MEASURING OUR INVESTMENT IN THE CARBON STATUS QUO: CASE STUDY OF NEW OIL DEVELOPMENT IN THE RUSSIAN ARCTIC

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INTRODUCTION

For thirty years, climate change has played an ever-increasing role in the public policy agenda. If we are to separate climate change talk from the actual carbon emissions data, an unpleasant picture emerges: greenhouse gas (GHG) emissions continue to rise. From 1990 to 2005, global GHG emissions grew by 26%.[1] Carbon dioxide emissions increased by 31%

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1. U.S. ENVTL. PROT. AGENCY, GREENHOUSE GASES 13 (2010), *available at* http://www.epa.gov/climatechange/indicators/pdfs/CI-greenhouse-gases.pdf.

during the same period.[2] The rise in CO_2 emissions is especially noteworthy because they constitute 77% of all GHGs.[3] Energy-related CO_2 emissions, which provide the greatest contribution—65% of all global anthropogenic GHG emissions[4]—have increased globally by over 40% between 1990 and 2008.[5]

To date, the effort to mitigate climate change has largely focused on reducing the demand for fossil fuels by targeting carbon emissions.[6] This approach, which served as the foundation for essentially every carbon reduction scheme from the Kyoto Protocol to Germany's environmental tax reform, has been based on seemingly solid logic: reduction in demand (i.e., CO_2 emissions) will lead to a reduction in supply (i.e., fossil fuels). Unfortunately, this approach, when applied, has significant flaws. The logic behind it only works if carbon emission controls are truly universal. Otherwise, fossil fuels, no matter where extracted, will find their way to a country where they can be "converted" into CO_2 without any constraint imposed by law. To remedy this monumental flaw, more than 190 nations at the COP17 meeting in Durban, South Africa agreed to begin the process for creating a new climate agreement that adopts universal controls.[7]

A failure to reconcile fossil fuel production, including oil production, with the impact of the extracted fossil fuels on climate change may put the new climate agreement in jeopardy. The carbon emissions curve follows the global increase in production of oil and other fossil fuels.[8] In the case of oil, this should not come as a surprise—almost all extracted crude ends up in

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2. *Id.*

3. Tim Herzog, *World Greenhouse Gas Emissions in 2005* (World Res. Inst., Working Paper, 2000), *available at* http://pdf.wri.org/working_papers/world_greenhouse_gas_emissions_2005.pdf.

4. INT'L ENERGY AGENCY, CO_2 EMISSIONS FROM FUEL COMBUSTION: HIGHLIGHTS 17 (2010), *available at* http://www.energyconf.ir/pdf/7.pdf.

5. *International Energy Statistics*, *Total Carbon Dioxide Emissions from the Consumption of Energy (Million Metric Tons)*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=90&pid=44&aid=8&cid=ww,&syid=1990&eyid=2008&unit=MMTCD (last visited Apr. 12, 2012).

6. Roman Sidortsov, *Creating Arctic Carbon Lock-In: Case Study of New Oil Production Development in the South Kara Sea*, 6 CARBON AND CLIMATE L. REV. 1/ 2012 (forthcoming Apr. 2012) (manuscript at 5) (on file with author).

7. United Nations Framework Convention on Climate Change, Durban, South Africa, Nov. 28, 2011–Dec. 9, 2011, *Establishment of an Ad Hoc Working Group on the Durban Platform for Enhanced Action*, Draft Decision -/CMP.17, preamble, *available at http://unfccc.int/files/meetings/durban_nov_2011/decisions/application/pdf/cop17_durbanplatform.pdf.*

8. Global primary energy supply increased by 39.9% from 349.86 quadrillion Btu in 1990 to 489.49 quadrillion Btu in 2008. *International Energy Statistics*, *Total Primary Energy Production (Quadrillion Btu)*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=44&pid=44&aid=1&cid=ww,&syid=1990&eyid=2008&unit=QBTU (last visited Apr. 12, 2012).

internal combustion engines and, eventually, in the atmosphere in the form of GHGs.[9] The status quo is unlikely to change as long as oil remains the backbone of the world's economy.[10] In fact, according to several forecasts, oil demand and, thus, production will be on the rise for several decades.[11] Significant financial investments will be required to accommodate this trend.[12] Investments in oil production are often heralded as the means of achieving important and even noble goals, such as providing jobs and ensuring energy independence.[13] However, there is another dimension of investing in seismic studies and productions platforms—every dollar creates a financial incentive for keeping the economy's carbon content high and GHG emissions steady. This financial "rut," known in literature as "carbon lock-in," sets the course for a painful collision between the chosen economic path and the reality of climate change that is already too dangerous to ignore.[14]

Offshore oil development in the Russian Arctic serves as a perfect case study for this paper. Largely undeveloped Arctic oil and gas resources make the region the world's last energy frontier.[15] Exploration and exploitation of these resources will require massive financial investments and extensive development of supporting infrastructure.[16] Therefore, development of

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9. *See infra* pp. 23–24.

10. For example, petroleum accounts for 37% of energy consumption in the United States (U.S.). U.S. ENERGY INFO. ADMIN., INTERNATIONAL ENERGY OUTLOOK 2011, at 1, 205.254.135.7/forecasts/ieo/pdf/0484(2011).pdf.

11. *See, e.g.,* INT'L ENERGY AGENCY, WORLD ENERGY OUTLOOK 444 (2010); EXXONMOBIL, THE OUTLOOK FOR ENERGY: A VIEW TO 2040, at 42 (2012), *available at* http://www.exxonmobil.com/corporate/files/news_pub_eo.pdf (projecting that global demand for liquid fuels will increase almost 30% over the next 30 years); SHELL INT'L, SHELL ENERGY SCENARIOS TO 2050, at 8 (2008), *available at* http://www-static.shell.com/static/public/downloads/brochures/corporate_pkg/scenarios/shell_energy_scenarios_2050.pdf.

12. INT'L ENERGY AGENCY, *supra* note 11, at 444.

13. Nick Snow, *Oil, Gas Created 9% of New US Jobs in 2011, WEF Report Notes,* OIL & GAS J., Mar. 8, 2012, http://www.ogj.com/articles/2012/03/oil-gas-created-9-of-new-us-jobs-in-2011-wef-report-notes.html?cmpid=EnlDailyMarch82012.

14. Sidortsov, *supra* note 6 (manuscript at 10–11).

15. Pursuant to a U.S. Geological Survey (USGS) report, the Arctic holds 412,157.09 million barrels of oil equivalent (boe). KENNETH BIRD ET AL., U. S. GEOLOGICAL SURVEY, CIRCUM-ARCTIC RESOURCE APPRAISAL: ESTIMATES OF UNDISCOVERED OIL AND GAS NORTH OF THE ARCTIC CIRCLE, 4 (2008), *available at* http://pubs.usgs.gov/fs/2008/3049/fs2008-3049.pdf. These resources constitute 13% of the planet's undiscovered oil, 30% of its undiscovered natural gas, and 20% of its undiscovered natural gas liquids. *See* PHILIP BUDZIK, ENERGY INFO. ADMIN. ARCTIC OIL AND NATURAL GAS POTENTIAL 6 (2009), *available at* http://www.eia.gov/oiaf/analysispaper/arctic/pdf/arctic_oil.pdf (describing the large undiscovered natural resource potential of the Arctic).

16. According to Russian leadership, the alliance between ExxonMobil and Rosneft to explore deposits in the South Kara and Black Seas may lead to a total investment of $500 billion. Yuriy Humber

Russian Arctic oil fields will have considerable geo-political, socio-economic, and climate change implications.

This paper focuses on a proposed stock-swap deal between British Petroleum (BP), the British oil supermajor, and Rosneft, the Russian oil champion, to jointly develop a vast area covering 125,000 square kilometers in the South Kara Sea.[17] The announcement of the BP-Rosneft deal represented, according to many, the commencement of exploration of the last energy frontier.[18] When the parties failed to close the agreement and Exxon took over as the Rosneft's partner in August 2011, BP became a subject of severe criticism by some business media outlets.[19] Such publications described the British oil giant's failure to enter the Russian Arctic in words usually reserved to significant misfortunes.[20]

This paper questions this rather one-sided point of view and suggests that BP's stakeholders may be better off not joining the economically and environmentally questionable Arctic venture. The overarching goal of this paper is to introduce a decision-making tool that helps to support the aforementioned challenge by quantifying an investment's dependence on carbon emissions. The proposed decision-making tool, Carbon Dependence of Investment (CDI), calculates carbon emissions that need to be emitted over a period of time to avoid economic loss. The first section of this paper explores the proposed climate change mitigation controls that target fossil

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& Stephen Bierman, *Exxon Confident of Right to Book Russian Arctic Oil Reserves,* BLOOMBERG (Sep. 27, 2011, 7:18 AM), http://www.bloomberg.com/news/2011-09-27/exxon-confident-it-can-book-oil-reserves-in-russian-arctic.html. Given the size of the South Kara Sea deposits, it is reasonable to assume that the lion's share of this amount will be spent on developing Arctic fields. *Arkticheskie Morya Rossii [Russian Arctic Seas]*, ROSNEFT, http://www.rosneft.ru/Upstream/Exploration/arctic_seas/ (last visited Apr. 9, 2012).

17. Stephen Foley, *Russian State Oil Giant Take $7.8bn Stake in BP*, THE INDEPENDENT (Jan. 15, 2011), http://www.independent.co.uk/news/business/news/russian-state-oil-giant-takes-78bn-stake-in-bp-2185228.html.

18. Foley, *supra* note 17. The South Kara Sea project is not the first attempt to explore hydrocarbon resources in the Arctic. For example, Statoil and Eni are currently developing the Goliat oil field in the Barents Sea (The field is projected to go onstream in November 2013). *Norway*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/countries/cab.cfm?fips=NO (last updated Aug. 2011). Another example is the Prirazlomnoe oil field in the Pechora Sea. First discovered in 1989, it is scheduled to start commercial production in 2012. *Prirazlomnoye Oil Field*, GAZPROM, http://www.gazprom.com/about/production/projects/deposits/pnm/ (last visited Apr. 9, 2012).

19. Jonathan Sibun, *Blow for BP as Rosneft, Exxon Mobil Sign Arctic Oil Deal*, THE TELEGRAPH (Aug. 30, 2011), http://www.telegraph.co.uk/finance/newsbysector/energy/oilandgas/8731228/Blow-for-BP-as-Rosneft-Exxon-Mobil-sign-Arctic-oil-deal.html; Guy Chazan, *Exxon's Arctic Deal Is Black Eye for BP*, WALL ST. J. (Aug. 31, 2011), http://online.wsj.com/article/SB10001424053111903352704576540702267428180.html.

20. Sibun, *supra* note 19; Chazan, *supra* note 19.

fuel production. The second section explains why targeted transparency (disclosure) may be the most effective form for such controls. The third part of this paper introduces CDI. In particular, this section contrasts CDI with the total emissions analysis, describes the temporal aspect of the CDI analysis, and describes differences between CDI and other "carbon assessment" tools. The fourth part of the paper identifies possible applications of CDI disclosure and potential challenges of CDI implementation.

