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Embracing the Water-Energy Contradiction: The Pebble Mine Conflict and Regulatory Implications Associated with Renewable Energy's Dependence on Non-Renewable Copper

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EMBRACING THE WATER-ENERGY CONTRADICTION: THE PEBBLE MINE CONFLICT AND REGULATORY IMPLICATIONS ASSOCIATED WITH RENEWABLE ENERGY'S DEPENDENCE ON NON-RENEWABLE COPPER

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I. INTRODUCTION

"Humankind could be about to exchange one kind of energy crisis for another."[1]

Almost universally, notions of sustainability cloak renewable energy, but it is nevertheless imperative to recognize that "renewable" refers to the energy source's conversion into electricity.[2] "Renewable" does not refer to the raw materials required to build the infrastructure that does the actual conversion.[3] Although renewable energy is generally less pollutant than fossil fuels,[4] a large-scale transition to these emerging technologies will consume substantial quantities of raw materials.[5] Renewable energy advocates overlook the subsequent increases in demand and consumption of raw materials – such as copper – that invariably accompany the proliferation of green technologies, including solar power, wind energy, and electric vehicles.[6] As a result, policymakers fail to appreciate the interconnected relationship between renewable energy, increased copper mining, and water pollution.[7] This challenge has elicited an interesting contradiction, as "today's economic and political shift toward renewable energy creates a strange dilemma for the environmentalists."[8]

Despite the perceived benefits of alternative energy, we often do not account for materials consumed along the entirety of the supply-chain, ensuring that "[t]he circle of energy and pollution continues."[9] In fact, even the renewable energy sector has expressed concern that "[n]ot enough attention has been paid to renewable energy infrastructure development critical to ensure successful project development."[10] Only the mining industry has genuinely taken note of the world's declining base metal supply.[11] The general public, as well as many renewable energy advocates, regularly overlook the potential ramifications of

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1. Tim Radford, *Renewable Energy Needs Huge Mineral Supply*, CLIMATE CENTRAL (Nov. 2, 2013), http://www.climatecentral.org/news/renewable-energy-needs-huge-mineral-supply-16682.

2. *See State and Local Climate and Energy Program: Renewable Energy*, U.S. ENVTL. PROT. AGENCY, https://www3.epa.gov/statelocalclimate/local/topics/renewable.html (last updated Feb. 22, 2016).

3. Radford, *supra* note 1.

4. Stephen C. Braverman, *State Renewable Portfolio Standards and the Commerce Clause*, 25-SPG NAT. RESOURCES & ENV'T, 15, 15 (2011).

5. Radford, *supra* note 1.

6. *See* BILL CARTER, BOOM, BUST, BOOM: A STORY ABOUT COPPER, THE METAL THAT RUNS THE WORLD 45 (2012).

7. *See* Richard A. Kerr, *The Coming Copper Peak*, 343 SCIENCE 723, 724 (Feb. 14, 2014), http://inside.mines.edu/UserFiles/File/economicsBusiness/Misc%20PDFs/Copper-Science-2014-Kerr-722-4.pdf.

8. *Id.*

9. *Id.*

10. Conference, *21st Century Infrastructure: Opportunities and Hurdles for Renewable Energy Development*, 10 SUSTAINABLE DEV. L. & POL'Y 69, 69 (2009).

11. MICHAEL T. KLARE, THE RACE FOR WHAT'S LEFT: THE GLOBAL SCRAMBLE FOR THE WORLD'S LAST RESOURCES 151 (2012).

diminishing copper production, particularly when coupled with its rapidly increasing demand.[12] Because copper maintains such a vital role in our lives, society depends on the benefits of copper mining.[13] This underscores an inevitable and contradictory-fueled debate about environmental tradeoffs.[14] These trade-offs become exacerbated within the context of natural resource development, specifically in regards to energy production, sustainability, and protection of vulnerable ecosystems.

