals emits more greenhouse gases than either steel or aluminium production, about 5% of worldwide emissions,

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70. *Id.*

71. *Id.*

72. Marcel W. Brinkman, Nick Hoffman & Jeremy M. Oppenheim, *How Climate Change Could Affect Corporate Valuations*, 29 MCKINSEY ON FINANCE 1, 5 (2008).

73. *Id.*

74. EUROPEAN COMM'N DIRECTORATE GEN. FOR ENV'T ET AL., *supra* note 52, at 6.

75. Julia Reinaud, Carbon Leakage and Competitiveness: Focus on Heavy Industry, IEA Presentation at Séminaire Dauphine (Dec. 3, 2008), *available at* http://www.ifd.dauphine.fr/fileadmin/mediatheque/recherche_et_valo/FDD/Reinaud_Dauphine_03_12_2008.pdf.

76. *See, e.g.*, Thorsteinn Hilmarsson, Energy and Aluminium in Iceland, Presented at Platts Aluminium Symposium (Jan. 12-14, 2003), *available at* http://www.lv.is/files/2003_2_6_Platts.THi.doc.

77. Llewellyn, *supra* note 40, at 105.

and is ranked number two in the energy-intensiveness of its production process.[78] The EU, United States, and Japan together account for 75% of worldwide production.[79] While the majority of chemicals are sold in the same country where they are produced, 30% of the finished products are traded internationally.[80] This suggests that competition for EU chemical manufacturers from an offshore competitor is not infeasible.[81]

A debate is ongoing whether to evaluate potential carbon leakage on a per chemical or a systemic level. Some academic researchers report that only "a small number of chemicals could be affected" by emissions caps.[82] For example, while chlorine production is unlikely to migrate, chlorine-intensive products are more susceptible.[83] The chemical industry, by contrast, urges a more systemic view of leakage.[84]

4. Potential Side Effect of Reducing Emissions Intensity in the EU Through Higher Emission Prices

To the extent that there is less use of emissions-intensive fossil fuels, such as coal, in the EU, this decline in demand should lower world prices for that fuel. At its new lower price, nonregulated countries may use more of that fuel and thus increase their emissions.[85] In other words, "the lower world prices of energy (reduced demand in the constrained economies exerts a downward pressure on energy prices) encourage substitution towards energy in countries without a carbon constraint,"[86] essentially creating a rebound effect.[87]

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78. Bartsch, *supra* note 41, at 18.

79. *Id.*

80. *Id.*

81. *Id.*

82. EurActiv.com, EU Chemical Industry in 'Carbon Leakage' Row (Dec. 5, 2008), http://www.euractiv.com/en/climate_change/eu-chemical-industry-carbonleakage-row/article_177781 (emphasis omitted).

83. *Id.*

84. Chemie.de Information Serv., Climate Change: Carbon Leakage Is Not a Myth, but Sound Evidence (Feb. 18, 2009), http://www.chemie.de/news/e/97048/ ("If one major building block such as chlorine moves out of Europe, an entire value chain will follow . . . ." (quoting Peter Botschek, Energy and HSE Director with Cerfic)).

85. Mathiesen & Mæstad, *supra* note 44, at 91-114.

86. Mustafa H. Babiker, *Climate Change Policy, Market Structure, and Carbon Leakage*, 65 J. INT'L ECON. 421, 422 (2005).

87. *See, e.g.*, Thomas Eichner & Rudiger Pethig, *Carbon Leakage, the Green Paradox and Perfect Future Markets* (CESifo Working Paper Series No. 2542, 2009) (describing the rebound effect as the "green paradox"). For a more general review of the rebound effect in the context of energy efficiency, see Horace Herring, *Energy Efficiency—A Critical View*, 31 ENERGY 10, 12-14 (2006).

Often, rebound effects stemming from lower prices do not occur until a supply price shock has lowered demand for a good or service.[88] When considering the impact of leakage, this preliminary price shock needs to be taken into account as well. Recent models of prospective carbon leakage in the United States under an emissions cap-and-trade regime suggest that only slightly lower than half of any domestic production decline would result in new overseas production due to decreased demand stemming from higher prices.[89] Indeed, if the initial price shock lasts long enough, it may trigger energy efficiency improvements in durable goods that are irreversible, even if prices lower again.[90] For example, "[t]he fact that overall passenger-car-fleet fuel economy remained comparatively flat during a period of declining real prices for gasoline also suggested that" technology and regulations "plac[ed] some sort of floor under new-car fuel economy."[91]

B. Emissions-Intensive Production Processes

Some industries are emissions-intensive due to their production processes more so than their energy consumption. This Part highlights one of those industries: cement.

Industry	Percent of GHG Emissions	Chief Source of Emissions	Susceptibility to Foreign Competition	Possible Impact of Purchasing Emissions
Cement	18 percent of all industrial emissions and 4 to 5 percent of worldwide emissions.	Burning coal to heat kilns, decomposing limestone, which frees CO_2.	Expensive to transport, except by sea. Developing country demand outstrips supply.	Between 8 and 35 percent cost increase.

The global cement industry accounts for a similar amount of carbon emissions as the steel industry, representing about 18% of all industrial CO_2 emissions,[92] and 5% of global emissions.[93] By 2050, global cement

88. Eichner & Pethig, *supra* note 87.

89. JOSEPH E. ALDY & WILLIAM A. PIZER, THE COMPETITIVENESS IMPACTS OF CLIMATE CHANGE MITIGATION POLICIES, PEW CENTER ON GLOBAL CLIMATE CHANGE (2009).

90. *See, e.g.*, FORD FOUND., A TIME TO CHOOSE: AMERICA'S ENERGY FUTURE 4 (1974) ("Energy policy has momentum, like a mammoth supertanker carrying a quarter-million tons of crude oil, which cannot stop in less than twenty minutes and three nautical miles.").

91. Brent D. Yacobucci & Robert Bamberger, *Automobile and Light Truck Fuel Economy: The CAFE Standards* (Congressional Research Report No. RL33413, 2006).

92. *Id.*

93. Lázslo Szabó et al., *Co2 Emission Trading with the European Union and Annex B Countries: The Cement Industry Case*, 34 ENERGY POL'Y 72, 74 (2006).

production is expected to produce nearly five billion tons of carbon dioxide annually.[94] Unlike steel production, cement emissions stem less from energy consumption than from direct emissions during production.[95] About half of the emissions from producing cement are caused by chemical processes[96] and energy is only 30% to 40% of the production cost.[97] Manufacturing cement requires "burning vast amounts of cheap coal to heat kilns to more than 1,500[º]C. It also relies on the decomposition of limestone, a chemical change which frees carbon dioxide as a byproduct."[98] The Cement Sustainability Initiative, coordinated by the World Business Council on Sustainable Development, has enlisted the eighteen largest cement producers to pledge to "reduce[] carbon dioxide emissions during cement production on average by 100kg of CO_2 per tonne of production";[99] however, this pales in comparison to total cement production emissions.