I. EXISTING CLIMATE CHANGE MITIGATION PROPOSALS TARGETING FOSSIL FUEL PRODUCTION.

As mentioned above, the global climate regime is currently in a position to ensure that CO_2 concentration remains at 450 ppm. Thus, until the international community adopts universal controls or comes up with an alternative or complementary approach, it is very likely that global GHG emissions, including energy-related emissions, will continue to rise steadily. Harnessing the climate change problem at the point of fossil fuel production should be on policymakers' radars because it compensates for the lack of universal control on global emissions.

Unfortunately, the best-known policy proposals that focus on limiting fossil fuel production suffer from the same problem as the current climate change regime—political feasibility. "[R]emaining fossil fuel reserves should not be exploited without a plan for retrieval and disposal of resulting atmospheric CO_2," concluded a group of scientists lead by James Hansen in a paper entitled *Target Atmospheric CO_2: Where Should Humanity Aim?*[21] The authors of *Cap & Share: A Fair Way to Cut Greenhouse Emissions* turned the statement into an epithet for their alternative to the Kyoto regime.[22] According to the proposal, all global emissions should be capped on an annual basis.[23] National caps would be determined based on the population of each country.[24] "National carbon protection trusts," national agencies responsible for domestic implementation of Cap and Share, would distribute individual permits or pollution authorization permits (PAPs) to all

21. JAMES HANSEN ET AL., TARGET ATMOSPHERIC CO2: WHERE SHOULD HUMANITY AIM? 13 (2008), *available at* http://www.columbia.edu/~jeh1/2008/TargetCO2_20080407.pdf.

22. FOUND. FOR ECON. OF SUSTAINABILITY, CAP & SHARE, A FAIR WAY TO CUT GREENHOUSE EMISSIONS 2 (May 2008), *available at* http://www.feasta.org/documents/energy/Cap-and-Share-May08.pdf [hereinafter CAP & SHARE].

23. CAP & SHARE, *supra* note 22, at 6.

24. CAP & SHARE, *supra* note 22, at 6.

adults.[25] People will then sell their PAPs to authorized financial institutions at a current market rate.[26] The institutions will resell PAPs to fossil fuel producers.[27] The producers will then be allowed to produce and sell fossil fuels pursuant to the emissions quota derived from the PAPs they purchased.[28]

A similar Cap and Dividend proposal is also based on an upstream cap, effectively limiting fossil fuel supply.[29] Under the Cap and Dividend proposal, the pollution permits would be auctioned directly to fossil fuel producers.[30] The producers will then be required to return the proceeds from the auction through a non-profit trust to individuals.[31] Cap and Dividend proponents claim that their system is efficient and would not require a large bureaucracy.[32] Kyoto2 is another upstream cap-based proposal.[33] Unlike Cap and Share and Cap and Dividend, this proposal also includes controlling emissions that are "close" to the point of production (e.g., cement plants).[34] Kyoto2 proposes distributing pollution permits at a global auction and using direct regulation when the market mechanisms fail or "create unnecessary cost."[35]

Oliver Tickell, the author of Kyoto2, pointed to the success of the Montreal Protocol at combining market mechanisms and direct regulation in the leaflet *Kyoto2 in a Nutshell*, distributed to participants of the UNFCCC meeting in Poznan, Poland.[36] Other climate strategies have looked at the Montreal Protocol for ideas as well. For example, in *Boiling Point*, Ross Gelbspan suggests taking the Montreal protocol model as the blueprint for the post-Kyoto climate regime.[37] In particular, he points at the role that the industry played to reduce CFC concentration in the

25. CAP & SHARE, *supra* note 22, at 6.
26. CAP & SHARE, *supra* note 22, at 6.
27. CAP & SHARE, *supra* note 22, at 7.
28. CAP & SHARE, *supra* note 22, at 7.
29. *How Cap and Dividend Works*, CAPANDDIVIDEND, http://www.capanddividend.org/?q=readfirst (last visited Apr. 9, 2012) [hereinafter CAPANDDIVIDEND].
30. CAPANDDIVIDEND, *supra* note 29.
31. CAPANDDIVIDEND, *supra* note 29.
32. CAPANDDIVIDEND, *supra* note 29.
33. *Kyoto2 Summary*, KYOTO2.ORG, http://www.kyoto2.org/page5.html (last visited Apr. 9, 2012).
34. KYOTO2.ORG, *supra* note 33.
35. OLIVER TRICKEL, KYOTO2.ORG, HOW TO MANAGE THE GLOBAL GREENHOUSE (no date), *available at* http://www.kyoto2.org/docs/kyoto2_leaflet_complete.pdf.
36. TRICKEL, *supra* note 35.
37. ROSS GELBSPAN, BOILING POINT: HOW POLITICIANS, BIG OIL AND COAL, JOURNALISTS, AND ACTIVISTS HAVE FUELED A CLIMATE CRISIS—AND WHAT WE CAN DO TO AVERT DISASTER 192, 194 (2004).

atmosphere.[38] It is a widely-shared point of view that the Montreal protocol happened largely because chemical companies who produced ozone-depleting chemicals had a technological solution to replace CFCs.[39] Thus, in Gelbspan's view, the way out of the climate gridlock is to turn to fossil fuel producers and oil companies and make them part of the de-carbonization solution.[40]

Although the reviewed proposals represent a measureable departure from the current climate regime in terms of substance, methodologically they are very similar. First, the reviewed proposals are based on the global problem/global solution approach that would require some kind of international consensus. Even if one of the proposed schemes becomes part of the new climate agreement, we will not see it come into force until 2020. Meanwhile, the decisions to develop Arctic oil fields are being made right now. Second, the proposals are built on the following types of government intervention: direct regulation, market-based mechanisms, or a combination of the two. Adoption of new regulations or market-based mechanisms (e.g., taxes) often becomes a politically charged issue domestically. Therefore, ratification of an international agreement that is based on these forms of governmental intervention may become a difficult hurdle to clear. Third, all three proposals require a new bureaucracy to implement and enforce the new rules. This will take time and financial resources that even some developed countries do not have.

The authors of the proposals argue that their models will work because they are simpler, more equitable, and more efficient than the current regime.[41] These claims may all be true regarding the substantive qualities of the proposals. However, these qualities do not necessarily make the proposals politically feasible. It is likely that any attempt to restrict a country's right to exploit its natural resources,[42] as authors of *Cap & Share* fully acknowledge, will be met with significant resistance, especially from fossil fuel exporting countries.[43] Because of this, the proposals would likely result in the same political gridlock they try to avoid.

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38. *Id.* at 192.

39. DAVID HUNTER ET AL., INTERNATIONAL ENVIRONMENTAL LAW 583 (3d ed. 2007).

40. GELBSPAN, *supra* note 37, at 192–93.

41. FOUND. FOR ECON. OF SUSTAINABILITY, *supra* note 22, at 3.

42. United Nations Conference on the Human Environment, Stockholm, Swed., June 5–16 1972, *Stockholm Declaration on the Human Environment*, U.N. Doc. A/Conf.48/14/Rev. 1 (June 16, 1972).

43. Cap & Share authors acknowledge this in the following passage: "The C&S proposal to share the scarcity rent fairly amongst the world's entire population is likely to provoke a hostile reaction from the fossil fuel producing companies and countries. And, since oil production is becoming

II. DISCLOSURE: WHY THE FORM MATTERS.

Considering the strength of global climate gridlock, policymakers need to find a solution that is not only theoretically effective, but also politically feasible. Currently, political feasibility may be the most important feature of a climate change policy tool. As noted above, several theoretically sound models exist for mitigating climate change. Some researchers assert that no technological breakthrough is needed to prevent a climate change meltdown as carbon emissions can be halted with existing technology.[44] Thus, finding the form of government intervention capable of overcoming the lack of political will is as important as the substance of the model. I thus propose using disclosure, or targeted transparency, as a methodology for designing a climate control mechanism that focuses on fossil fuel production.

A. Disclosure as a Policy Instrument.

As mentioned above, government intervention comes in the form of direct regulation (e.g., standards), market-based mechanisms (e.g., tax incentives, cap-and-trade schemes, etc.), and targeted transparency.[45] Theoretically, direct regulation guarantees the highest certainty in reaching a regulatory goal.[46] A firm has little choice but to comply with a specific target (standard) that the government sets because suspending operations or paying a significant penalty leaves no or very little room for alternative behavior.[47] Market-based mechanisms, despite sending a clear regulatory signal, do not provide the same level of certainty that direct regulation does.[48] For example, in a "classic" cap-and-trade scheme, a firm has a choice of whether to improve its technology and reduce emissions or to purchase more permits. Targeted transparency guarantees achieving the

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increasingly concentrated in a few countries (Saudi Arabia and Russia alone are responsible for 18% of world oil exports) and only three countries—Russia, Iran and Qatar—have 58% of the world's gas reserves, the producers do have a strong hand particularly as the recent high prices have left many of them flush with funds." FOUND. FOR ECON. OF SUSTAINABILITY, *supra* note 22, at 17.

44. A study by Stanford researcher Mark Z. Jacobson and UC-Davis researcher Mark A. Delucchi concluded that the world's energy mix can be fossil-fuel free in 20–40 years by using technology available now. Lois Bergeron, *The World Can Be Powered by Alternative Energy, Using Today's Technology, in 20-40 Years, Says Stanford Researcher Mark Z. Jacobson*, STANFORD REPORT (Jan. 26, 2011), http://news.stanford.edu/news/2011/january/jacobson-world-energy-012611.html.

45. ARCHON FUNG ET AL., FULL DISCLOSURE: THE PERILS AND PROMISE OF TRANSPARENCY 46 (2007).

46. *See id.* at 48 (explaining that direct regulation stipulates clear standards and leaves little room for industry discretion).

47. *Id.* at 47–48.

48. *Id.* at 48.

regulatory goal to an even lesser extent.[49] Regulators usually have some idea of how people will respond to the disclosed information (e.g., people are likely to buy the stock of a more carbon-neutral oil company).[50] However, the reactions or "the ability of disclosers to perceive those reactions" are not guaranteed because, at the end of the day, people may care more about money than the environment.[51]

A legitimate question arises: why should we even bother with disclosure? To answer this question, I will turn to the benefits of targeted transparency vis-a-vis the direct regulation and market-based instruments. Archon Fung, Mary Graham, and David Weil, the authors of *Full Disclosure: The Perils and Promise of Transparency*, describe targeted transparency as follows:

> Instead of aiming to generally improve public deliberation and official's accountability, targeted transparency aims to reduce specific risks or performance problems through selective disclosure by corporations and other organizations. The ingeniousness of targeted transparency lies in its mobilization of individual choice, market forces, and participatory democracy through relatively light-handed government action.[52]

Targeted transparency has a wider set of pathways to achieve a desired objective.[53] Direct regulation and market-based mechanisms operate via economic pathways.[54] For example, suspension of further operations or a high penalty assessed against a firm will likely result in economic loss to its owners.[55] Similarly, a firm may choose to improve energy efficiency of its building because of the economic incentives in the form of a tax credit. In addition to economic pathways, targeted transparency employs political pathways.[56] Political pathways are especially important in our case because they create political power to push the "regulatory envelope." For example, information about the impact of emissions "exported" by oil companies

49. *Id.* at 48–49.
50. *Id.* at 48.
51. *Id.*
52. *Id.* at 5.
53. *Id.* at 47.
54. *Id.*
55. *Id.*
56. *See id.* at 47 (explaining that standard and market-based regulations are largely economic and that targeted transparency employs political pathways as well).

may prompt voters to advocate for extending the reach of a carbon cap to the emissions that are yet to be released from fossil fuels.