On one hand, there is widespread acceptance that non-renewable fossil fuels will reach eventual depletion.[15] Yet conversely, society also fails to consider renewable energy's reliance on non-renewable raw materials, such as the metals that comprise the necessary infrastructure.[16] Like most technologies, both fossil fuels and renewable energy have adverse or collateral effects.[17] Rather than demonizing either of these energy sources, regulatory schemes that comprehensively understand these operations capitalize on the benefits, while further mitigating and adapting to the risks. Distinguished scientist Ugo Bahdi described society's inadequate approach to our planet's limited supply of raw materials, "people, industries, and governments that rely on finite resources are often loath to take a true, hard look at just how plentiful or scarce certain resources are, not to mention the consequences of mining or using them."[18] Most alarmingly, Bahdi reflected on the root of this concern: "We remain, as a society, reluctant to accept natural limits[.]"[19]

Environmentalists suggest that renewable energy should coerce society into a new energy revolution, effectively safeguarding the world against imminent dangers of climate change.[20] Notwithstanding the perpetual debate concerning whether or not the effects of climate change are the result of fossil fuel emissions,[21] regulatory approaches that focus solely on preventing or mitigating climate change will likely ignore the potential environmental consequences of a widespread transition to renewable energy.[22] In comparison, scientists scrutinize the environmental impacts of liquefied natural gas ("LNG"), coal, and petroleum throughout their entire lifecycles.[23] Scientists analyze and the government subsequently regulates greenhouse gas emissions ("GHG") throughout the

12. *See id.*

13. *About*, COPPER MATTERS, http://www.coppermatters.org/about/ (last visited Mar. 28, 2016).

14. *See* CARTER, *supra* note 6, at 45.

15. *See* Jeff Nesbit, *Fossil Fuels are Doomed*, U.S. NEWS & WORLD REPORT (Aug. 13, 2015, 10:51 AM), http://www.usnews.com/news/blogs/at-the-edge/2015/08/13/fossil-fuels-are-doomed.

16. *See* Olivier Vidal, Bruno Goffé & Nicholas Arndt, *Metals for a Low-carbon Society*, 6 NATURE GEOSCIENCE 894, 894 (2013).

17. *Id.* at 894-95.

18. UGO BARDI, EXTRACTED: HOW THE QUEST FOR MINERAL WEALTH IS PLUNDERING THE PLANET, at xv (2013).

19. *Id.*

20. *See generally* Vidal et al., *supra* note 16

21. *E.g.*, Paul Bedard, *Carbon Dioxide Doesn't Cause Global Warming*, U.S. NEWS & WORLD REPORT (Oct. 7, 2009, 4:15 PM), http://www.usnews.com/news/blogs/washington-whispers/2009/10/07/scientist-carbon-dioxide-doesnt-cause-global-warming.

22. *See* Radford, *supra* note 1.

23. *See, e.g.*, Thomas W. Merrill, David M. Schizer, *The Shale Oil and Gas Revolution, Hydraulic Fracturing, and Water Contamination: A Regulatory Strategy*, 98 MINN. L. REV. 145, 169 n.112 (2013).

complete process (i.e., assessed throughout upstream and downstream production), taking a comprehensive approach that aggregates the direct and indirect effects, beginning with the extraction of fossil fuels and ending with the production and consumption of electricity.[24] Perhaps because of the perceived benefits of renewable energy,[25] society does not examine or condemn the sources of renewable energy for the significant amount of copper required to fuel these technological advances. Thus, the contradiction arises through the recognition of these contrasting regulatory approaches.

This Article examines the extensive production of raw materials required to advance the development of renewable energy. Most notably, renewable energy is inextricably linked to copper mining, and therefore indirectly associated with the negative environmental effects stemming from the production of copper, such as water pollution.[26] Further, this Article suggests that because the water-energy nexus presents diverse regulatory challenges, we should instead embrace the inevitable contradictions on a case-by-case basis. Similar to an ecosystem-based management approach, perhaps we should consider these water-energy challenges in isolation, rather than relying on guidance from overarching principles. Although this solution may lead to novel conflicts, it also will likely promote interdisciplinary decision-making among industry stakeholders, government agencies, and environmentalists.

The proposed Pebble Mine in Alaska provides a unique example of these principles. The Pebble deposit holds vast quantities of copper,[27] the metal that is essential to renewable energy technology.[28] Despite the Environmental Protection Agency's ("EPA") apparent goal of reducing carbon emissions under the Clean Air Act, the EPA instead chose to preemptively veto the mining company's permit under the Clean Water Act[29] – even though the substantial copper deposit at Pebble Mine could be paramount in advancing the growth of the renewable energy sector.[30] By embracing the water-energy contradiction, the EPA, in its unlikely alliance with commercial fishermen, is in the midst of attempting to preserve an economically-valuable salmon fishery through its regulatory protection of the Bristol Bay watershed.[31] Nevertheless, this Article explores the ongoing legal conflict in the U.S. District Court for the District of

24. *See generally* Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards, 77 FED. REG. 49490, 49496-507 (Aug. 16, 2012) (to be codified at 40 C.F.R. pts. 60-63) (discussing new rule's changes to performance standards for oil and natural gas sources).