A model of Dutch cement production suggests that a price of €20/ton of CO_2 emissions yields an 8% increase in cement production costs; however, this cost increase is entirely passed through to consumers.[100] Because cement inputs, such as slag and fly ash from steel production, are readily found in most countries, it is likely that cement production elsewhere in the EU will experience a similar dynamic. An EU-wide model of the cement industry projects that if CO_2 emissions cost €40/ton, then the EU will cut its cement production by 3.5%; however, other, nonregulated regions may increase their production by more than this amount.[101]

The German cement industry cites a study by McKinsey & Company that suggests the purchase of emissions permits for more than €50/ton would cause up to 90% of its production to relocate outside the EU, with a €35/ton price causing half the industry to move.[102] This industrial relocation will not only cause carbon leakage, but also increase

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94. David Adam, *The Unheralded Polluter: Cement Industry Comes Clean on Its Impact*, GUARDIAN, Oct. 12, 2007, at 9, *available at* http://www.guardian.co.uk.environment/2007/oct/12/climatechange.

95. *See id.* (discussing how the manufacturing process requires the incineration of large quantities of coal to heat the kilns).

96. Bartsch, *supra* note 41, at 18.

97. Szabó et al., *supra* note 93, at 74.

98. Adam, *supra* note 94.

99. Mayer, *supra* note 45.

100. De Bruyn, *supra* note 50, at 7.

101. Szabó et al., *supra* note 93, at 84.

102. *German Cement Industry Joins Lobby Against Full Auctioning*, POINT CARBON NEWS: CARBON MARKET EUR., Sept. 5, 2008, at 4-5.

overall emissions as the cement is transported back to the EU.[103] Likewise, U.K. cement producers fear that direct and indirect costs, depending on the actual carbon price, could rise up to 35% of value added in UK cement production (assuming a price of 20 Euro per tonne CO_2).[104]

The European Cement Association (Cembureau) projects that the EU ETS "could put an end to cement production in the EU."[105] An analysis of the market, however, suggests otherwise. At present, EU cement producers face scant competition from abroad, because cement "is not conducive to international trade"[106] due to its relatively high weight and low value. Any international competition that does exist is limited to coastal regions because heavy weight has less impact on the cost of sea transport.[107] Once the cement makes landfall, however, it "is hardly transported more than 150km inland."[108] This explains why, as of 1997, only 7% of cement consumption was provided through international trade.[109] Thus, "inland [regions] seem to be relatively protected"[110] and able to pass through price increases related to carbon emissions to the consumers. However, one study for the European Commission suggests that the cost of emissions allowances for the cement industry would be "roughly equal to freight costs from northern Africa or the eastern European countries outside the EU."[111]

The cement industry's relative concentration and its "limit pricing strategy" to deter "traders and imports" is another factor that enables the industry to pass through any emissions-related price increases to consumers.[112]

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103. *Id.*

104. Susanne Dröge, *Tackling Leakage in a World of Unequal Carbon Prices*, CLIMATE STRATEGIES, Jan. 2007, *available at* http://www.climatestrategies.org/our-reports/category/32/153.html.

105. Chris Sleight, *Cembureau Concerns over Carbon Trading Plans*, CONSTRUCTION EUR., Dec. 8, 2008, http://www.khl.com/magazines/construction-europe/detail/item29783/Cembureau-concerns-over-carbon-trading-plans/.

106. Bartsch, *supra* note 41, at 18.

107. Samuel Barkin, *The Counterintuitive Relationship Between Globalization and Climate Change*, 3 GLOBAL ENVTL. POL. 8, 10 (Aug. 2003).

108. Szabó et al., *supra* note 93, at 73.

109. De Bruyn, *supra* note 50.

110. Damien Demailly & Philippe Quirion, *CO2 Abatement, Competitiveness and Leakage in the European Cement Industry Under the EU ETS: Grandfathering vs. Output-Based Allocation*, 6 CLIMATE POL'Y 93, 98 (2006).

111. EUROPEAN COMM'N DIRECTORATE GEN. FOR ENV'T ET AL., *supra* note 52, at 37.

112. Jean Pierre Ponssard, *Carbon Leakage from the EU Emission Trading Scheme: A Comment on the Cement Sector* 3 (Climate Strategies Working Paper, 2009).

Cement consumption growth abroad in China, Southeast Asia, and India is "tied to their intensive industrialisation processes."[113] Almost half of the world supply of concrete is produced in China,[114] and consumption continues to grow there and in India.[115] The EU, by comparison, produces and consumes only about 11% of the world cement market, and this share is declining.[116] By 2030, it is expected that China and India "will consume almost half of the world cement production."[117] Because cement is difficult to transport inland, these markets will likely rely on domestic production.

New technological developments suggest that cement may evolve from a liability to an asset in the battle against climate change. Calera, a California startup company, has demonstrated new cement technology that not only is emissions-free, but also helps sequester emissions from power plants, up to a half-ton of carbon dioxide for every ton of cement.[118] Meanwhile, Carbon Sciences "plans to use flue gas and the water leftover after mining operations" to create cement, while Carbon Sense Solutions "plans to accelerate the natural process of cement absorbing CO_2 by exposing a fresh batch to flue gas."[119]

C. Electricity

Western Europe is not situated close enough to unregulated countries to import electric power from abroad.[120] This means that the power generation industry in those countries can pass through increased costs related to emissions reductions to consumers without a fear of price competition from countries lacking an emissions control policy. By contrast, the newer member states of the EU, such as Poland and the Baltic states, could conceivably face power imports from the Ukraine, Russia, or Belarus.[121] Indeed, because 90% of Poland's power is coal-generated, its power prices may be more affected by carbon caps than

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113. Szabó et al., *supra* note 93, at 84.
114. Adam, *supra* note 94.
115. Szabó et al., *supra* note 93, at 74.
116. *Id.* at 73.
117. *Id.* at 78.
118. Carrie Sturrock, *Green Cement May Set CO2 Fate in Concrete*, S.F. CHRON., Sept. 2, 2008, *available at* http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2008/09/02/MNGD12936I.DTL; *cf.* Joseph Romm, *Exclusive: Does Carbon-Eating Cement Deserve the Hype?*, CLIMATEPROGRESS.COM, Apr. 2, 2009, http://climateprogress.org/2009/04/02/calera-caldeira-green-cement-carbon-co2/.
119. David Biello, *Cement from CO_2: A Concrete Cure for Global Warming?*, SCI. AM., Aug. 7, 2008, http://www.scientificamerican.com/article.cfm?id=cement-from-carbon-dioxide.
120. *See* EUROPEAN ENV'T AGENCY, *supra* note 29, at 14.
121. Dröge, *supra* note 104, at 38-39.

other EU member states.[122] Thus, there is a potential for electric power generation leakage in parts of the EU. Policymakers are attempting to reduce this national disparity by setting aside 10% of EU emissions quotas for a "solidarity fund" to help poor countries in Central and Eastern Europe.[123]

D. Paper

The paper industry is projected to face higher costs after purchasing emissions allowances. Even if the industry received free allowances for 95% of its current emissions, it would still face a "cost increase . . . in the order of 0.3 to 1.0% in processes with chemical pulp and up to 1.9% in pulp and paper production based on recovered fibre. Mechanical pulping (6% of total pulp) and thermo-mechanical pulping (12% of total pulp) [would be] affected by a 3-4% and 5-6% net cost increase, respectively."[124] These additional costs stem in part from higher power prices. A consultant to the UK Confederation of Paper Industries projects that the expense of purchasing emissions would exceed the industry's annual profits.[125]

The paper industry is also quite international, which means there may be significant contribution from non-EU ETS countries. The German paper and board industry conducts nearly 20% of its trade outside the EU.[126]

V. LEAKAGE SHOULD NOT BE A SIGNIFICANT CONCERN FOR THE EU ETS

Many academic studies and scholars suggest that industry warnings about carbon leakage may be exaggerated. For example, Professor Michael Wara of Stanford Law School, an expert on emissions trading,

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122. EurActiv.com, EU Moves Closer to Climate Deal for Heavy Industry (Dec. 4, 2008), http://www.euractiv.com/en/climate_change/eu-moves-closer-climate-deal-heavy-industry/article-177769.