The combination of public pressure and low degree of government intervention make targeted transparency a politically feasible solution. When Congress considered domestic climate legislation in 2007, Mary Graham and Elena Fagotto, both from Harvard's Transparency Policy Project, noted that: "A transparency requirement could break the political logjam that has held up climate change legislation in Congress. Transparency often has broad appeal to both Democrats and Republicans because it empowers ordinary citizens, strengthens market mechanisms, and allows executives to choose what actions to take in response."[57] We will never find out whether Ms. Graham and Ms. Fagotto were right, as Congress never considered a climate change bill based on targeted transparency. However, the attempt to adopt the largely market-based Waxman-Markey policy failed as the composition of Congress changed after the mid-term elections in 2010.[58]

Strong indicators exist as to why people will respond to the disclosed climate related information. According to Gallup public opinion polls, more than half the population in developed countries believes that global warming is a serious threat.[59] Figures from other polls indicate that the number of concerned people is even higher.[60] For example, according to a Yale and George Mason University study conducted in 2009 and 2010, 61% of Americans believe that global warming is real.[61] More importantly, 65% of Americans support signing a global treaty that would require the United States to reduce its emissions by 90% by 2050.[62] What is even more encouraging for this case study is the fact that 83% of Britons view climate

57. Elena Fagotto & Mary Graham, *Full Disclosure: Using Transparency to Fight Climate Change*, ISSUES IN SCI. & TECH. (2007), http://www.issues.org/23.4/fagotto.html.

58. *See H.R. 2454 (111th): American Clean Energy and Security Act of 2009*, GOVTRACK.US, http://www.govtrack.us/congress/bills/111/hr2454 (last visited Apr. 12, 2012) (providing an overview of ACES major provisions and procedural history).

59. Anita Pugliese & Julie Ray, *Fewer Americans, Europeans View Global Warming as a Threat*, GALLUP (Apr. 20, 2011), http://www.gallup.com/poll/147203/Fewer-Americans-Europeans-View-Global-Warming-Threat.aspx. The focus is on the figures from developed countries because the proposed disclosure is aimed at the investors from these countries.

60. Lee Dye, Op-Ed., *Global Warming and the Pollsters: Who's Right?,* ABC NEWS (June 16, 2010), http://abcnews.go.com/Technology/DyeHard/global-warming-polls-climate-change/story?id=10921583.

61. Dye*, supra* note 60; In the Gallup poll, 53% of Americans indicated that global warming represented "a serious threat to them and their families." Pugliese & Ray, *supra* note 59.

62. Dye, *supra* note 60.

change as a "current and imminent threat."[63] A Guardian/ICM poll published in January 2011 showed little change in public opinion from August 2009.[64] Remarkably, "Climategate" of 2009 and two uncharacteristically cold winters in 2009 and 2010 made no difference in how Britons feel about the most serious environmental problem of our times.[65]

The climate marketing campaigns of oil majors offer further evidence of the connection between people's thoughts on climate change and their behavioral responses.[66] The "last bastion" of open opposition to climate change fell in 2007 when Exxon Mobil softened its stance on the issue.[67] Now all oil majors recognize the threat of global climate change and even offer solutions to the problem.[68] Regardless of whether the climate change material of these marketing campaigns reflects a real effort to combat climate change or the effort to please the customers, it ultimately underscores the fact that people care about the issue.

Despite a higher level of uncertainty as to its outcome, disclosure offers two great advantages: light government intervention and opportunity to create the much-needed political will. Both factors make disclosure a

63. Damian Carrington, *Public Belief in Climate Change Weathers Storm, Poll Shows*, THE GUARDIAN (Jan. 31, 2011, 9:03 AM), http://www.guardian.co.U.K./environment/2011/jan/31/public-belief-climate-change.

64. Carrington, *supra* note 63.

65. Carrington, *supra* note 63.

66. JACQUELINE WEAVER, THE FUTURE OF THE PETROLEUM INDUSTRY IN A WORLD OF GLOBAL WARMING: TO 2030 AND BEYOND (2009), *available at* http://www.pesa.org/site_uploads/publications/PESA_2009_Weaver.pdf.

67. Rick Piltz, *Exxon Mobil Takes First Steps to Accept Climate Change Science and Cut Funding of the Denial Machine*, CLIMATE SCIENCE WATCH (Jan. 22, 2007), http://www.climatesciencewatch.org/2007/01/22/exxon-mobil-takes-first-steps-to-accept-climate-change-science-and-cut-funding-of-the-denial-machine.

68. *Climate Change*, CHEVRON, http://www.chevron.com/globalissues/climatechange/ (last visited Apr. 12, 2012); *Climate Change*, SHELL, http://www.shell.com/home/content/environment_society/environment/climate_change/ (last visited Apr. 12, 2012); *Climate Change*, BP, http://www.bp.com/sectiongenericarticle800.do?categoryId=9036321&contentId=7067103 (last visited Apr. 12, 2012); *Managing Climate Change Risks*, EXXONMOBIL, http://www.exxonmobil.com/Corporate/safety_climate.aspx (last visited Apr. 12, 2012); *Energy and Climate*, TOTAL, http://www.total.com/en/our-challenges/preserving-the-environment/combating-climate-change/energy-and-climate-201004.html (last visited Apr. 12, 2012); *Climate Change*, CONOCOPHILLIPS, http://www.conocophillips.com/EN/susdev/environment/climatechange/Pages/index.aspx (last visited Apr. 12, 2012). BP, Chevron, ExxonMobil, Royal Dutch Shell, and Total S.A. are generally considered "supermajors." However, some add ConocoPhillips to this category as well. *Supermajors-Largest Oil Companies*, OILPRICES.ORG, http://www.oilprices.org/largest-oil-companies.html (last visited Apr. 19, 2012).

politically feasible form for designing a climate control mechanism that focuses on fossil fuel production. A switch from direct regulation to disclosure may shift the public rhetoric from "excessive regulation kills private companies" to "what are oil companies hiding" while keeping the target (e.g., oil production) constant. And this shift might be enough to prevent nations from making economically and environmentally unsound decisions.

B. Why the Existing Information Is Not Enough.

"We already know what oil companies do—they produce oil, what else is there to know?" This was a typical comment that a few people made in response to this study. The response exemplifies what is known in the literature as "imperfections of real-world information."[69] As it is unwise to judge a book by its cover, it is also unwise to judge the true contribution of an oil company to climate change by the mere fact that it is an oil company, or by what the company says in its advertising materials or even financial reports. The latter seldom include information about the emissions to which the company contributed by providing its customers with the "fuel to burn." The emission information that the marketing materials and financial reports provide includes emissions from production, refining, and/or transportation operations. This information hardly reflects a company's real impact on climate change, as the "total" emissions data may exceed the reported data by as much as fifteen times.[70] Similarly, not all oil companies may be the same, as some are more serious than others about diversifying their business model and gradually reducing their oil output and, thus, "total" emissions. The currently available information about oil exploration and extraction is not sufficient to create a picture of the effect of these operations on climate change. The ensuing discussion highlights the deficiency of the real-world information and calls for the disclosure that sets mandatory reporting requirements for all actors in the sector.

Information conveyed in BP's "Beyond Petroleum" advertising materials and the company's financial reports serve as good examples of imperfect real-world information.[71] "'Beyond petroleum' sums up our brand in the most succinct and focused way possible. It's both what we stand for

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69. FUNG ET AL., *supra* note 45, at 31.

70. *See infra* pp. 17–20.

71. *Beyond Petroleum*, BP, http://www.bp.com/sectiongenericarticle.do?categoryId=9038318&contentId=7019491 (last visited Apr. 12, 2012).

and a practical description of what we do," states BP on its website.[72] BP defines the substance of its "Beyond Petroleum" corporate brand in the following three-prong explanation of its activities:

- exploring, developing and producing more fossil fuel resources to meet growing demand
- manufacturing, processing and delivering better, more advanced products
- enabling the material transition to a lower carbon future.[73]

It appears that producing more fossil fuels serves as the focus of BP's activities, and "better, more advanced products" to "satisfy growing demand," thereby laying the foundation for transitioning to "a lower carbon future."[74] Although this statement defies the rules of logic (prongs one and three directly contradict each other), the statement contains key words appealing for environmentally conscious, as well as "traditional," investors.

Perhaps the "devil" is in details. BP proudly notes a $5 billion investment (since 2005) in renewable energy, as well as its commitment to invest up to $8 billion by 2015.[75] The section of BP's site dedicated to alternative energy is impressive as well.[76] It provides detailed information about BP's clean energy programs, including biofuels, wind, solar, hydrogen power, and carbon capture and sequestration, as well as BP's venture capital arm that finances "early and growth stage [cleantech] companies around the world."[77]

In its annual report, BP discloses its GHG emissions and risks to its operations due to the physical consequences of climate change.[78] BP also

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72. BP, *supra* note 71.
73. BP, *supra* note 71.
74. BP, *supra* note 71.
75. *Annual reporting 2011*, BP, http://www.bp.com/sectionbodycopy.do?categoryId=9039423&contentId=7072266 (last visited Apr. 9, 2012).
76. *Alternative Energy*, BP, http://www.bp.com/modularhome.do?categoryId=7040&contentId=7051376 (last visited Apr. 9, 2012).
77. *AE Ventures*, BP, http://www.bp.com/productlanding.do?categoryId=9025020&contentId=7065292 (last visited Mar. 30, 2012).
78. BP P.L.C., ANNUAL REPORT AND FORM 20-F 2010 72 (2011), *available at* http://www.bp.com/assets/bp_internet/globalbp/globalbp_uk_english/set_branch/STAGING/common_assets/downloads/pdf/BP_Annual_Report_and_Form_20F.pdf. [hereinafter BP ANNUAL REPORT 2010].

provides a thorough summary of existing and pending legislative and regulatory GHG controls and their potential effect on the company's operations.[79] BP recognizes potential drawbacks of carbon controls but reiterates its commitment to transitioning to a low-carbon economy in the following statement:

> **Climate change and carbon pricing – climate change and carbon pricing policies could result in higher costs and reduction in future revenue and strategic growth opportunities.**
>
> Compliance with changes in laws, regulations and obligations relating to climate change could result in substantial capital expenditure, taxes, reduced profitability from changes in operating costs, and revenue generation and strategic growth opportunities being impacted. Our commitment to the transition to a lower-carbon economy may create expectations for our activities, and the level of participation in alternative energies carries reputational, economic and technology risks.[80]

BP creates the appearance of providing a comprehensive position on climate change. The company reports its direct GHG emissions, and describes its climate change policy and steps taken in its furtherance. As a result, BP has been regarded as a proactive, transparent, and responsible company in terms of climate change.[81] According to public polls, consumers found BP the "greenest" oil company in 2006.[82] The company's sales increased from $192 billion to $266 billion between 2004 and 2006.[83] There is no firm evidence suggesting that the increase in sales was strictly due to the campaign. However, given the fact that "Beyond Petroleum" was getting significant public attention during this time period, it is reasonable

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79. BP ANNUAL REPORT 2010, *supra* note 78 at 78–81.