25. *See Renewable Energy*, U.S. ENVTL. PROT. AGENCY, https://www3.epa.gov/statelocal climate/state/topics/renewable.html (last updated Feb. 22, 2016).

26. *See* Kerr, *supra* note 7, at 724.

27. *See* Joby Warrick, *Pebble Mine Debate in Alaska: EPA Become Target by Planning for Rare 'Veto,'* WASH. POST (Feb. 15, 2015), https://www.washingtonpost.com/national/health-science/internal-memos-spur-accusations-of-bias-as-epa-moves-to-block-gold-mine/2015/02/15/3ff101c0-b2ba-11e4-854b-a38d13486ba1_story.html.

28. *See Copper: Renewable Energy, A 21st Century Solution*, COPPER ALL. [hereinafter *A 21st Century Solution*], http://copperalliance.org/societal-benefits-landing-page/renewable-energy-3/ (last visited Mar. 28, 2016).

29. *See* Warrick, *supra* note 27.

30. *See id.*; *A 21st Century Solution*, *supra* note 28.

31. *See* Warrick, *supra* note 27.

Alaska, and its significance within the context of Arctic natural resource development and its connection to the renewable energy sector.

II. CHALLENGES INTRINSIC TO ADVANCEMENTS IN THE RENEWABLE ENERGY SECTOR

The U.S. population is largely supportive of renewable energy, particularly those developments in wind and solar energy.[32] Several forces drive the proliferation of renewable energy, such as minimizing the harmful effects of GHG emissions and reducing American dependence on foreign oil.[33] According to noted economist Thomas Friedman, developing clean energy and green technology will "enable us to grow as a world economy. . . without exacerbating energy supply and demand issues, petrodictatorship, climate change, biodiversity loss, and energy poverty, but while actually reducing them at the same time."[34] These sentiments overlook the logistical reality of a large-scale transition to renewable energy, primarily because this transition to "clean" fuel will likely implicate a mosaic of unforeseen consequences. Although renewable energy may ultimately reduce GHG emissions,[35] the overarching environmental costs that will accompany this endeavor receive little attention. As renewables begin to engulf more significant portions of the U.S. and global energy portfolios,[36] it remains in the best interest of sustainability to examine the entire supply chains of these emerging technologies. In particular, these advancements and their ensuing rebound effect may indirectly result in environmental consequences of their own.

A. FACTORS INFLUENCING GROWTH IN RENEWABLE ENERGY

Several catalysts are influencing robust growth within the renewable energy regime. These advancements are correlated with opportunities for growth within the copper industry, especially as demand for the natural resource increases.[37] Recent trends indicate that government mandates, federal renewable fuel standards, and free-market forces are not only instigating, but also encouraging the transition to renewable energy.[38]

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32. *See, e.g., Large Majorities in U.S. and Five Largest European Countries Favor More Wind Farms and Subsidies for Bio-fuels, but Opinion is Split on Nuclear Power*, HARRIS INTERACTIVE (Oct. 13, 2010), http://media.theharrispoll.com/documents/HI_UK_CORP_ARTICLE_Renewable_Energy.pdf.

33. *See* Sara C. Bronin, *Building-Related Renewable Energy and the Case of 360 State Street*, 65 VAND. L. REV. 1875, 1877 (2012).

34. THOMAS L. FRIEDMAN, HOT, FLAT, AND CROWDED: WHY WE NEED A GREEN REVOLUTION—AND HOW IT CAN RENEW AMERICA 186 (2008).

35. *See Renewable Energy, supra* note 25.

36. *See* Melissa Powers, *Small Is (Still) Beautiful: Designing U.S. Energy Policies to Increase Localized Renewable Energy Generation*, 30 WIS. Int'l L.J. 595, 605-06 (2012); Penny Trussell, *Copper: Solving Society's Challenges*, RIO TINTO: MINES-TO-MARKETS, http://m2m.riotinto.com/issue/3/article/copper-solving-societys-challenges (last visited Mar. 25, 2016).