123. EurActiv.com, Industry Set To Win EU Climate Concessions (Dec. 12, 2008), http://www.euractiv.com/en/eu_summit/industry-set-win-eu-climate-concessions/article-178003.

124. EUROPEAN COMM'N DIRECTORATE GEN. FOR ENV'T ET AL., *supra* note 52, at 5.

125. Bryan C. Bateman, *Where Have All the Scouts Gone*, 7(34) POINT CARBON NEWS: CARBON MARKET EUR., Sept. 12, 2008, at 7.

126. Franzjosef Schafhausen, How To Address Carbon Leakage in the EU ETS, German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety Presentation at Symposium on Allocation and Leakage/Competitiveness Issues of Emissions Trading Schemes, Institute for Global Environmental Strategies, Tokyo 16 (Mar. 12, 2009), *available at* http://www.iges.or.jp/jp/cdm/pdf/20090312et/Schafhausen.pdf.

notes that "[m]ost of the industries claiming to be hurt by emissions standards are not competitive for a lot of reasons . . . . There will be a small number of companies on the margins that this will affect, but they are the exceptions to the rule."[127] Industry forecasts are often devised largely to justify why each industry should be granted free emissions permits. As a result, even industries insulated from foreign competition, such as inland cement producers, have instrumental motives in raising the specter of businesses "fleeing the continent in search of countries where emitting CO_2 is cheaper or free."[128] Indeed, threats of leakage from businesses that earn their most significant profits from the EU, such as Europe's own aviation industry,[129] must be taken with more than a grain of salt.

Other academicians agree that leakage should have "only a very limited impact on the overall [EU] economy"[130] because "serious leakage problems could only occur for a narrow range of sectors and products,"[131] "represent[ing] well under 1% of GDP and a much smaller fraction still of employment."[132] Even within European manufacturing centers like Germany and the United Kingdom, "[d]etailed analysis . . . shows that only 1% to 2% of GDP is associated with activities that face significant cost increases from carbon pricing."[133]

The *Economist* reports that "even the most vulnerable industries would not suffer the Armageddon that lobbying groups are predicting,"[134] as illustrated by a "Pew Centre on Global Climate Change [study which] . . . sizes up a $15 carbon price . . . [and] concludes that output would fall by 2% or less in 80% of cases[; although], [p]aper and glass would face a bigger contraction, of 5%."[135] Experts from Mission Climat of Caisse des Depots, Massachusetts Institute of Technology (MIT), and University

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127. Pentland, *supra* note 21; *see also* Carbon Trust, EU ETS To Have Marginal Impact on Competitiveness of EU Industry (Jan. 15, 2008), http://www.carbontrust.co.uk/News/presscentre/2008/EU_ETS.htm ("For more than 90% of manufacturing industry, carbon costs will remain trivial compared to . . . other influences on international competitiveness." (quoting Michael Grubb, Chief Economist at the Carbon Trust and Chairman of Climate Strategies)).

128. *See, e.g.*, EurActiv.com (Sept. 3, 2008), *supra* note 19.

129. ERNST & YOUNG, INCLUSION OF AVIATION IN THE EU ETS: CASES FOR CARBON LEAKAGE, at iii (2008).

130. Neuhoff & Matthes, *supra* note 37, at 7.

131. EurActiv.com, The Role of Auctions in Emissions Trading (Oct. 14, 2008), http://www.euractiv.com/en/climate-change/role-auctions-emissions-trading/article-176346.

132. Neuhoff & Matthes, *supra* note 37, letter from Michael Grubb, Chairman, Climate Strategies.

133. *Id.* at 7; *see also* Dröge, *supra* note 104.

134. *Emissions Suspicions*, ECONOMIST, June 21, 2008, at 88.

135. *Id.*

College Dublin concur, forecasting that less than 5% of European industrial output and even less European employment would be affected by the requirement of purchasing emissions permits.[136] As do the Netherlands Bureau for Economic Policy Analysis and the Netherlands Environmental Agency, which predict that in an asymmetric carbon emissions regulatory regime, "production from energy-intensive sectors in the EU would fall 4.5 per cent and employment decrease 3.2 per cent."[137] Roughly 40% of this lost production would reappear outside the EU, resulting in "3% of the intended emissions reduction [coming] undone."[138] This is similar in scope to the IPCC's estimate that while "trade flows in response to changes in relative [emissions] prices might lead to very limited carbon leakage in the order of 5% to 20%,"[139] flexible emissions reduction mechanisms under the Kyoto Protocol "could lower abatement costs by 1% of global GDP."[140]

Ex post facto assessments of the impact to date of the EU ETS support the proposition that estimates of its cost and impact may be somewhat exaggerated. The International Energy Agency has noted that emissions credits in the steel sector were over-allocated and the cement industry has shown "[l]ittle change in market prices yet small evidence of [a] price increase."[141] Meanwhile, the refinery sector has retained a surplus of allowances and any impacts of EU ETS on the sector are "difficult to see."[142]

MIT Professor Mustafa Babiker and Julia Reinaud of the International Energy Agency advise caution about placing too much reliance economic simulations. Reinaud's comparison of *ex ante* simulations to *ex post* assessments suggests that "methodological uncertainties abound" in simulations, resulting in widely varying carbon leakage projections.[143] By example, Reinaud cites studies of leakage in the iron and steel industries ranging from 0.5% to 25%, and leakage in the cement industry ranging from 40% to 70%.[144]

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136. Convery et al., *supra* note 34, at 20.

137. *Using More CERs Can Slow EU Carbon Leakage in EU: Report*, PointCarbon News: Carbon Market Eur., Oct. 10, 2008, at 2-3; T. Manders & P. Veenendaal, Neth. Envtl. Assessment Agency, Border Tax Adjustments and the EU-ETS: A Quantitative Assessment 9 (2008), https://www.gtap.agecon.purdue.edu/resources/download/4334.pdf.

138. Manders & Veenendaal, *supra* note 137, at 9.

139. Bartsch, *supra* note 41, at 17.

140. *Id.* at 18.