80. *BP P.L.C. Annual Financial Report–DTR 6.3.5 Disclosure*, 4-TRADERS (Mar. 6, 2012), http://www.4-traders.com/BP-PLC-9590188/news/BP-PLC-Annual-Financial-Report-14200324/.

81. Ingvild Sæverud & Jon Birger Skjærseth, *Oil Companies and Climate Change: Inconsistencies Between Strategy Formulation and Implementation?*, 7 GLOBAL ENVTL. POL. 42, 42–43 (2007) (explaining that BP is one of the few energy companies with significant measures and investments in activities that can reduce GHG emissions), *available at* http://www.fni.no/doc&pdf/ins_jbs_gep_2007.pdf; *"Beyond Petroleum" Pays Off for BP*, ENVTL. LEADER (Jan. 15, 2008), http://www.environmentalleader.com/2008/01/15/beyond-petroleum-pays-off-for-bp/.

82. *"Beyond Petroleum" Pays Off for BP*, *supra* note 81.

83. *"Beyond Petroleum" Pays Off for BP*, *supra* note 81.

to conclude that the campaign at least contributed to the company's commercial success.

Unfortunately, the disclosed carbon emission information represents a small fraction of BP's current contribution to climate change. BP estimated that in 2004, consumption (combustion) of its products resulted in 1,376 Mt in CO_2 equivalent.[84] In the same year, BP's direct and indirect[85] emissions amounted to 91.6 Mt of CO_2 equivalent.[86] Thus, BP's "own" emissions constituted only 6.2% of the company's "total" emissions.

Given the company's strategy of selling mature assets and aggressively investing in new oil production to "meet growing demand," BP's total future emissions presumably will increase. Accordingly, the increase in emissions due to the increase in production may outweigh the gains from investment in green technologies in terms of the overall effect on climate change.[87] Thus, the credibility and logic of the following BP statement appears to be questionable:

> We will also continue to respond to climate change, and to the prospect of fossil fuels becoming a smaller part of the energy mix. For these reasons, BP must continue to be a leader in high-quality hydrocarbons today, while developing the intelligent options we will all rely on tomorrow. Lower-carbon resources remain central to this long-term strategy.[88]

As BP's example clearly shows, measuring a company's "own" emissions does not provide a complete picture of a firm's overall contribution to climate change. Theoretically, the "hidden" emissions could be accounted for at the point of consumption. However, because no universal global reporting requirement exists, a significant part of the "hidden" emissions remains hidden. Additionally, conventional emissions

84. Sæverud & Skjærseth, *supra* note 81, at 42.

85. The company defines indirect emissions as follows: "Indirect emissions result from fossil fuel combustion in third party power plants from which BP purchases energy, supplied as either electricity or heat." BP, 2004: DETAILED PERFORMANCE DATA (2004), *available at* http://www.bp.com/assets/bp_internet/globalbp/STAGING/global_assets/downloads/E/ES_2004_climate_change_detailed_data.pdf.

86. *Id.*

87. It is worthwhile to note that the company does not provide any quantified data about the offsetting effect of its commendable investments in green technologies on the "total" present and future emissions.

88. BP ANNUAL REPORT 2010, *supra* note 78, at 7.

reporting is done retrospectively and does not include potential future emissions.

As noted above, one could argue that we already know that oil companies produce oil along with petroleum products and measuring potential emissions from the extracted fossil fuels is not new information. This misconception perfectly demonstrates the imperfection of the real-world information phenomenon.[89] For example, investors may know the company's current daily output, but this information is unlikely to reflect the company's dependence on maintaining or increasing its output in ten years. Because information is a public good (i.e., its consumption is not rival), many actors have real incentives to withhold it (fully or partially).[90] This leads to information asymmetries that lead to two parties having uneven "information power" (i.e., adverse selection), with one party unable to validate the information given by the other (i.e., moral hazard).[91]

As concluded above, investing in fossil fuel production without taking into consideration future emissions generated by the extracted minerals creates dangerous carbon lock-in. Despite the apparent link between an increase in production of fossil fuels and an increase in emissions, the consequences may seem too abstract and amorphous for investors, as well as corporate and government decision-makers, to account for when considering new production capacity.[92] On the other hand, arguments in favor of oil exploration and extraction usually have a quantifiable component. For example, a projected decrease in Russia's revenue as a result of not replacing depleting oil fields in Western Siberia with fields in the South Kara Sea can be presented in real numbers easily understood by general public. Similarly, the failure to close the stock swap deal cost BP's balance sheet up to 114.36 billion barrels of oil equivalent (boe) of hydrocarbons, including 35.74 billion barrels of oil.[93] A carefully crafted mandatory disclosure that sets forth requirements for reporting data

89. FUNG ET AL., *supra* note 45, at 31.

90. *Id.*

91. *Id.*

92. *See* Elinor Ostrom, *A Polycentric Approach for Coping with Climate Change* 8 (The World Bank Dev. and Econ. Research Grp., Working Paper No. 5095, 2009), *available at* http://www.iadb.org/intal/intalcdi/PE/2009/04268.pdf (arguing that the problem with collective action is that the costs of contributing are concentrated and the benefits are diffuse). The same logic can apply to production of fossil fuels, yet in the reverse order. Based on investment records, oil exploration and extraction offers real economic benefits while abstaining from it offers uncertain (in terms of costs) consequences.

93. The "booking" South Kara Sea resources should not be underestimated. ExxonMobil announced that it would be able to do so (despite the fact that Rosneft holds the licenses) less than a month after signing the agreement with the Russian company. Humber & Bierman, *supra* note 16.

connecting investment and emissions can provide certainty for the field hindered by the biases, inaccuracies, and distortions of real-world information. Such disclosure can do for climate change analysis of investment in new oil production what estimated reserves do for economics analysis—offer quantifiable consequences of the action.

III. WHAT INFORMATION SHOULD BE DISCLOSED?

A. Total Emissions and Carbon Dependence of Investment (CDI).

Knowing what total emissions are is important for understanding the impact of oil production operations on climate change. However, while answering the question of what the total climate change impact was or can be, the total emissions analysis lacks an important feature. It does not show the connection between investment in fossil fuel production and climate change consequences of the production. As a result, the total emissions analysis is not a very effective tool for reconciling economic activities with climate change concerns. CDI, on the other hand, ties investment interests and their climate change consequences together and helps to determine the carbon emissions that a project will have without incurring economic loss.

The total emissions analysis can be done in many different ways: per company, project, geographic region, or even country. This analysis can be done prospectively or retrospectively. In the BP example above, I noted the British oil giant's total emissions for 2004. A similar calculation can be done prospectively based on the projected company's output and own emissions for the given year. The total potential emissions analysis for an oil field, geographic region, or country can be done using reserves or estimated resources data.[94] The following example provides an illustration of the analysis. According to the USGS, Russia hosts 43 of 61 significant Arctic oil and gas fields,[95] which translates into approximately 100 billion boe of undiscovered resources.[96] 20% of it is believed to be oil.[97] Combustion of one barrel of oil results in 0.43 tonnes of CO_2 equivalent on

94. Although often used interchangeably, definitions of oil reserves and resources differ significantly. For a discussion regarding defining and measuring oil reserves and resources, *see* INT'L ENERGY AGENCY, *supra* note 11, at 114–15.

95. Budzik, *supra* note 15, at 6.

96. Bird, *supra* note 15, at 4.

97. *How much oil is in the Arctic?*, VOICE OF RUSSIA, (Nov. 29, 2011, 11:28 AM), http://english.ruvr.ru/2011/11/29/61188118.html.

average.[98] Production or Well-to-Tank (WTT) emissions usually comprise 18% of all emissions per barrel.[99] Thus, it takes, on average, 22 barrels worth of GHG emissions (in CO_2 equivalent) to produce and deliver 100 barrels of crude-based fuel (Production Emissions Factor).[100] Finally, the combustion factor for crude oil is 92–95%.[101] This means that, on average, 9395% of all extracted crude oil is used as fuel. Thus, total emissions from Russian Arctic oil should be calculated as follows:

> Total Emissions = Combustion Emissions + Production Emissions
>
> where:
>
> Combustion Emissions = Fossil Fuel Commodity x Combustion Factor x Carbon Intensity
>
> and;
>
> Production Emissions = Combustion Emissions x Production Emissions Factor

If USGS is correct about the Russian Arctic resources, the total emissions could potentially reach 9.9–10 Gt.[102]

The key word in the last sentence is "potentially," as the total emissions analysis does not indicate the likelihood of these potential omissions

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98. *Green Power Equivalency Calculator Methodologies*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/greenpower/pubs/calcmeth.htm#gasoline (last visited Apr. 9, 2012). This, of course, is an approximation as different kinds of crude oil have different carbon intensity.

99. The average is based on the three transportation fuels delivered for consumption to the U.S. NAT'L ENERGY TECH. LAB., CONSIDERATION OF CRUDE OIL SOURCE IN EVALUATING TRANSPORTATION FUEL GHG EMISSIONS 2 (2009), *available at* http://www.netl.doe.gov/energy-analyses/pubs/Life%20Cycle%20GHG%20Analysis%20of%20Diesel%20Fuel%20by%20Crude%20Oil%20Source%202.pdf [hereinafter NETL Report]. The "production" emissions include emissions from extraction, refining, and transportation. The report does not include emissions from exploration activities.

100. *Id.*

101. *Frequently Asked Questions: What are the Products and Uses of Petroleum?* U.S. ENERGY INFO. ADMIN., http://www.eia.gov/tools/faqs/faq.cfm?id=41&t=6 (last visited Apr. 9, 2012). Crude oil is used to manufacture a variety of non-fuel products, including: petrochemical feedstocks, asphalt and road oil, lubricants, special naphthas, and waxes. *Id.* Petroleum coke, another product derived from crude oil, has fuel and non-fuel uses. *See Raw Petroleum Coke*, INDIAN OIL, http://www.iocl.com/Products/RawPetroleumCoke.aspx (last visited Apr. 9, 2012) (describing the primary fuel and non-fuel end uses of petroleum coke).

102. The methodology used for calculating total emissions is similar to the Life Cycle Analysis approach used in the NETL report. NETL Report, *supra* note 99, at 2–3.

occurring. Likewise, it does not provide any information regarding the strength of the carbon lock-in if the production operations have already started. In contrast, the CDI analysis targets carbon lock-in and its economic aspect in particular. CDI measures the amount of carbon (in CO_2 equivalent) that needs to be emitted over a period of time to avoid economic loss. In that sense, CDI provides a quantitative and temporal assessment of one's financial dependence on activities that inevitably lead to carbon emissions. CDI is based on the following two elements.