37. *See* Zolaikha Strong, *Copper Use in Renewable Energy Expected to Increase Dramatically as U.S. Legislates Upgraded Energy Policies*, MINING & POWER MAGAZINE, http:/www.miningandpower-magazine.com/index.php/features/alternative-energy/43-copper-use-in-renewable-energy-expected-to-increase-dramatically-as-u-s-legislates-upgraded-energy-policies (last visited Apr. 4, 2016).

38. *See* Uma Outka, *The Renewable Energy Footprint*, 30 STAN. ENVTL. L.J. 241, 247-48

State-mandated renewable portfolio standards ("RPSs") statutorily impose that power utilities must derive a specified percentage of their energy from renewable sources.[39] States differ in how quickly they should reach this target and what they characterize as a renewable energy source.[40] At least thirty-seven states and the District of Columbia currently mandate some variety of a renewable energy target.[41] Financial motivations, in the form of tax incentives and government subsidies, further promote the production of renewable energy. Following the Energy Policy Act of 1992, the federal government established a "production tax credit," essentially allowing wind and other renewables to be cost-competitive with electricity generated from fossil fuels.[42] Additionally, the U.S. Department of Energy provides a loan guarantee program for renewable energy projects that seek to reduce GHG emissions.[43] In 2014, the Clean Power Plan introduced the ambitious objective of reducing 30 percent of the power sector's carbon emissions by year 2030.[44]

The federal government has influenced the transition to cleaner technology from a regulatory perspective. In an effort to reduce GHG emissions, Congress enacted fleet-wide automobile fuel efficiency standards, referred to as Corporate Average Fuel Economy ("CAFE") standards.[45] In *Massachusetts v. EPA*, the Supreme Court ruled that the EPA has authority to specify CAFE standards.[46] This Supreme Court decision incentivized the production of plug-in and hybrid vehicles.[47] Because there is still demand for large vehicles that do not meet the fuel efficiency standards,[48] automakers must sell more of these "green" vehicles in order to reach the fleet-wide standard of 34.1 miles per gallon by 2016 (i.e., by indirectly offsetting the much less efficient large vehicles).[49]

Free-market advocates suggest that clean energy initiatives will succeed if

(2011).

39. LINCOLN L. DAVIES ET AL., ENERGY LAW AND POLICY: ELECTRICITY REGULATION IN TRANSITION 484 (2015).

40. *Id.* at 484.

41. *Id.* at 140; *see also* Lincoln L. Davies, *State Renewable Portfolio Standards: Is There a "Race" and Is It "To the Top"?*, 3 SAN DIEGO J. CLIMATE & ENERGY L. 3 (2011-12). The geographical prevalence of RPSs illuminates the concept of embracing a contradictory approach to energy policy because both conservative and liberal (i.e., historically "red" and "blue") states have adopted some form of renewable energy mandates. *See* Joshua P. Fershee, *When Prayer Trumps Politics: The Politics and Demographics of Renewable Portfolio Standards*, 35 WM. & MARY ENVTL. L & POL'Y REV. 53, 61 (2010).

42. *See* DAVIES ET AL., *supra* note 39, at 140.

43. *See id.* (noting that pursuant to the Energy Policy Act of 2005, Clean Energy Renewable Bonds are available to finance renewable energy projects in the public sector).

44. *Overview of the Clean Power Plan: Cutting Carbon Pollution From Power Plants*, U.S. ENVTL. PROT. AGENCY FACT SHEET, http://www2.epa.gov/sites/production/files/2014-05/documents/20140602fs-overview.pdf (last visited Mar. 23, 2016).

45. DAVIES ET AL., *supra* note 39, at 548-49.

46. *See Massachusetts v. EPA*, 549 U.S. 497, 513-14, 528 (2007).

47. *Cf. id.*

48. *See* Robert Wright, *Low Fuel Prices Drive US Light Truck Sales*, FINANCIAL TIMES (May 19, 2013, 1:53 PM), http://www.ft.com/cms/s/0/45e4da48-bcf8-11e2-9519-00144feab7de.html#axzz43lpqougX.