141. Reinaud, *supra* note 75, at 6.

142. *Id.*

143. *Id.*

144. *Id.*

Meanwhile, Babiker believes that many simulations underestimate the possibility of carbon leakage by improperly neglecting "unexploited economies of scale" that may be available to unregulated producers who receive increased industrial investment as a result of production being shifted away from regulated countries.[145] Further, Babiker warns that current leakage models may be too aggressive in their assumption that product differentiation based on national origin makes home country producers less susceptible to foreign competition.[146] If energy-intensive products produced worldwide are more homogenous than perceived, "the perceived demand curves facing the [lower-cost producer] foreign firm becomes flat, markups fall, foreign sales in OECD increase, and accordingly both total production and production per firm expand in non-OECD economies."[147] If firms in each market enter and exit the industry, Babiker's model predicts that "[u]nder the assumption of differentiated goods, the number of firms falls by 2% and output per firm by 3.7%."[148] By contrast, assuming a world of product homogeneity regardless of national origin, "the number of [energy-intensive OECD] firms falls by 53.3% and output per firm [falls] by 57%."[149]

In sum, carbon leakage modeling challenges do exist, as demonstrated by comparison with *ex post facto* results to date and the great variance of the analyses. Nonetheless, modeling remains an important analytical tool because it is only in comparison to the counterfactual scenarios shown in such models that leakage can be demonstrated.[150] The next Part of the Article moves beyond economic models to fundamental tenets and trends that explain why carbon leakage should not be a significant issue for EU ETS.

A. Barriers to Entry

Static neoclassical models of imports assume instant equilibrium. In reality, "[f]oreign exporters cannot build up supply networks overnight."[151] Likewise, local EU firms can create other barriers to the entry of energy-intensive commodities shipped in bulk, such as cement

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145. Babiker, *supra* note 86, at 441.

146. *Id.* at 422. Babiker refers to this assumption as an Armington structure, as contrasted with a Hecksher-Ohlin framework wherein goods are assumed to be homogenous and undifferentiated, regardless of national origin.

147. *Id.* at 436.

148. *Id.*

149. *Id.*

150. Reinaud, *supra* note 75, at 1.

151. Demailly & Quirion, *supra* note 110, at 100.

and steel, by occupying all available port facilities so foreign companies cannot bring their product onshore.[152] The European Commission's own research shows that "market concentration in the cement industry is rather high and prone to collusion and the formation of cartels and the cement sector is unlikely to be significantly exposed to international competition due to high transportation costs."[153]

Research by Professor Michael Grubb from Cambridge University suggests that "expos[ure] to non-EU competition is not even 2% for [the] EU['s] lime and cement industry," and for the steel sector, competition does not reach 20%.[154] As discussed earlier, cement's high land transit costs limit the competitiveness of international imports to coastal regions.[155]

Recent events support this perspective. For example, a study by the International Energy Agency shows that European aluminium production has not been negatively impacted by putting a price on carbon emissions; to the contrary, "a shuttered smelter in Germany reopened in 2007, despite the rising cost of emissions."[156] Likewise, a study by New Carbon Finance showed that power prices in Poland and Germany already reflected the cost of carbon emissions permits, despite the fact that these permits were initially given to power producers for free in the first round of EU ETS.[157] As a result, power consumers, including aluminium and steel companies, are already paying for carbon emissions in their power bill, yet have remained onshore.[158]

Because most energy-intensive industries are capital-intensive, much of the production in unregulated countries is the result of investment from EU and other Western firms already in the industry. EU

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152. *Id.*

153. S. Kumar, *Carbon Leakage or Auctioning Avoidance: How To Pervert Emissions Trading*, POINT CARBON NEWS: CARBON MARKET EUR., Sept. 5, 2008, at 7 (quoting EU Commission) (internal quotation marks omitted).

154. *See* Claude Turmes, Wolf or Sheep?: Myth and Realities Behind Energy Intensive Industry Lobby Efforts To Dilute the EU Climate Package (2008), *available at* http://www.euractiv.com/29/images/Turmes%20European%20Spring%20Council%202008-Background_tcm29-170918.doc.

155. *But cf.* Michael Grubb & Karsten Neuhoff, *Allocation and Competitiveness in the EU Emission Trading Scheme: Policy Overview*, 6 CLIMATE POL'Y (SPECIAL ISSUE) 5, 10 (2006) ("[H]ardly any cement is currently imported from outside the EU. This does not imply that changes in production costs cannot create opportunities for international trade.").

156. *Emissions Suspicions*, *supra* note 134.

157. *Electricity Prices Not Affected by Full Auctioning of Allowance: Report*, POINT CARBON NEWS, Sept. 23, 2008, http://www.pointcarbon.com/news/1.974855.

158. JULIA RENAUD, ISSUES BEHIND COMPETITIVENESS AND CARBON LEAKAGE: FOCUS ON HEAVY INDUSTRY 84 (2008).

firms can use their ownership of foreign subsidiaries to require that the subsidiaries focus on their home market, rather than export to the EU.[159]

B. Emissions Pricing Alone Will Not Drive Manufacturers Out of the EU

"[I]ndustries [such] as cement manufacture [a]re not so easily transferable."[160] Indeed, "[c]osts imposed by tighter pollution regulation are not a major determinant of trade and location patterns, even for those sectors most likely to be affected by such regulation."[161] Manufacturing plant movement is more likely driven by factors such as "labour costs and skills, market size, political stability, income levels, physical infrastructure and a wide range of government policies (taxes, financial and investment regulations)."[162] Even European Parliamentarians in favor of free emissions allocations to industry acknowledge that "[c]arbon leakage is difficult to prove."[163]

Morgan Stanley concurs:

> [C]oncerns that carbon-intensive industries could relocate due to loss of competitiveness seem overblown. Only a relatively small number of carbon-intensive industries would feel a significant impact even if GHG emissions were fully priced. Even for those industries, climate policy would be only one of many factors in their decision about location of production.[164]

One "reality check" of this viewpoint is readily demonstrable today: "Europe has had more expensive energy than just about everywhere for decades, yet we still produce virtually all our own steel and our own cement."[165]

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159. *Id.* This may, however, be a two-sided coin. Because the EU firms have invested in unregulated countries, they may also be better-suited to quickly shift some of their production abroad.

160. Michael Willoughby, *Power Industry, Construction Products Take Beating from EU on 'Super Tuesday,'* BUILDING, Oct. 7, 2008, *available at* http://www.building.co.uk/story.asp?storyCode=3124389.

161. EurActiv.com (May 16, 2008), *supra* note 19 (quoting the Stern Report on Climate Change); *see also* Bartsch, *supra* note 41, at 18 ("Environmental policy regulations are only one factor and, according to most empirical studies, not yet a significant one.").

162. Bartsch, *supra* note 41, at 18.

163. E. Korhola, *Emissions Trading—The Last Chance To Get It Right*, POINT CARBON NEWS: CARBON MARKET EUR., Sept. 19, 2008, at 7.

164. Bartsch, *supra* note 41, at 17.

165. Richard Black, *Trade Can 'Export' CO2 Emissions*, BBC NEWS, Dec. 19, 2005, http://news.bbc.co.uk/1/hi/sci/tech/4542104.stm.

C. Controlling Emissions Can Create New Jobs and Profits

Technological advances to reduce emissions provide excellent opportunities for export sales.[166] "[A] strict environmental policy might even create a first-mover advantage by shaping new technological leaders in abatement technology by setting tough emission standards."[167] As a result, countries with tighter emissions regulations are well-positioned for international sales of environmental protection equipment.[168] In short, putting a price on carbon emissions might foster, rather than impede, industrial growth and employment.