First, CDI includes activities whose economic success is contingent, directly or indirectly, on combustion of fossil fuels. Oil exploration and extraction, the illustration for CDI application used in this study, is one example of such activities (the "CDI target activities"). Because over 92% of extracted crude oil is combusted to produce energy, the success of an investment in oil exploration and extraction effectively depends on the demand for combustion of the extracted oil, and thus, indirectly, on emission of greenhouse gases (GHGs). Another example of the CDI target activities is construction on an oil pipeline. The purpose of an oil pipeline is to transport crude oil. It usually cannot be used for anything else. Thus, the economic success of such an investment depends on how much oil is transported through the pipeline.[103] Similarly to the first example, an investor in an oil pipeline becomes a de facto cheerleader of steadily increasing GHG emissions.

Second, CDI employs targeted transparency. For the reasons stated above, disclosure is the most politically feasible form of "carbon" solution today. In addition, CDI gives people an opportunity to "vote" with their money according to their political and moral beliefs. It also gives them a comprehensive tool for assessing climate change risks associated with their investment.

Both total emissions and CDI analyses provide important information for understanding the cumulative impact of fossil fuel production on climate change. Both indicators can be used as a basis for designing a climate control mechanism. However, the carbon lock-in angle that CDI helps to reveal brings another dimension to the disclosure that the total emissions analysis fails to do.

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103. This explains the great support of Alyeska, the operator of the Trans Alaska Pipeline System for oil exploration in the U.S. Arctic. *Arctic Oil and Gas Development,* CTR. FOR STRATEGIC AND INT'L STUDIES (July 12, 2011) (downloaded using iTunes).

B. CDI in a Nutshell: Mechanics and Components.

CDI ties investment interests together with their climate change consequences in the following manner. First, it determines how much of a fossil fuel commodity needs to be subjected to a CDI target activity (e.g., barrels of crude sold in production activities, barrels of crude transported via an oil pipeline, etc.) for the firm to recoup its investment in the activity and avoid economic loss.[104] Second, it determines the combustion emissions from the fossil fuel commodity by using the carbon intensity and combustion factor of the fossil fuel. Third, it calculates the emissions from producing the fossil fuel commodity. Fourth, it combines the combustion and production emissions to show how "dependent" the investment is on carbon emissions. Based on the above, the general formula for CDI is as follows:

> CDI = (Investment ÷ Price per Unit of Fossil Fuel) x Combustion Factor x Carbon Intensity) + Production Emissions

I explain each element of the CDI formula below using the failed BP-Rosneft deal as an example. For the sake of keeping this illustration simple, consider the following hypothetical scenario. It is assumed that the BP-Rosneft deal had succeeded and the companies formed a joint venture (Karaoil) to develop three license blocs in the South Kara Sea—EPNA 1, 2, and 3.[105] Based on the value and number of the exchanged shares,[106] it is assumed that Rosneft and BP equally own Karaoil, with Rosneft holding at least 51% of voting rights.[107]

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104. As noted above, not all extracted crude is combusted. Therefore, for the purposes of this calculation, the term "fossil fuel commodity" provides a more accurate description of the extracted mineral.

105. Foley, *supra* note 17.

106. Anna Shiryaevskaya & Kari Lungren, *BP-Roneft Share Swap Collapses as Billionaires Block Deal*, BLOOMBERG BUSINESSWEEK (May 17, 2011, 12:23 PM), http://www.businessweek.com/news/2011-05-17/bp-rosneft-share-swap-collapses-as-billionaires-block-deal.html.

107. Pursuant to article 9 of the Federal Law of the Russian Federation "on Subsoil Resources," the right to use offshore oil and gas deposits can only be given to a company that satisfies the following criteria: 1) it has been formed under the laws of the Russian Federation; 2) it has five or more years of oil and gas exploration and extraction experience in the Russian continental shelf; and 3) the Russian Federation controls more than 50% of the company's voting stock. Thus, the British ownership of the license holder could not have exceeded 50%. Federal'nyi Zakon RF o Nedrah [Federal Law of the Russian Federation on Subsoil Resources], Vedomosti S"ezda Narodnykh Deputatov Rossiiskoj Federatsii I Verkhovnogo Soveta Rossiiskoi Federatsii [Bulletin of the Congress of People's Deputies of

To complete the first step of the CDI formula, we need to determine the total investment (sunk cost) of the project and the price of the fossil fuel commodity, crude oil in this case. Karaoil, through its BP and Rosneft shareholders, made "finding and development" (F&D) investments to explore the oil fields.[108] Because none of the discovered oil has been sold, the investment in exploration returned zero dollars in revenue to date. Certain assets will have salvage value; thus, the fixed cost should be discounted by the salvage value of some capital assets. Karaoil discovered oil and moved to the production phase. Once lifting and sales began, Karaoil, BP, and Rosneft's shareholders started recouping their investment in the South Kara Sea project. To lift the hydrocarbons, Karaoil incurred operating costs, such as worker's salaries, equipment maintenance, cost of energy, etc. (also known as the "lifting cost").[109] Additionally, Karaoil paid taxes, as well as interest on the funds it borrowed.[110] In the end, Karaoil's total investment in exploration and extraction of the oil deposits can be represented by the following formula:

> Investment = (F&D Costs - Salvage Value) + Lifting Cost + Financing Cost & Taxes

Determining the price of fossil fuel commodity (crude oil) is the next sub-step. It is assumed that Karaoil will sell all the extracted crude oil without refining and delivering it. Thus, Karaoil will use the revenues from sales of the extracted crude to recoup its investment in the project. Oil prices are extremely volatile and virtually impossible to predict.[111] For example, the EIA's scenarios vary from an increase of as much as $199.90 per barrel by 2035 (the High Price Scenario) to $51 per barrel (the Low Price Scenario).[112] The Reference Scenario prices oil at $125 by 2035.[113]

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the Russian Federation and Supreme Council of the Russian Federation] [Ved. RF] 1992, No. 16, Item 834, *last amended by* FZ No. 417, Sobranie Zakonodatel'stva Rossiiskoi Federatsii [Russian Federation Collection of Legislation] 2011, No. 50, Item 7359.

108. INT'L ENERGY AGENCY, *supra* note 11, at 139. It is important to note that 70% of activities in an oil or gas project are carried out by contractors and subcontractors. EMMA WILSON & JUDY KUSZEWSKI, INT'L INST. FOR ENV'T AND DEV., SHARED VALUE, SHARED RESPONSIBILITY: A NEW APPROACH TO MANAGING CONTRACTING CHAINS IN THE OIL AND GAS SECTOR 8 (2011). Thus, in the hypothetical example given here, contractor and subcontractor payments will comprise a significant portion of the F&D and lifting cost.

109. INT'L ENERGY AGENCY, *supra* note 11, at 444.

110. *Id.*

111. *International Energy Outlook 2011: Liquid Fuels,* U.S. ENERGY INFO. ADMIN., www.eia.gov/forecasts/ieo/liquid_fuels.cfm (last visited Mar. 31, 2012) [hereinafter *Liquid Fuels*].

112. *Liquid Fuels, supra* note 111. It is important to note that many sources assess Arctic resources at a "certain price."

Access to supply appears to be the dominating factor of the EIA analysis.[114] As mentioned above, the EIA "de-carbonization" analysis prices oil at $135, $113, and $90 per barrel by 2035 depending on, respectively, the Current Policies, New Policies, and 450 scenarios.[115] Thus, the CDI analysis can be done based on the past (e.g., $100 per barrel as a mean crude oil price over the last x years) or forecasted data (increasing or decreasing with time). It can also be done based on a mean of different scenarios or as a range.

The first step of the CDI analysis is the only critically different calculation from the total emissions analysis. The second step of the CDI analysis essentially duplicates the combustion emission calculation performed in the previous sub-section. Here, the fossil fuel commodity is multiplied by the combustion factor to determine the amount of fossil fuel, and then converted into the fossil fuel into combustion emissions by using the carbon intensity. The combustion factor may vary depending on the type of crude oil, as chemical composition of crude oil varies from one geographic location to another.[116] The combustion factor may also fluctuate based on the market demand for fuels versus other petroleum products.[117]

To complete the third step of the CDI analysis, calculation of the emissions from producing the fossil fuel commodity, we need to determine the phase(s) of the production process for which the firm is responsible.[118] If Karaoil sells the extracted oil from the production platform (where it is pumped into the purchasers' tankers), the company will be responsible for emissions from extraction. If Karaoil conducts exploration activities, then it will also be responsible for its share of exploration emissions. An average,

113. *Liquid Fuels, supra* note 111.

114. *Liquid Fuels, supra* note 111.

115. INT'L ENERGY AGENCY, *supra* note 11, at 444. Prices are listed in 2009 money.

116. Clifford Krauss, *Why the Disruption of Libyan Oil Has Led to a Price Spike*, N.Y. TIMES, Feb. 23, 2011, http://www.nytimes.com/2011/02/24/business/energy-environment/24oil.html?pagewanted=all.

117. *Refinery Yield*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/dnav/pet/pet_pnp_pct_dc_nus_pct_m.htm (last visited Apr. 9, 2012).

118. Several studies use the term "Well to Tank" (WTT) for the production process. Another term used by the studies, "Well to Wheel" (WTW), reflects the entire life cycle of crude oil. *See* NETL Report, *supra* note 99, at 5 (describing one example of WTT analysis); THE INT'L COUNCIL ON CLEAN TRANSP., CARBON INTENSITY OF CRUDE OIL IN EUROPE 43 (2010), *available at* http://www.theicct.org/sites/default/files/publications/ICCT_crudeoil_Europe_Dec2010.pdf.; SIMON MUI ET. AL, NATURAL RES. DEF. COUNCIL, GHG EMISSION FACTORS FOR HIGH CARBON INTENSITY CRUDE OILS 2 (2010), *available at* http://docs.nrdc.org/energy/files/ene_10070101a.pdf. In this paper, I use the terms "production" and "combustion" emissions to highlight the fact that not all petroleum fuels are used in transportation. As much as 20% of all petroleum products (per barrel) are used as non-transportation fuels.

baseline share of the production emissions (Production Emissions Factor) during the extraction process is 7.3%.[119] This means that it takes, on average, nine barrels worth of GHG emissions (in CO_2 equivalent) to extract 100 barrels of crude oil. Thus, production emissions should be calculated pursuant to the following formula:

Production Emissions = Combustion CDI x Production Emissions Factor

It is worth noting that extraction of some types of crude oil is a very energy and, thus, emission-intensive process. For example, emissions from extraction of Canada oil sands exceed the baseline crude oil extraction emissions by the factor of three.[120] The fourth step of the CDI analysis represents a simple summation of the combustion and production emissions.