49. *See DOT, EPA Set Aggressive National Standards for Fuel Economy and First Ever Greenhouse Gas Emission Levels for Passenger Cars and Light Trucks*, NAT'L HIGHWAY TRAFFIC SAFETY ADMIN. (Apr. 1, 2010), http://www.nhtsa.gov/PR/DOT-56-10.

governments reform their policies.[50] For instance, they argue that competitive markets and performance improvements should drive cost-reductions.[51] As a testament to the free-market, the city of Georgetown, Texas, recently became one of the largest municipally owned utilities in the country powered completely by renewable energy.[52] In early 2015, the city entered long-term agreements – without governmental inference – to acquire the output from a wind farm and two solar plants in rural west Texas.[53] Although environmentalists would certainly commend the city for its transition to emissions-free electricity, economic benefits were the primary reason for the transition to renewable power.[54] Contrary to the argument that renewable energy is more expensive, the city indicated that "the new renewable power contracts. . . [will] provide electricity at a lower overall cost than its previous wholesale power contracts."[55]

Both government mandates and free-market trends compel the broad availability of renewable energy upon the development of new and improved technology. As we adapt to regulate this transition, it is vital to both consider and prepare for the long-term environmental implications that may reverberate from an expanding renewable energy sector.

B. JEVONS PARADOX & THE POTENTIAL ALTERNATIVE-ENERGY "REBOUND EFFECT"

Significant increases in renewable energy development will likely have environmental benefits, but it is crucial to envision the trade-offs associated with such a resource-intensive transition. As one author explained: "Meager alternative-energy schemes won't topple the hulking environmental concerns standing before us."[56] Further, the author contended that "the alternative-energy boomerang, with all of its side effects and limitations, may make matters worse."[57] As the popularity of renewable energy enlarges, the improving "environmental" efficiency and decreasing costs may help facilitate the transition, but will also elicit certain drawbacks.

Jevons Paradox derives from the principle that improvements in the efficiency with which one uses a natural resource, ultimately makes the resource relatively cheaper and subsequently leads to the increased consumption of that resource.[58] The increased demand eventually depletes the resource, resulting

50. *See generally* Jesse Jenkins et al., *Beyond Boom & Bust: Putting Clean Tech on a Path to Subsidy Independence* 7-11 (Apr. 2012), http://thebreakthrough.org/blog/Beyond_Boom_and_Bust.pdf (summarizing suggestions for policy reforms of U.S. clean energy sector).

51. *Id.* at 8.

52. *Georgetown Utility to be Powered by Solar and Wind Energy by 2017*, CITY OF GEORGETOWN (Mar. 18, 2015), https://georgetown.org/2015/03/18/georgetown-utility-to-be-powered-by-solar-and-wind-energy-by-2017/; Daniel Gross, *The Texas Town That Just Quit Fossil Fuels*, SLATE.COM (Mar. 23, 2015, 5:34 PM), http://www.slate.com/articles/business/the_juice/2015/03/georgetown_texas_goes_renewable_why_the_town_is_dropping_fosil_fuels_for.html.

53. *See ibid.*

54. *Id.*

55. *Georgetown Utility to be Powered by Solar and Wind Energy by 2017*, *supra* note 52.

56. OZZIE ZEHNER, GREEN ILLUSIONS: THE DIRTY SECRETS OF CLEAN ENERGY AND THE FUTURE OF ENVIRONMENTALISM 177 (2012).

57. *Id.*

58. Richard York, *Ecological Paradoxes: William Stanley Jevons and the Paperless Office*, 13 HUMAN ECOLOGY REVIEW 143, 143 (2006); David Owen, *The Efficiency Dilemma: If Our*

in negative environmental impacts.[59] Scholars primarily debate the dynamics of increased energy efficiency within a fossil fuel context, such as coal, oil, and natural gas.[60] In contrast, by applying these principles to renewable energy, it is also conceivable that improvements in the efficiency and availability of renewable energy sources will increase the infrastructure needed for the consumption of resources by wind, solar, and hybrid vehicles.[61] This will demand more copper and other raw materials, thus exacerbating and increasing the ecosystem degradation associated with copper mining.[62]

In 1865, an Englishman named William Stanley Jevons published *The Coal Question*. These observations became the foundation for the Jevons Paradox, one of the most widely known phenomenon in the field of ecological economics.[63] He observed that as Great Britain's coal industry improved its efficiency, this facilitated the production of more goods per unit of coal, thus increasing the consumption of this resource.[64] The improved efficiency increased steam engines' popularity, while also intensifying coal's demand.[65] As a result, production and consumption actually expanded because of the decreased price for the resource, despite the perceived benefits of better efficiency.