If models of potential carbon leakage in the United States foreshadow similar changes in the EU, then even emissions-intensive industries stand to lose few jobs, with employment declining by only 2% in industries in the top tenth percentile of energy intensity.[169]

D. Projections of Carbon Leakage Fail To Account for Technology

Estimates of the cost of emissions abatement often fail to consider technology innovations and economies of scale that would be spurred by the emissions cap.[170] An apt analogy is the Acid Rain Program required by the Clear Air Act, wherein industry overestimated the cost of abatement by 300%, due to a failure to include technological advances in their forecasts.[171]

A recent study by McKinsey & Company suggests that energy efficiency improvements would suffice to meet all of the EU's emissions

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166. Thomas L. Friedman, *The Power of Green*, N.Y. TIMES, Apr. 15, 2007, *available at* http://www.nytimes.com/2007/04/15/magazine/15green.t.html ("Clean-tech plays to America's strength because making things like locomotives lighter and smarter takes a lot of knowledge—not cheap labor. That's why embedding clean-tech into everything we design and manufacture is a way to revive America as a manufacturing power.").

167. Bartsch, *supra* note 41, at 18.

168. *Id.* at 18.

169. Aldy & Pizer, *supra* note 89, at 19.

170. Richard G. Richels & Geoffrey J. Blanford, *The Value of Technological Advance in Decarbonizing the U.S. Economy* 1 (AEI-Brookings Joint Center for Regulatory Studies, Working Paper No. 07-19, Nov. 2007), *available at* http://www.aei-brookings.org/admin/authorpdfs/redirect-safely.php?fname=../pdffiles/WP07-19_topost.pdf ("[N]o meaningful reduction in carbon dioxide emissions will occur without some type of price signal to creat[e] an incentive for low-emitting technologies.").

171. Matthew F. Pawa & Benjamin A. Krass, *Global Warming as a Public Nuisance:* Connecticut v. American Electric Power, 16 FORDHAM ENVTL. L. REV. 407, 429 (2005) (discussing how projected costs up to $6.6 billion per year were reduced to $1.5 to $2.1 billion per year once the program was implemented).

targets.[172] Academic econometric models and simulations confirm this hypothesis. For example, in a model of two countries' economies, wherein only one country enforces a cap on emissions, employment of "directed technical change" (for example, technology designed to reduce emissions) brings about "a counterbalancing induced-technology effect" and a lowering of carbon leakage.[173] If energy demand is elastic, which it is more likely to be in the long-run,[174] then even a nonregulated country will be induced "to voluntarily reduce its emissions," effectively creating negative leakage.[175] Accordingly, "the leakage rates reported in the literature [so far] may be too high, as these estimates neglect the effect of [relative] price changes on the incentives to innovate."[176]

An economic simulation by economic researchers at Fondazione Eni Enrico Mattei observed a similar effect: "We build-in the endogenous energy-saving technology in a large CGE [Computational General Equilibrium] model and verify that the results from the formal model carry over. Carbon leakage becomes negative for moderate levels of international technology spillover."[177]

The steel industry demonstrates the role of energy-saving technology at a more micro-level. Because one type of steelmaking (EAF) has a much lower emissions profile than the other method (BOF), "overall emissions may be reduced through substitution across technologies."[178] And, regardless of the process employed, emissions can sometimes be further "reduced by substitution of less polluting inputs for more polluting ones."[179] This is demonstrated in a static numerical partial equilibrium model of the world steel industry, simulating "production of steel with three technologies in ten regions, consumption and trade of two steel qualities, and the markets for iron ore, metallurgical coal, and scrap as well as the sea transports related to the steel industry."[180] The

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172. *See EU Could Meet GHG Targets by Energy Efficiency Alone: McKinsey*, POINT CARBON NEWS: CARBON MARKET EUR., Sept. 12, 2008, at 6; McKinsey & Co., The Case for Investing in Energy Efficiency (Feb. 2008), http://www.mckinsey.com/mgi/publications/investing_Energy_Productivity/.

173. Di Maria & Van der Werf, *supra* note 23, at 55 (emphasis omitted).

174. *See, e.g.*, ROBERT S. PINDYCK & DANIEL L. RUBINFELD, MICROECONOMICS 39 fig.2.13 (6th ed. 2005) (discussing short-run and long-run demand curves for gasoline).

175. Di Maria & Van der Werf, *supra* note 23, at 68.

176. *Id.* at 55.

177. Reyer Gerlagh & Onno Kuik, *Carbon Leakage with International Technology Spillovers* (Fondazione Eni Enrico Mattei (FEEM), Working Paper No. 33, 2007), http://www.feem.it/Feem/Pub/Publications/WPapers/default.htm.

178. Mathiesen & Mæstad, *supra* note 85, at 92.

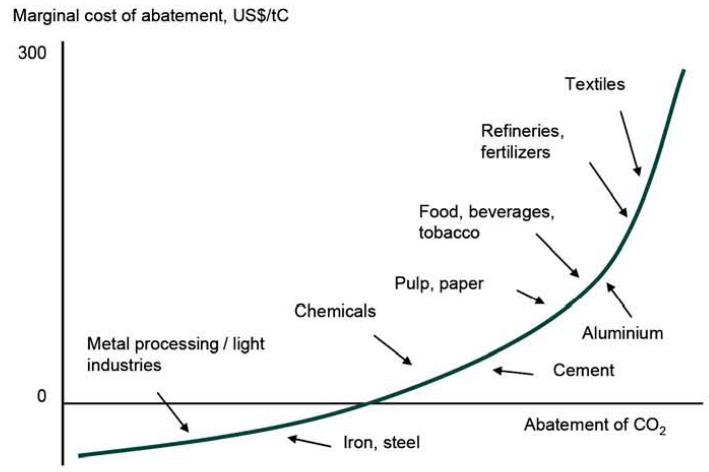
179. *Id.*

180. *Id.*

model reveals that substitution of steelmaking processes can halve potential carbon leakage from 53% to approximately 26%,[181] and reduced input of coal in the BOF production process "suggest[s] that emissions of carbon dioxide from the steel industry will decline more than twice as much as global steel production."[182]

According to IPCC, there are enough untapped efficiencies in the steel industry that the cost of abating carbon emissions is likely to be negative, as demonstrated in the following graph:

Figure 21. Industrial energy efficiency costs (US$/tC)



Source: Intergovernmental Panel on Climate Change (2001), vol.IV, ch.4.

Top gas recycling blast furnaces, new smelting reduction processes, direct reduction of iron ore, and electrolysis allowing for hydrogen-based steel production are examples of new steel technologies under development by a 48-member consortium of European steel producers, suppliers, research institutes, small and medium businesses, and universities.[183] Likewise, the European Union is sponsoring research that promises 30% to 50% energy efficiency gains in the production of cement through waste reduction; and this technology may be transferable to other energy-intensive industries.[184]

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181. *Id.* at 107.

182. *Id.* at 106.

183. José-Lorenzo Vallés, *NMP Research for Emissions Reduction*, EUR. COMMISSION, Sept. 26, 2008, at 10-14, *available at* http://ec.europa.eu/environment/climat/emission/pdf/5_future_tech.pdf.

184. *Id.* at 17.