Revisiting some of the numbers referenced throughout this study illustrates how the general CDI formula can be applied. The initial BP-Rosneft investment in exploring three license blocs located in the South Kara Sea (license blocs EPNA 1, 2, and 3) is believed to be up to $2 billion.[121] We do not, and likely will not, know what constituted this "initial investment" because the agreement between BP and Rosneft never materialized. For purposes of this exercise, the "initial" investment is treated as part of exploration costs or capital costs for the entire project. The average price of oil is assumed to be $97.34, the price on the New York Mercantile Exchange for July 2011.[122] It is also assumed that Karaoil outsourced all of the exploration activities and is not responsible for any exploration emissions. Thus, with the carbon intensity of oil at 0.43 metric ton of CO_2 equivalent the combustion factor is 95%, CDI of the initial investment equals over 8.4 million tonnes of CO_2 equivalent. This figure represents almost a week's worth of CO_2 emissions in the United Kingdom at the 2009 level.[123]

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119. NETL Report, *supra* note 99, at 5.

120. *Id.*

121. Olga Tanas & Ekaterina Geraschenko, *BP ne Nuzhna 'Rosneft' bez Arktiki* [*BP Does Not Need Rosneft Without the Arctic*] (Mar. 28, 2011, 11:36 AM), http://www.gazeta.ru/business/2011/03/28/3566513.shtml.

122. *Petroleum and Other Liquids: Cushing, OK Crude Oil Future Contract 1*, U.S. ENERGY INFO. ADMIN. (Mar. 28, 2012), http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RCLC1&f=M.

123. DEP'T OF ENERGY & CLIMATE CHANGE, UK CLIMATE CHANGE SUSTAINABLE DEVELOPMENT INDICATION: 2009 GREENHOUSE GAS EMISSIONS, PROVISIONS FIGURES AND 2008 GREENHOUSE GAS EMISSIONS, FINAL FIGURES BY FUEL TYPE AND END-USER (2010), *available at*

C. Temporal Aspect of CDI Analysis.

Should the government provide tax incentives for advanced oil recovery (AOR) or exploration of new oil fields? How strongly will an oil company lobby against new climate legislation? Should a lender consider adding other collateral in addition to the drilling rig it is about to finance? Would it be more prudent for a pension fund to invest in an oil company that favors mature assets or an oil company that aggressively pursues new production capacity? The temporal CDI analysis can help answer these vastly different questions. The temporal analysis determines carbon dependence of a project, activity, firm, or asset in a given year. In this sense, the temporal aspect of the CDI analysis opens the decision-making tool for a variety of applications. It can help reconcile the nation's economic policy with its climate policy. It makes evaluating different actors in the political process possible. It can serve as a risk assessment tool for certain types of projects and activities. Finally, it allows for comparing of fossil fuel-centric projects that are at a different stage of their development.

To understand the difference between the "static" CDI analysis described in the previous sub-section and temporal CDI analysis, it is sufficient to look at the initial phase of an oil development project. Oil companies usually estimate the duration of oil exploration and extraction for each new oil field based on a number of economic, technological, and geological factors. Using the estimated project duration, it is possible to allocate the total CDI based on the projected investment and production in each year. Allocating CDI just on the basis of investment in each given year does not give a complete picture of financial "dependence" on carbon emissions. For example, if a firm spent $1 billion each year for five years in F&D costs, its CDI at the end of year five should not be calculated in the $1 billion investment made that year. Assuming that the field has not produced any oil and, thus, has not recovered any investment, CDI in year five should be calculated based on the $5 billion cumulative investment.

The temporal analysis becomes even more important for an undertaking of the South Kara Sea venture's size and magnitude. To illustrate this point, consider the following hypothetical:[124] Karaoil estimates $280 billion to be the total investment in the project to develop and lift 3.5 billion barrels of

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http://www.decc.gov.uk/assets/decc/statistics/climate_change/1_20100325084241_e_@@_ghgnationalstatsrelease.pdf.

124. This example is provided for illustrative purposes only. Although some assumptions are based on the real data, they should not be viewed as a forecast of any oil development project in the Russian Arctic.

recoverable oil.[125] 35% of this amount, or $98 billion, will be invested in the form of F&D cost with 65% or $182 billion representing lifting cost, financing cost, and taxes. The extraction emissions will be at the baseline level of 7.3% of the life cycle emissions and the combustion factor is estimated at 94.5%.[126] Karaoil anticipates that the total duration of the project will be 25 years—five years of exploration and development followed by 20 years of production. The project started on January 1, 2011 and will end on December 31, 2035. Karaoil will make the F&D investment during the first five years of the project in five equal amounts of $19.6 billion. The first four years of the production stage will see the highest expenditures. Investments will gradually decrease toward the end of the production phase. Oil production will peak in year nine. Oil prices from 2011 to 2035 are taken from the EIA's Reference oil price scenario.[127]

Based on the general CDI formula, the more Karaoil invests without producing, the higher its CDI will be. The increasing oil prices offset some of the CDI growth, but not nearly enough to curb its steady growth during the first nine years. Thus, because no oil was produced during the exploration phase, CDI accumulates, and at any year during this period can be calculated as follows:

$$\sum\text{CDI}_{\text{n years}} = \text{CDI (Cumulative)}_{\text{n year}}$$

However, once the project starts producing oil, Karaoil starts recouping some of its cost, thus decreasing the amount of total investment. Because of the decrease in the total investment, the total project CDI will start going down in proportion to the depletion rate.

$$\text{Total CDI x Depletion Factor}_{\text{n years}} = \Delta\text{CDI (Depletion)}_{\text{n year}}$$

Thus, the CDI in a given year for combustion emissions can be calculated using this formula:

125. According to Rosneft, the field's resources are estimated at 16 billion tons of oil equivalent (toe) (114.36 billion boe) with up to 5 billion tons of oil (35.74 billion barrels). Russian Arctic Seas, *supra* note 16; *Bolshoi Petroleum*, VEDOMOSTI (Jan. 17, 2011), http://www.oilru.com/news/227118/. For the purposes of this exercise, I "discounted" Rosneft's projection of 35 billion barrels of oil by the factor of ten. I also assumed $80 per barrel cost of recovery of Arctic oil, which is 20% lower than the projected cost referenced above.

126. Given the harsh operating conditions, the extraction emissions for the offshore project of this kind will likely be higher than the baseline.

127. *Liquid Fuels*, *supra* note 111.

$$CDI_{n\ year}\ (Combustion) = CDI\ (Cumulative)_{n\ year} - \Delta CDI\ (Depletion)_{n\ year}$$

Finally, we need to add production emissions CDI for the given year to calculate Net CDI in the given year:

$$Net\ CDI_{n\ year} = CDI_{n\ year}\ (Combustion) + CDI_{n\ year}\ (Production)$$

where:

$$CDI_{n\ year}\ (Production) = CDI\ n\ year\ (Combustion) \times Production\ Emissions\ Factor$$

When the project is well into the production phase, its CDI drops significantly. It continues to drop until all the investment is recouped.

The following table and graph provide illustrations of the Net CDI dynamics:

Numeric Example of CDI Temporal Analysis
Net CDI over a 25-year project

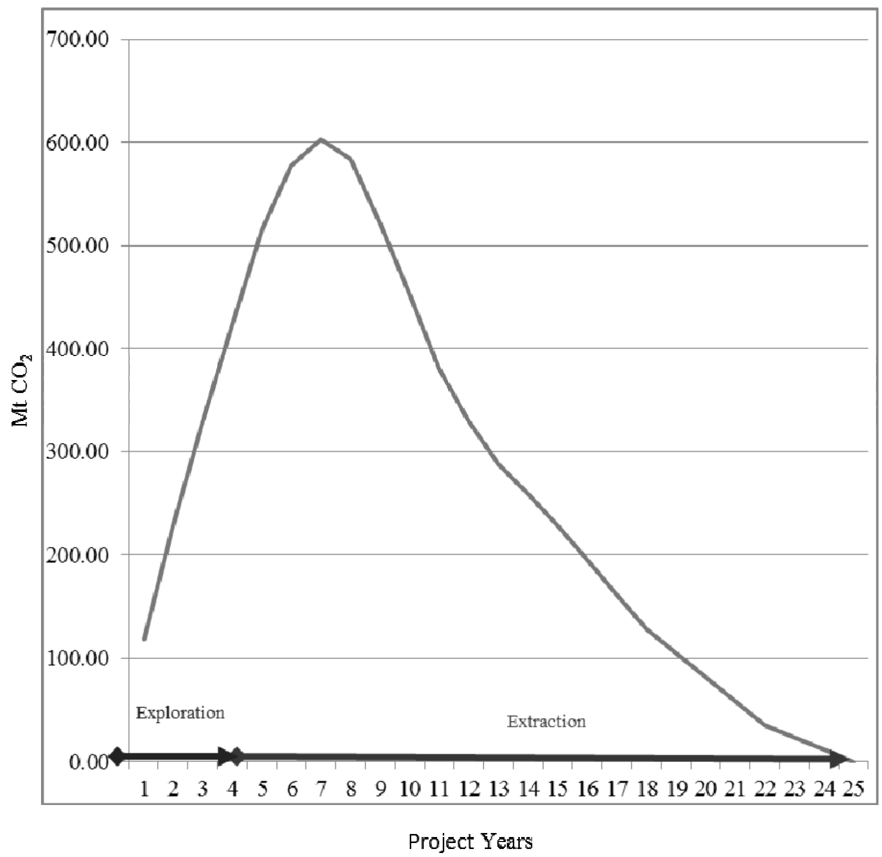
Year	Investment Year	Estimated Oil Price per Barrel	Estimated Production Per Year (mbo)	Depletion Percentage	Total Investment Per Year ($ billion)	Total Cumulative Investment ($ billion)	Static CDI Per Year (Mt CO_2-eq)	CDI (Cumulative) (Mt CO_2-eq)	CDI (Depletion) (Mt CO_2-eq)	CDI (Combustion) Per Year (Mt CO_2-eq)	CDI (Production) Per Year (Mt CO_2-eq)	Net CDI (Mt CO_2-eq)
2011	1	73.06	0	0	19.6	19.6	118.82	109.01	0.00	109.01	9.81	118.82
2012	2	79.41	0	0	19.6	39.2	109.32	209.31	0.00	209.31	18.84	228.15
2013	3	85.74	0	0	19.6	58.8	101.25	302.20	0.00	302.20	27.20	329.40
2014	4	90.91	0	0	19.6	78.4	95.49	389.81	0.00	389.81	35.08	424.89
2015	5	94.52	0	0	19.6	98	91.85	474.07	0.00	474.07	42.67	516.74
2016	6	98.23	150	4	25.46	123.46	114.80	579.39	49.54	529.85	47.69	577.54
2017	7	101.23	200	6	22.28	145.74	97.48	668.82	115.59	553.24	49.79	603.03
2018	8	104.41	300	9	20.92	166.66	88.75	750.24	214.66	535.58	48.20	583.78
2019	9	106.47	400	11	19.56	186.22	81.37	824.89	346.76	478.13	43.03	521.16
2020	10	108.28	350	10	13.74	199.96	56.20	876.46	462.35	414.11	37.27	451.38
2021	11	109.52	350	10	13.74	213.7	55.57	927.44	577.94	349.50	31.46	380.96
2022	12	110.92	250	7	9.6	223.3	38.33	962.61	660.50	302.11	27.19	329.30
2023	13	112.32	200	6	7.78	231.08	30.68	990.75	726.55	264.20	23.78	287.98
2024	14	113.63	150	4	6.46	237.54	25.18	1,013.85	776.09	237.77	21.40	259.17
2025	15	115.09	150	4	5.76	243.3	22.17	1,034.19	825.62	208.57	18.77	227.34
2026	16	116.61	150	4	5.76	249.06	21.88	1,054.26	875.16	179.10	16.12	195.22
2027	17	118.32	150	4	5.46	254.52	20.44	1,073.01	924.70	148.32	13.35	161.66
2028	18	120.13	150	4	5.46	259.98	20.13	1,091.48	974.24	117.25	10.55	127.80
2029	19	122.04	100	3	3.64	263.62	13.21	1,103.60	1,007.26	96.34	8.67	105.01
2030	20	123.50	100	3	3.64	267.26	13.05	1,115.58	1,040.29	75.29	6.78	82.07
2031	21	125.56	100	3	3.64	270.9	12.84	1,127.36	1,073.31	54.05	4.86	58.91
2032	22	127.43	100	3	3.64	274.54	12.65	1,138.97	1,106.34	32.63	2.94	35.57
2033	23	129.29	50	1	1.82	276.36	6.23	1,144.69	1,122.85	21.84	1.97	23.80
2034	24	131.25	50	1	1.82	278.18	6.14	1,150.32	1,139.36	10.96	0.99	11.95
2035	25	133.22	50	1	1.82	280	6.05	1,155.87	1,155.87	0.00	0.00	0.00