Moreover, "as efficiency increases, an energy source becomes more affordable and increasingly available to consumers."[66] Because economic growth will continue to surpass gains in energy efficiency, illustrations of the Jevons Paradox appear at both micro- and macro-economic levels.[67] Within the context of the 1970s oil crisis, economist Len Brookes revisited Jevons' observations, referring to the paradox as the "rebound effect."[68] In response to higher oil prices, Brookes argued that by instituting ways to produce more goods with less oil, it would only cause energy consumption to be higher than if one had exerted no

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Machines Use Less Energy, Will We Just Use Them More?, NEW YORKER (Dec. 20, 2010), http://www.newyorker.com/magazine/2010/12/20/the-efficiency-dilemma.

59. ZEHNER, *supra* note 56, at 174.

60. *See generally* DAVID OWEN, THE CONUNDRUM: HOW SCIENTIFIC INNOVATION, INCREASED EFFICIENCY, AND GOOD INTENTIONS CAN MAKE OUR ENERGY AND CLIMATE PROBLEMS WORSE 33-37 (2011); Blake Alcott, *Jevons' Paradox*, 54 ECOLOGICAL ECON. 9 (2005) (surveying scholarly debate on technological efficiency gains), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.233.1718&rep=rep1&type=pdf.

61. *See, e.g.*, ZEHNER, *supra* note 56, at 43-46 (discussing wind power's and solar power's impact on electrical grid).

62. *See* CARTER, *supra* at note 6, at 45.

63. *See* Brett Clark & John Bellamy Foster, *William Stanley Jevons and the Coal Question: An introduction to Jevons's "Of the Economy of Fuel,"* 14 ORG. & ENV'T 93, 95 (2001).

64. *Id.* at 95 (quoting WILLIAM S. JEVONS, THE COAL QUESTION: AN INQUIRY CONCERNING THE PROGRESS OF THE NATION, AND THE PROBABLE EXHAUSTION OF OUR COAL-MINES 140 (3d ed., rev. 1906)) ("It is wholly a confusion of ideas to suppose that the economical use of fuel is equivalent to a diminished consumption. The very contrary is the truth.").

65. ZEHNER, *supra* note 56, at 174.

66. Eric Bonds & Liam Downey, *"Green" Technology and Ecologically Unequal Exchange: The Environmental and Social Consequences of Ecological Modernization in the World-System*, 18 J. OF WORLD-SYS. RES. 167, 170 (2012) (citation omitted).

67. *See* Michael M'Gonigle & Louise Takeda, *The Liberal Limits of Environmental Law: A Green Legal Critique*, 30 PACE ENVTL. L. REV. 1005, 1082 (2013).

68. *See* Steve Sorrell, *Jevons' Paradox Revisited: The Evidence for Backfire from Improved Energy Efficiency*, 37 ENERGY POL'Y 1456, 1456, 1461-63 (2009), http://www.sciencedirect.com/science/article/pii/S0301421508007428.

effort to increase efficiency.[69] As Brookes explained, "if you increase the productivity of anything, you have the effect of reducing its implicit price, because you get more return for the same money – which means the demand goes up."[70]

More recently, Harry D. Saunders suggested that "energy efficiency gains will increase energy consumption above where it would be without these gains."[71] This phenomenon suggests that "increased efficiency lead[s] to a reduction in the price of the services, leading in turn to increased consumption of services[.]"[72] The rebound effect is paradoxical because it "*offsets the benefits* of the initial improvements in efficiency."[73] In fact, scholars suggest that "efficiency gains actually fuel macro-economic growth[.]"[74] For example, since 1975 the efficiency of fuel consumption in the aviation industry has increased by over 40 percent.[75] Yet, with more passenger flights, the resulting increases in efficiency corresponded with a 50 percent increase in fuel consumption.[76] Similarly, as renewable energy becomes more efficient and widespread, an intensified demand for copper – as well as the increased consumption and depletion of this natural resource – will likely accompany any future growth in the "clean" energy sector.

From a macro-economic perspective, efficiency savings actually increase energy consumption, "leaving overall energy footprints unchanged or even larger."[77] The relationship between consumption and production becomes a positive feedback, leading to the overexploitation of natural resources. This intensifies the environmental consequences of pollution and resource depletion across the globe. In regards to renewable energy's dependence on copper, the world's largest copper mines are overexploited, and many have already reached the peak level of resource output.[78] The ramifications are immense, particularly because "global consumption of copper has soared in recent years. . . and every leading producer has struggled to keep up with demand."[79] Resounding regulatory implications will likely become more apparent, as mining companies must resort to seeking profits in politically-volatile and environmentally-sensitive areas of the world.[80]