As discussed above, new cement technologies hold significant promise for both lower production emissions and the sequestration of emissions from other sources.[185] While beyond the scope of this Article to describe in detail, the International Energy Agency (IEA) has also shown the promise of carbon abatement technology in other sectors, reporting that "there is considerable room for adopting more efficient technologies in buildings, industry and transport."[186] By accelerating the deployment of energy efficiency technologies, the IEA estimates a seventeen to thirty-three percent gain in efficiency by 2050.[187]

E. Manufacturing in Developing Countries May Still Lower Emissions

Forecasts of carbon leakage may be based on a faulty assumption that production of energy-intensive products in unregulated countries will inherently be less energy efficient and produce more carbon emissions, essentially forming a "pollution haven."[188] For example, the chief executive officer of European steel producer Corus argues that Chinese-produced steel creates twice as many emissions as European-produced steel due to the use of older equipment in China.[189]

This perspective neglects the reality that "some countries are currently in the process of making large capital investments in their energy sector (India, China) and hence [would be more likely to adopt clean technology because they] would not have to write off the existing capital stock."[190] Developing countries like China may use cleaner or more efficient production methods than the EU for certain commodities.

On these grounds, Claude Turmes, a Green Party member of the European Parliament, circulated a paper describing EU carbon leakage as a "myth."[191] Turmes argues that energy efficiency performance in energy-

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185. *See supra* text accompanying notes 118-119.

186. Llewellyn, *supra* note 40, at 28.

187. *Id.* For a description of energy efficiency opportunities in the United States, many of which are replicable in the European Union, see Michael Grunwald, *America's Untapped Energy Resource: Boosting Efficiency*, TIME, Dec. 31, 2008, http://time.com/time/magazine/article/0.9171,1869224-1,00.html.

188. *See, e.g.*, Jota Ishikawa & Toshihiro Okubo, *Greenhouse-Gas Emissions Controls and International Carbon Leakage Through Trade Liberalization* 2-4 n.4 (RIETI Discussion Paper Series No. 09-E-008, 2009).

189. Tricia Holly Davis, *Corus Chief Warns of European Steel Threat*, INDEPENDENT, Dec. 14, 2008, http://independent.co.uk/news/business/news/CORUS-we-will-quit-eu-to-avoid-carbon-regime-1065639.html.

190. Bartsch, *supra* note 41, at 18.

191. *See* Turmes, *supra* note 154, at 1.

intensive industries like steel, cement, and aluminium are actually *more stringent* outside the European Union.[192] Thus, there are no laxer energy efficiency rules that would give these imported products a competitive advantage over EU producers.

> The world's best performing steel plant is in Korea, the world's best cement plant [is] in Brazil, and the world's best primary aluminium plant is in Dubai. And all new investments in the energy intensive industry—in Brazil, in Kazakhstan or in China—are always more energy efficient than old EU production processes.[193]

The World Wildlife Fund confirms this observation, reporting that "the least CO_2-intensive means of producing steel is located in South Korea, not the EU."[194]

Many of the investments abroad in new, cleaner technologies are being made by EU companies, such as cement producers, according to the European Commission's Environment Directorate.[195] There is far less likelihood of "competitive disadvantage" stemming from emissions costs in the EU when similar abatement techniques are used elsewhere.[196]

A look at China's energy sector reveals the need to study developing country industrial practices before assuming they create carbon leakage. A recent comprehensive study of China's electric power sector by a team from MIT revealed "a sizable portion of plants employing state-of-the-art equipment, much of it sourced from global suppliers. Interestingly, some of the newest and most advanced coal combustion technologies [are] currently used in China . . . ."[197] This includes "technologies for environmental cleanup, most notably those for handling SOx emissions," such as "'clean coal' technologies" and "flue-gas desulfurization . . . 'scrubbers.'"[198] The MIT team concluded that the incentive to install these technologies was two-fold. First, "some kind of institutional

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192. *Id.* at 1-2.

193. *Id.*

194. Kumar, *supra* note 153, at 7.

195. EurActiv.com, Commission Weighing Up Options on CO2 Border Tax: Interview with Jos Delbeke, Deputy Director General at the Commission's Environment Directorate (Feb. 27, 2008), http://www.euractiv.com/en/climate-change/commission-weighing-options-co2-border-tax/article-170587; *see also* Bartsch, *supra* note 41, at 18.

196. EurActiv.com, *supra* note 195.

197. EDWARD S. STEINFELD ET AL., CHINA ENERGY GROUP, MASS. INST. TECH. INDUS. PERFORMANCE CTR., GREENER PLANTS, GRAYER SKIES: A REPORT FROM THE FRONT LINES OF CHINA'S ENERGY SECTOR 7 (Aug. 2008), http://web.mit.edu/ipc/publications/pdf/08-003.pdf; Keith Bradsher, *China Outpaces U.S. in Cleaner Coal-Fired Plants*, N.Y. Times, May 11, 2009, at A3.

198. Steinfeld et al., *supra* note 197, at 7.

pressure exists in the Chinese system to push at least some kinds of power producers to purchase environmental cleanup technologies."[199] Second, "more efficient electric power generating technologies permit less fuel to be burned per unit of electricity produced . . . . Escalating coal prices and mandatory emission control policies clearly serve as an important lever . . . ."[200] China's sheer economy of scale also means that "it can now cost a third less to build an ultra-supercritical power plant [the most efficient type in the world] in China than to build a less efficient coal-fired plant in the United States."[201] China's recent economic stimulus package includes "substantial investment in energy-efficient transportation and upgrades to improve the efficiency of the electricity transmission network."[202]

Many "Europeans . . . are . . . surprisingly ill-informed about the rapid changes in Chinese energy and environment policy over the last five years."[203] They are unaware that "China's energy efficiency and pollution-abatement programs have support from industrial planners . . . for an energy policy that emphasizes thrift and the deployment of cutting-edge technology"[204] to reduce both energy intensity relative by 20% and sulfur dioxide and chemical oxygen demand by 10%.[205] China's adoption of these cleaner technologies is likely to continue because it is driven by concerns over energy security. McKinsey & Company reports that "[b]y taking advantage only of currently existing technologies *that pay for themselves*, China could . . . reduce total energy demand in 2020 by as much as 23 percent [and] cut its projected oil imports by up to 15 percent and its CO_2 emissions by at least 20 percent by 2020."[206]

"China does not want to be an exporter of cement (export tariff)."[207] There are also signs that China is unilaterally discouraging energy-intensive exports through elimination of VAT rebates on steel and

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199. *Id.*

200. *Id.* at 9.

201. Bradsher, *supra* note 197.

202. *Energy Efficiency Faces Obstacles in China*, FORBES.COM, Apr. 30, 2009, *available at* http://www.forbes.com/2009/04/29/china-energy-efficiency-business-oxford-analytica.html.

203. Deborah Seligsohn, *Doing More Than You Think*, CHINA ECON. Q., Sept. 2008, at 21, *available at* http://pdf.wri.org/ceq_seligsohn_doing_more_than_you_think.pdf.

204. *Id.*

205. *Id.*

206. McKinsey & Co., Leapfrogging to Higher Energy Productivity in China (July 2007), *available at* http://www.mckinsey.com/mgi/publications/leap_frog/index.asp) (emphasis added).