Total Investment **$280 billion**

Project Duration **25 Years**

Total CDI **1.2599 Gt**

Graphic Example of CDI Temporal Analysis
Net CDI over a 25-year project



The temporal CDI analysis allows for appropriate adjustments in the degree of the financial carbon lock-in if certain conditions change. In the above example, based on many projections, Karaoil assumes that demand, as well as the price of oil, will grow. For purposes of illustration, it is assumed that climate negotiations will produce a new international agreement based on equal responsibilities. It is also assumed that, by the time the new agreement comes into force in 2020, the production cost of the South Kara Sea oil goes up by $10 per barrel due to various regulatory fees, taxes, and surcharges targeting carbon. This cost increase will require a higher investment every year, which, in turn, will require Karaoil to sell more oil. Thus, the project's CDI will increase, making it more "locked-in in the oil production." If one assumes that the IEA's estimate of oil demand and price was correct, and 2018 will, in fact, be the peak oil year, then the price of oil will start gradually going down, reaching $81 per barrel in 2035. The decrease in oil price will require Karaoil to sell more oil to recoup its investment in the project, exacerbating the effect of the cost increase. If carbon controls continue to drive the cost of oil up and shrink the market, then Karaoil's decision made in 2011 to proceed with the development may not be economically sound in 2030, when oil sales do not generate enough revenue to recoup remaining investment.

The ability of the temporal CDI analysis to assess carbon dependence at virtually any point in time goes beyond project evaluation. The nation may not have to choose between participating in the new climate agreement and meeting its current energy needs by promoting a short-term AOR solution with potentially lower CDI. The oil company may turn out to be the leader in diversifying its business model and be in a position to break from the more "carbon dependent" pack. This fact could turn the firm into a potential ally in the push for new climate legislation. The bank may ask for additional collateral or a higher interest rate, considering the risk that a drilling rig may not be a productive asset in light of the reduced demand for oil. The pension fund may invest in the oil company, favoring mature assets because of the lower net CDI exposure.

D. CDI, Carbon Accounting, LCA, and Risk Assessment.

When first considering the idea for CDI, it seemed likely that someone was already measuring indirect financial dependence on carbon emissions. Upon reviewing carbon accounting, life cycle assessment (LCA), and climate change risk assessment (RA), however, it became apparent that, while having many similar features, CDI is distinct enough to warrant at least an introduction. CDI does not in any way, shape, or form replace the aforementioned mechanisms. Rather, it compliments them by providing a different dimension of assessing impacts on climate change while making important economic decisions.

What truly differentiates CDI from other "carbon assessment" tools is the nature of the relationship between an investment and future carbon emissions. In this relationship, an investor retains a choice even after the decision has been made. The choice is between, on one side, "sponsoring" the ensuing emissions and recouping costs or, on the other side, abandoning the activity in which the investment was made and, as a result, suffering financial loss. CDI should be applied prospectively unless one wishes to assess a past decision.

Unlike CDI, carbon accounting measures actual carbon emissions. For example, the Greenhouse Gas Protocol, one of the most well-known and accepted carbon accounting systems,[128] focuses on the following emission types: "[d]irect GHG emissions are emissions from sources that are owned or controlled by the reporting entity" and "[i]ndirect GHG emissions are emissions that are a consequence of the activities of the reporting entity, but occur at sources owned or controlled by another entity."[129] The primary goal of carbon accounting is to provide accurate emissions data.

"Handbook of Life Cycle Assessment: Operation Guide to ISO Standards" provides the following definition of LCA:

> LCA is a tool for the analysis of the environmental burden of products at all stages in their life cycle – from the extraction of resources, through the production of materials, product parts and the product itself, and the use of the product to the management after it is discarded, either by reuse, recycling or final disposal (in effect, therefore, "from cradle to the grave"). The total system of unit processes involved in the life cycle of a product is called the "product system".[130]

Similarly to CDI, LCA looks at the prospective environmental impact of a product and, in some respects, is more thorough and inclusive in assessing such impacts.[131] However, LCA does not establish a direct, one-step dependence link between an investment and ensuing emissions.

Both CDI and RA serve as decision-making tools. Both depolarize the climate change debate by shifting the focus of public discussion from the "existence" of the problem to the "degree" of the problem. However, RA's scope is much wider, as "[i]t considers the likely human and financial costs and benefits of investing in prevention, adaptation and contingency planning responses."[132] CDI, on the other hand, provides much narrower information about the risks of tying investment in the "carbon business as usual world."

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128. U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-09-423T, CLIMATE CHANGE SCIENCE HIGH QUALITY GREENHOUSE GAS EMISSIONS DATA ARE A CORNERSTONE OF PROGRAMS TO ADDRESS CLIMATE CHANGE 10 (2009).

129. *FAQ*, GREENHOUSE GAS PROTOCOL, http://www.ghgprotocol.org/calculation-tools/faq (last visited Apr. 9, 2012).

130. HANDBOOK ON LIFE CYCLE ASSESSMENT 5–6 (Jeroen B. Guinée et al. eds., 2002), *available at* http://media.leidenuniv.nl/legacy/new-dutch-lca-guide-part-1.pdf.

131. For an excellent example of LCA analysis, see NETL Report, *supra* note 99.

132. NICK MABEY ET AL., THIRD GENERATION ENVIRONMENTALISM, INC, DEGREES OF RISK: DEFINING A RISK MANAGEMENT FRAMEWORK FOR CLIMATE SECURITY 10 (2011), *available at* http://www.c2es.org/docUploads/Degrees_of_Risk_Defining_a_Risk_Management_Framework_for_Climate_Security_Executive_Summary_0.pdf.

IV. CDI DISCLOSURE: POSSIBLE APPLICATIONS AND POTENTIAL CHALLENGES.

CDI is a flexible and universal decision-making tool that can be used statically or temporally, alone or in combination with carbon accounting, LCA, and RA. The CDI appeal to both moral beliefs and economic interests expands its application even further. This subsection summarizes how CDI can apply based on users (policymakers, regulators, and investors), scale (asset, project, and firm), scope (national and international), and sectors (oil industry, coal-fired power generation, transportation, etc).

A. Possible Applications.

CDI can become a useful decision-making tool for a wide spectrum of users, including policymakers, regulators, and investors. The example illustrating the total emissions analysis considered the potential emissions from exploring the Russian Arctic. A similar analysis can be conducted using CDI. A combination of information about climate-related economic risks of oil development and climate change consequences of such a development may influence the decision about opening the region to oil exploration and extraction. For the same reasons, regulators may want to consider making CDI part of the permitting and licensing process. Environmental impact assessment, exploration, and production licenses could be issued based on the results of the CDI analysis.

Because investors and lenders constitute a prime audience for CDI disclosure, they will be discussed in greater detail. CDI will give shareholders sufficient information to intelligently "vote with their money." Institutional investors and lenders will be able to assess regulatory climate-related risk of investing in fossil-fuel centric projects. CDI can be reported in the form of voluntary or mandatory disclosure. Such a disclosure can be made as a stand-alone document or so-called mainstream financial reports (financial statements and other financial reporting).[133] Strong arguments exist for making CDI disclosure mandatory as part of mainstream financial

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133. CLIMATE DISCLOSURE STANDARDS BD., CLIMATE CHANGE REPORTING FRAMEWORK–EDITION 1.0 6 (2010). The CDSB exposure draft provides the following definition of a "mainstream financial report": "[T]he annual reporting packages in which certain companies are required to deliver their audited financial results under the corporate, compliance or securities laws of the territory or territories in which they operate. Mainstream financial reports are normally publicly available. They provide information to existing and prospective investors and are distinct from material published on a voluntary basis, such as corporate social responsibility reports. The exact provisions under which companies are required to deliver mainstream reports differ internationally."

reporting. First, many companies already report their GHG emissions on a voluntary basis.[134] For example, all oil supermajors report their "own" carbon emissions.[135] The work that the Carbon Disclosure Project has done to proliferate voluntary carbon emissions reporting throughout the globe is truly commendable.[136] Thus, a step from voluntary to mandatory reporting should not be difficult for many firms. Second, some countries, the United States, for example, already require some form of carbon disclosure.[137]

And some countries that are in the process of forming carbon emissions disclosure rules are leaning toward mandatory disclosures.[138] Aldersgate Group's response to DEFRA's "Measuring and reporting of greenhouse gas emissions by U.K. companies: a consultation on options" succinctly summarizes the benefits of mandatory reporting:

> A clear, consistent, comparable definition of carbon disclosure is vital for progress towards U.K. climate change targets. Now that voluntary GHG reporting guidance has been published, it should be made mandatory for all large U.K. companies to ensure greater accountability and transparency. The administrative costs would be minimal for those who report anyway and help those who don't to identify significant cost savings and address more effectively material climate risks and opportunities. It would also create a level playing field, allowing investors, consumers and the media to make meaningful comparisons, thus driving further emission reductions.[139]

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134. *Reporting to CDP*, CARBON DISCLOSURE PROJECT, https://www.cdproject.net/en-US/Pages/HomePage.aspx (last visited Apr. 9, 2012). For example, in 2007, 80% of U.K. companies reported their carbon emissions. ACCA, AN ANALYSIS OF DISCLOSURE IN U.K. CORPORATE REPORTS 10 (Feb. 2007), *available at* http://www.acca.co.uk/pubs/general/activities/library/sustainability/sus_archive/TECH-UK6-CC-150.pdf.

135. *E.g.*, BP ANNUAL REPORT 2010, *supra* note 78, at 12.

136. CARBON DISCLOSURE PROJECT, *supra* note 134.

137. *See generally* KEVIN A EWING, BRACEWELL & GIULIANI, PRIMER ON MANDATORY CORPORATE ENVIRONMENTAL DISCLOSURES IN THE US (2010), *available at* http://csis.org/files/attachments/100623_Final_Environmental_Disclosure_Primer_Ewing.pdf (explaining corporate disclosure requirements in the U.S.).

138. Three out of four carbon reporting options offered by DEFRA involve mandatory disclosure. DEP'T FOR ENV'T FOOD AND RURAL AFFAIRS, MEASURING AND REPORTING OF GREENHOUSE GAS EMISSIONS BY U.K. COMPANIES: A CONSULTATION ON OPTIONS 10–13 (May 2011), *available at* http://www.defra.gov.uk/consult/files/110511-ghg-emissions-condoc1.pdf.

139. ALDERSGATE GRP., GOVERNMENT CONSULTATION ON MEASURING AND REPORTING OF GHG EMISSIONS 2–3 (2011), *available at*

Whether it is a drilling rig, license blocks EPNA 1, 2, and 3, or an oil major, CDI can be applied on different scales. One of the aforementioned examples mentioned that a drilling rig may not be safe collateral for a lender in a financing transaction. A rig's monetary value may diminish with its value as a productive asset if oil demand goes down due to adoption of carbon controls. Additionally, a shrewd firm may choose to retrofit a "carbon-contingent" asset instead of replacing it with a new one based on a CDI analysis that shows a higher carbon dependence. Although a project's CDI analysis has been covered at great length, one additional point must be emphasized. The CDI analysis of a project will not be effective if it is conducted without any frame of reference. Thus, it is important to use comparable data; one project can be compared against another, as well as against national emissions.

A point of reference becomes even more important when equity investors need to decide whether to invest into a particular company. The following features will strengthen CDI's educational effect. First, the comparable data should tell how the companies stack up against each other. This can be accomplished by showing CDI per dollar invested by the company. Second, investors should know what CDI data means in terms of national emissions and a country's commitment to reduce its own carbon footprint.[140] Third, if possible, CDI should be "personalized," i.e., allocated according to the interest that each shareholder owns in the company.[141] Thus, a disclosure showing a total CDI per shareholder over a given period of time compared to other firms in the same sector, as well as the national emissions (both current and the ones that the country vowed not to exceed in the future) should provide effective comparative information.

Calculating CDI for an entire company will likely involve compiling CDI information from many projects, activities, and groups of assets. As tedious and complex as this task may seem, the potential benefits of collecting and processing the necessary data will outweigh the cost, especially if the firm intends to practice what it preaches. CDI disclosure may help the company back up its environmental claim with quantified

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http://www.aldersgategroup.org.uk/asset/download/380/1107%20Costs%20and%20Benefits%20of%20 Mandatory%20CO2%20Reporting.pdf.

140. For example, the information that BP "helped" create as much GHG emissions as the country of Germany in 2004 does not sit well with BP's image as a "green" oil company. Sæverud & Skjærseth, *supra* note 81, at 42.

141. Allocating CDI per shareholder, rather than per share, accomplishes the goal of creating a "personal carbon burden." Additionally, the amount of CDI per shareholder should not change if the value of a company's share changes. "Personalizing" CDI may prove to be a challenge as large corporations can have many types of shares, giving their holders different rights.

evidence. However, CDI disclosure can also deal a quantified blow to a firm's climate change public relations campaign. For example, BP's decision to sell off its mature assets appears to be contradicting its "Beyond Petroleum" strategy. As the above graph suggests, investing in new oil production does the opposite of "enabling the material transition to a lower carbon future."[142]

Although CDI is more likely to find its application as a national disclosure, it can also be incorporated into the international climate regime. CDI can be developed within the framework of mandatory climate change disclosures that some countries have already adopted.[143] This, however, does not mean that countries should not coordinate their disclosure requirements. In fact, national CDI disclosure laws and regulations can only benefit from international guidelines and coordination.

On the international level, CDI can be used to measure a country's ability to develop or transition to a low-carbon economy. Additionally, including CDI disclosure as part of national notifications under the UNFCCC will aid developed nations in demonstrating that they are truly following their commitments to mitigating climate change, i.e., reducing emissions at home while not financing them abroad.

Because CDI targets activities whose economic success is directly or indirectly contingent upon combustion of fossil fuels, CDI application is not limited to oil production or the oil and gas sector. CDI analysis can be applied to mining of fossil fuels at large, electric power generation (especially coal and natural gas), transportation, and essentially to any activity that will "live or die" based on whether fossil fuels continue to be combusted.

B. Potential Challenges.

It is a daunting task to come up with a detailed list of challenges to a concept that has only been introduced. However, even this introductory discussion of CDI evokes several considerations as to why the concept may or may not succeed.

As useful as the concept of CDI may appear, developing CDI into a functioning tool beyond this introduction may run into serious practical problems. Calculating CDI may prove to be too complex and costly. Firms may fight disclosure of certain information for confidentiality reasons. Due to a large number of assumptions and uncertainties, CDI data may simply

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142. *Beyond Petroleum*, *supra* note 71.

143. *See generally* Ewing, *supra* note 137 (outlining the U.S. system of corporate disclosures).

be too speculative on which to rely. Finally, voters' concern over climate change may not translate into shareholders deciding to abandon new oil production development. Thus, further studies are necessary to determine if CDI can join carbon accounting, LCA, and RA as a valuable "climate change" tool.

Yet, virtually all models rely on assumptions and have to grapple with uncertainty. Despite missing big in some forecasts, analysts keep giving investors a glimpse of what the world would be like in the short-, medium-, and long-term future. More importantly, investors continue to rely on these forecasts and make decisions based on them. After all, analysts are often right. A great deal of the data needed for calculating CDI is already reported by companies or is otherwise available. Annual reports give a great deal of information about the types and value of assets, including oil reserves. Additionally, some assumption deficiencies, such as the price of oil, can be avoided by using a data range.

Additionally, CDI does not rely solely on the moral aspect of people's concern about climate change. It shows how much and for how long a firm is invested in the carbon status quo. An oil company with a "high" and "long" CDI may face a shrinking demand for its products if carbon prices make the alternatives more economically appealing. A careful investor mindful of a company's CDI will think twice before "sinking" money into a potentially losing enterprise. In this sense, CDI assists investors in quantifying the risk of investing in a company whose performance is contingent (directly or indirectly) on high carbon emissions.

CDI's success will also depend on the design, implementation, and enforcement of the disclosure. As many examples indicate, a disclosure can be rendered effective or useless depending on what information is disclosed and how the user perceives this information.[144] Some disclosures, such as the Toxic Release Inventory (TRI), worked before the information ever reached the user. For example, executives of several large companies made a commitment to reduce toxic waste pollution by 90% before the first TRI reports were released.[145]

Correspondingly, CDI may also play an effective role in investor-targeted disclosures. Countries that are committed to transitioning to an economy with a low carbon net effect can use a CDI analysis to shape their public policy. For example, the government may design tax incentives

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144. *See* FUNG ET AL., *supra* note 45, at 92–105 (summarizing the effectiveness of eight selected transparency policies).

145. *Id.* at 85.

favoring advanced recovery from mature oil fields instead of developing new oil production capacity. National CDI analysis may be especially important for countries like Russia with economies that depend heavily on fossil fuel production.

While CDI may not be a "silver bullet" in solving the climate change problem, it may provide enough information to force decision-makers to think twice before launching projects that would be potentially disastrous for the global climate change mitigation effort. Correspondingly, a quantified picture of the carbon lock-in may convince debt or equity investors to choose more carbon-friendly investments. Regardless of the grounds for motivation, reconciliation of climate and fossil fuel production policies is needed to prevent economic loss at the expense of the environment, or environmental degradation at the expense of the economy. Thus, CDI analysis should be given proper consideration before the carbon hungry world goes full-steam ahead with the Arctic oil expedition.

CONCLUSION

Two starkly opposite points of view dominate the debate about transitioning to a low carbon economy.[146] On one end of the spectrum is the smiling oil company executive who talks about jobs, energy security, and, occasionally, his company's attempts to move toward cleaner fuels.[147] On the other hand, authors like Paul Roberts, James Howard Kunstler, and Raymond J. Learsy warn readers about the grave dangers of our addiction to fossil fuels, oil in particular.[148] Yet little research has been done to quantitatively link the investments that we are making now to achieve the goal of a low-carbon economy in the future.[149] Pundits on the pro-fossil-fuel end of the spectrum cite economic reasons for continuing the status

146. *Bridging the Climate Divide: Can Risk Management Reveal a Prudent Path Forward?*, CTR. FOR STRATEGIC AND INT'L STUDIES (Feb. 10, 2011) (downloaded using iTunes).

147. Victoria Taylor, *Oil Companies Back Slick Ad Campaigns*, FORBES.COM (Jun. 28, 2010, 12:00 PM), http://www.forbes.com/2010/06/28/bp-oil-spill-advertising-shell-chevron-citgo-cmo-network-crisis-communications.html.

148. *See generally* PAUL ROBERTS, THE END OF OIL: ON THE EDGE OF A PERILOUS NEW WORLD (2004) (discussing the unsustainable costs of the oil-based global energy economy); JAMES HOWARD KUNSTLER, THE LONG EMERGENCY: SURVIVING THE CONVERGING CATASTROPHES OF THE TWENTY-FIRST CENTURY (2005) (predicting calamitous consequences from a continued reliance on oil); RAYMOND J. LEARSY, OVER A BARREL: BREAKING OIL'S GRIP ON OUR FUTURE (2007) (establishing that OPEC's practices with respect to the pricing of oil have been responsible for the increase in gas prices in the 21st Century).

149. *Bridging the Climate Divide*, *supra* note 146.

quo. The proponents on the other end employ environmental reasons for ending the world's dependency on fossil fuels. The reluctance of each group to compromise is easy to understand. The first group fears that phasing out fossil fuels will effectively mean the end of its existence, and the second group often operates under the assumption that because a low carbon economy means the end of the first group, the sides have nothing to talk about. As a result, the stalemate alienates the majority of people who are caught in the crossfire.[150]

As the two camps continue to argue, fossil fuel production and climate change policies go in separate directions, and GHG emissions continue to increase with the growth in supply of coal, oil, and natural gas. The failure of the current climate regime to provide a universal clamp on this growth has prompted governments and non-state actors to plan for ever-increasing fossil fuel production capacity. Every step in this direction perpetuates the carbon lock-in and puts a new climate "shared responsibilities" agreement in jeopardy. If the BP-Rosneft deal had gone through, then oil development in the South Kara Sea likely would have contributed to the existing carbon lock-in by adding a tight and strong dependence sub-system.

CDI can compensate for the lack of universal emission controls by targeting fossil fuel production. Because CDI helps to quantify the carbon dependence of investment decisions made by many people in the "middle," it will help shift the climate debate to the center and, hopefully, amass greater political will to achieve meaningful emission reductions. The temporal aspect of the CDI analysis makes it even more flexible and open to many applications. Ultimately, CDI may or may not succeed. However, the potential benefits of the CDI analysis warrant, at least, further and more in-depth inquiry. Because the principal purpose of this study was to introduce the concept of CDI, the focus must now shift to fitting it for a specific application, and this is where the real work begins.

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150. *Id.*