207. Damien Demailly, CIRED, Presentation at the Climate Strategies Workshop: Preliminary Analysis/Proposal for a Sectoral Agreement: The Case of the Chinese Cement Sector (May 7, 2007).

cement.[208] Moreover, an export tax was instituted "to discourage cheap, environment-unfriendly production of energy-intensive products for export."[209] To ensure these incentives take hold permanently, China "closed 14.4 gigawatts (gw) of [inefficient] electric power plants, more than 1,000 obsolete cement plants with annual production of 50m tons, and thousands of aluminum, steel, glass and paper factories."[210] The result was a jump from a 1.6% to 3.7% drop in energy intensity that was predicted to drop further in 2008.[211] South Korea appears to be marching along the same path, as it considers a mandatory domestic emissions trading scheme.[212]

These trends suggest that "[i]n the long term, however, the short- to medium-term advantage enjoyed by aluminum producers in lower-cost regions like China, the Middle East, and North Africa will probably fall: the global standardization of carbon costs [and the drive for energy efficiency] will erode margin differentials."[213] An Indian delegate to the climate change meeting in Ghana believes that developing countries are not even the lowest cost producers for many commodities because "[r]ich countries would also have an easier time achieving their emission reductions potentials, thus putting developing states at a competitive disadvantage."[214]

F. Increased Offshore Production Is Driven by Growth Abroad, Not Leakage

As discussed above, China, India, and other developing countries are becoming the largest consumers of the most energy-intensive products: cement, steel, aluminium, etc.[215] It is per capita GDP growth that drives cement consumption.[216] Because developing countries have much higher per capita GDP growth, their cement consumption rate will be higher as well. Given their inherent lower labor and transportation costs, most of these commodities will be produced domestically. Due to transportation and labor costs, EU companies would not be cost-

208. Seligsohn, *supra* note 203, at 21.
209. Llewellyn, *supra* note 40, at 35.
210. Seligsohn, *supra* note 203, at 23.
211. *Id.*
212. *South Korea To Unveil Low-Carbon Plan in September*, TRADING CARBON, Vol. 2, No. 7, Sept. 2008, at 8.
213. Brinkman et al., *supra* note 72, at 6.
214. Mayer, *supra* note 45.
215. *See supra* Part IV.A.
216. Szabó et al., *supra* note 93, at 74.

competitive in those marketplaces, regardless of carbon pricing. Thus, analyses that forecast EU carbon leakage based on increased production in countries like China and India are misleading because such increases will occur regardless of EU emissions regulations.

VI. OTHER REASONS FOR CAUTION IN CREATING POLICIES TO ADDRESS CARBON LEAKAGE

A. Carbon Leakage Is Often Addressed with Unnecessarily Blunt Policies

The most common method of responding to carbon leakage has been to grant potentially affected industries free carbon emissions allowances, under the theory that these allowances will offset higher energy costs and/or enable these industries to more effectively compete with competitors abroad who have no emissions restrictions.[217] Indeed, this approach is under consideration in the EU. By December 2009, the European Commission will decide which industry sectors will be eligible for free emissions allowances based on guidelines announced in December 2008.[218] This will be followed by an analytical report to be delivered by the Commission to the European Parliament in June 2010, reflecting the impact of international climate change negotiations in Copenhagen.[219] The EU has promised free emissions allowances to industries and subsectors exposed to a significant risk of carbon leakage, provided that they adopt "the best technology available" to reduce emissions.[220] While many industries aspire to receive these free emission credits, it is unclear how many will qualify. The benchmarks for the required technological measures will initially be derived from the

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217. Stephen Gardner, *EU ETS: The Winners and Losers of EU Carbon Trading*, CLIMATECHANGECORP.COM, Sept. 22, 2008, http://www.climatechangecorp.com/content.asp?ContentID=5654.

218. EurActiv.com, 'Carbon Leakage': A Challenge for EU Industry (Jan. 27, 2009), http://www.euractiv.com/eu/climate-change/carbon-leakage-challenge-eu-industry/article-176591 [hereinafter EurActiv.com (Jan. 27, 2009)]; Memorandum from General Secretariat of the Council to Delegations of Energy and Climate Change (Dec. 12, 2008); European Comm'n, Carbon Leakage, http://ec.europa.eu/environment/climat/emission/carbon_en.htm (last visited Aug. 30, 2009); EurActiv.com, Commission Services Paper on Energy Intensive Industries Exposed to Significant Risk of Carbon Leakage: Approach Used and State of Play, http://www.euractiv.com/29/images/Comm%20paper%20carbon%20leakage%20180908_tcm29-175576.doc (last visited Aug. 30, 2009).

219. EurActiv.com (Jan. 27, 2009), *supra* note 218.

220. Memorandum from General Secretariat of the Council to Delegations of Energy and Climate Change, *supra* note 218.

average performance of the 10% most efficient installations in that industry.[221]

According to the recent European Council compromise, denounced by environmental groups,[222] the threshold for exposure to carbon leakage is that implementation of the next phase of EU ETS cause the industry's direct and indirect costs to rise by greater than 5%, and offshore imports into the EU combined with exports from the EU exceed 10% of the EU market size for that industry.[223] Industries facing a 30% cost increase or 30% of their market exposed to foreign competition may also qualify.[224] As of April 2009, only three industrial sectors had been identified that "are above 30% CO_2 cost with respect to" their Gross Value Add: Coke Oven Products, Cement, and Lime.[225] Meanwhile, only seven sectors get over 5% CO_2 cost due to indirect cost, such as increased electricity prices for the manufacture of paper, starches, and bricks, and the quarrying of limestone, gypsum, and chalk.[226] These allowances are to be provided regardless of any qualitative analysis indicating "market characteristics [that] could demonstrate a sector's ability to pass on the cost."[227]

In short, only industries facing much higher costs as a result of purchasing emission allowances, major international competition, or some combination of the two, will qualify for free emissions in response

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221. Damien Meadows, DG Environment, European Comm'n, The EU Emissions Trading System—A Driver for a Low-Carbon Economy, Address at the European Sustainable Energy Policy Seminar slide 7 (Apr. 28, 2009), *available at* http://www.inforse.org/europe/seminar09_BXL.htm.

222. EurActiv.com, Industry 'Encouraged' by EU Climate Deal (Dec. 16, 2008), http://www.euractiv.com/eu/climate_change/industry_encouraged_eu_climate_deal/article_178106; Joint Press Release, Friends of the Earth Europe et al., Shame on EU 'Leaders': Call on the European Parliament To Reject Today's Deal on Effort Sharing (Dec. 12, 2008).

223. Meadows, *supra* note 221, slide 8; *Auctioning Under Cap and Trade: Design, Participation and Distribution of Revenues: Hearing Before the S. Comm. On Finance*, 111th Cong. 10 (2009) (statement of Jos Delbeke, Deputy Director-General, Directorate General for Environment, European Commission) [hereinafter *Auctioning Under Cap and Trade*], *available at* http://www.finance.senate.gov/hearings/testimony/2009test/050709jdtest.pdf.

224. *Auctioning Under Cap and Trade*, *supra* note 223, at 10.

225. Marek Prezeor et al., Identifying Sectors Deemed To Be Exposed to a Significant Risk of Carbon Leakage: Direct CO2 Cost Calculation and Preliminary Results, Presentation of the European Commission, DG ENTR B.1, Ad Hoc Meeting of the ECCP Working Group in Emissions Trading on Carbon Leakage 12 (Brussels Apr. 29, 2009).

226. Marek Prezeor et al., Identifying Sectors Deemed To Be Exposed to a Significant Risk of Carbon Leakage: Indirect CO2 Cost Calculation and Preliminary Results, Presentation of European Commission, DG ENTR B.1, Ad Hoc Meeting of the ECCP Working Group in Emissions Trading on Carbon Leakage 9 (Brussels Apr. 29, 2009).

227. Report of the Ad-Hoc Stakeholders Meeting of the ECCP Working Group on ETS on Carbon Leakage and Benchmarking (Mar. 30, 2009), *available at* http://ec.europa.eu/environment/climat/emission/pdf/093003finrep.pdf.

to carbon leakage. Nonetheless, providing free emissions credits is a flawed approach because it fails to put a price on carbon.[228] As a result, companies and industries granted free allowances do not consider the cost of emissions in their own calculations and continue to fill the air with greenhouse gases, as if no emissions cap existed. In the case of the European utility industries, they generated "windfall profits" by selling the free allowances,[229] while the government loses revenue and "misallocate[es] . . . productive resources."[230] Likewise, econometric simulations of the EU cement industry suggest that the industry will use its market power to charge its customers for emissions, regardless its receipt of free credits, because these credits could otherwise be sold.[231]

Price signaling created by selling credits, by contrast, forces emitters to "internalize the cost of GHG emissions into the decision-making process of governments, corporations, and—eventually—individuals."[232] Such signaling is essential to "a desirable restructuring of the domestic economy toward less polluting activities."[233] Price signals create "incentives for the use and innovation of more carbon efficient technologies, and induces substitution towards lower carbon fuels, products and services by industry and final consumers."[234]

B. Carbon Leakage Will Only Occur If No Global Climate Deal Is Reached

It is essential to "factor in the impact of an international climate treaty expected to be adopted in Copenhagen" before addressing any prospective carbon leakage claims.[235] Such an agreement would blunt the criticism that producers in China, India, and elsewhere are succeeding

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228. *Green Groups, Academics Call for Increased Auctioning in EU ETS*, POINTCARBON NEWS, July 9, 2007, http://www.pointcarbon.com/news/1.257016.

229. *Id.*; Julia Reinaud, Trade, Competitiveness and Carbon Leakage: Challenges and Opportunities 12 (Energy, Environment and Development Programme Paper 09/01, 2009) (on file with Chatham House).

230. COMM'N ON SUSTAINABLE DEV., UNITED NATIONS, RESEARCH ON LINKAGES BETWEEN TRADE, ENVIRONMENT AND SUSTAINABLE DEVELOPMENT § II(A)(15) (1999), *available at* http://un.org/documents/ecosoc/ch17/1996/background/ech171996-bp22.htm.

231. Ponssard, *supra* note 112, at 1 (noting that EU cement firms "would take the CO_2 price as an opportunity cost" when calculating their pricing).

232. LABATT & WHITE, *supra* note 9, at 148.

233. Ottar Mæstad, *Allocation of Emission Permits with Leakage Through Capital Markets*, 29 RESOURCE & ENERGY ECON. 40, 42 (2007).

234. KARSTEN NEUHOFF, TACKLING CARBON: HOW TO PRICE CARBON FOR CLIMATE POLICY 5 (2008), *available at* http://www.eprg.group.cam.ac.uk/wp-content/uploads/2009/03/tackling-carbon_final_3009082.pdf.

235. ENDS Europe Daily, *supra* note 36.

solely due to unregulated emissions in their market. Less or "[n]o emissions leakage occurs with full international participation" in a new emissions reduction regime.[236] Several of the EU's largest trading partners for its emissions-intensive industries are Turkey, the United States, Norway, and Switzerland.[237] There is a significant possibility that some of these countries will ultimately take part in the EU ETS. For example, Turkey would be bound by the EU ETS if it succeeded in its quest to join the EU, while Switzerland and Norway may create a link with the EU ETS. Meanwhile, in the United States the Regional Greenhouse Gas Initiative and Western Climate Initiative are moving forward, as well as pending federal climate change legislation.[238]

Likewise, worldwide industry sectoral agreements need to be considered before concluding that leakage is inevitable.[239] For example, the World Steel Association reports that "[s]teel companies are committed to reduc[ing] CO_2 emissions per tonne of steel produced worldwide" and plans to have a more unified sector that "is supported by its members in both . . . developed and developing countries[,] including China, which accounts for nearly 50% of total steelmaking CO_2 emissions."[240] Such sectoral agreements have the potential to supersede the need for policymakers to develop a carbon leakage policy for that industry.

C. An Economic Slowdown Creates an Emissions Slowdown

As the world economy slows, there is scant need to open new manufacturing plants of any type, which should slow leakage considerably. For example, German utility company RWE announced that it will not build new coal and lignite-fired power plants in Western Europe "until power prices are high enough,"[241] due to the rules governing the European Union's carbon dioxide emissions trading scheme. Even China, the epicenter of world production, has reduced its

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236. Christa S. Clapp, OECD Environment Directorate Presentation at OECD Side Event at UNFCCC, Addressing Carbon Leakage Concerns: Recent US Analysis 5, 9 (Apr. 7, 2009).

237. Dröge, *supra* note 51, at 22.

238. *See* Darren Samuelsohn, *Boxer, Kerry Set To Introduce Climate Bill in Senate*, N.Y. TIMES, Sept. 28, 2009, www.nytimes.com/cwire/2009/09/28/28climatewire-boxer-kerry-set-to-introduce-climate-bill-in-43844.html.

239. Reinaud, *supra* note 229, at 17-18.

240. WORLD STEEL ASS'N, *supra* note 40, at 10.

241. *RWE: No New Coal Plants in Western Europe, Looks East*, POWER ENGINEERING INT'L, Jan. 21, 2009, *available at* http://pepei.pennnet.com/articles/Online_SubCategory.cfm (search "no new coal plants").

output, with "energy-intensive industry [hit] harder than the rest of the economy."[242] Some observers hope the recession "could buy enough time until solar [energy] matures" and less emissions-intensive production methods are perfected.[243]

VII. CONCLUSION

While many EU industries claim immediate or imminent threat from carbon leakage, policymakers need to apply careful scrutiny before addressing this issue for several reasons. First, many of these industries are not subject to true international competition, because offshore products are expensive to transport to and within the EU and other barriers to entry will reduce foreign competition. Second, new energy efficiency and carbon abatement technologies may enable EU manufacturers to compete cost effectively in the world market while still reducing their emissions. Third, moving industrial plants from the EU to developing countries like China or India may not increase, and could possibly decrease, carbon emissions because many plants in these countries are new and incorporate the latest energy efficiency technology. Lastly, responding to potential carbon leakage by providing free emissions allowances disincentivizes the development of emissions abatement technologies and potentially harms the development of cleaner industries by depriving them of capital.

242. FORBES.COM, *supra* note 202.
243. Grunwald, *supra* note 187.