III. COPPER IN RENEWABLE ENERGY

Copper is vital to the proliferation of renewable energy regimes. In comparison to traditional fossil fuels, renewable energy technologies use much more

69. *Id.* at 1461.
70. Owen, *supra* note 60, at 112.
71. *Id.* (citation omitted).
72. Bronin, *supra* note 33, at 1887 n.47.
73. *Id.* (emphasis added).
74. M'Gonigle & Takeda, *supra* note 67, at 1083.
75. *Id.*
76. *Id.*
77. ZEHNER, *supra* note 56, at 175; *see also id.* at 173 (explaining that "increasing alternative-energy production will not displace fossil-fuel side effects but will instead simply add more side effects to the mix").
78. *See* KLARE, *supra* note 11, at 10.
79. *Id.*
80. *Id.* at 10-11.

copper.[81] "The use of copper helps reduce CO_2 emissions and lowers the amount of energy needed to produce electricity[.]"[82] Industry-wide attempts to promote energy efficiency will also implicate copper because of its cost-effectiveness and conductivity.[83] The interconnected relationship intertwined in copper mining, renewable energy, and environmental law further emphasizes the contradictory nature of the water-energy nexus. Despite the benefits of copper within the realm of solar, wind, and other "green" technologies,[84] it is important to recognize the environmental tradeoffs associated with this transition. This reality presents formidable challenges: "Humankind faces a vicious circle: a shift to renewable energy will replace one non-renewable resource (fossil fuel) with another (metals and minerals)."[85]

According to a mining company executive, "increasing environmental awareness is another emerging demand driver for copper,"[86] This occurs because the industry believes that increasing renewable energy production "presents an upside for copper demand[.]"[87] As the capacity for renewable energy production increases, so too will an additional global demand for raw materials, and often in significant quantities. In fact, over the next forty years, researchers acknowledge an impending five to eighteen percent annual increase of the global production of copper and steel.[88] As the exponential demand for these base metals continues, scientists warn that "if this trend continues, the quantity of metal production for the next 15 years will need to match that from the start of humanity to 2013."[89] To match the present capacity of fossil fuels, solar and wind facilities will require up to fifty times more iron, copper, and glass, as well as ninety times more aluminum.[90]

Although copper is technically recyclable, it is not inherently recyclable when it is sequestered over the lifespan of renewable energy infrastructure.[91] The construction and continuous maintenance of renewable energy infrastructure requires large quantities of raw materials.[92] From an economic perspective, these base metals have no substitutes.[93] Before considering the potential ramifications of increased copper production, it is imperative to recognize the relationship between copper and renewable energy.

A. ELECTRIC & HYBRID VEHICLES

Recent market trends suggest that sales of electric and hybrid vehicles will

81. *See* Bobby Magill, *Study: Renewables as Green as You'd Expect,* CLIMATE CENTRAL (Oct. 7, 2014), http://www.climatecentral.org/news/study-renewables-as-green-as-youd-expect-18146.
82. *A 21st Century Solution, supra* note 28.
83. *Id.*
84. *See* Magill, *supra* note 81.
85. Vidal et al., *supra* note 16, at 894.
86. Trussell, *supra* note 36.
87. *Id.*
88. *See* Vidal et al., *supra* note 16, at 896 (Figure 2).
89. *Id.*
90. *Id.*
91. *See id.*
92. *See id.*
93. *Id.*

continue to increase, both in the United States and abroad.[94] In comparison to traditional fuel-burning vehicles, each hybrid car contains approximately twice as much copper.[95] Hybrid vehicles, primarily within their electrical cables and motor, may require up to one hundred pounds of copper.[96] Copper's robust conductivity will likely ensure that it remains an integral part of the electric vehicle industry, especially in comparison to suggested alternatives like aluminum.[97] As the market for "green" vehicles advances to maintain a larger role in the automotive industry, additional increases in copper demand and extraction of these raw materials will assuredly flank any supposed environmental gains.

Martin Eberhard, co-founder of Tesla Motors,[98] championed the relationship between copper and electric vehicles: "The electric car is a key to our energy independence and our future. We expect copper to continue to lead the way for our high-performance electric automobiles."[99] Through 2014, U.S. consumers have purchased over a quarter million "plug-in" electric vehicles.[100] Even alternative forms of mass transportation demand substantial quantities of copper. The average electric trolley, bus, or subway car contains over 2,000 pounds of copper.[101] In addition, China may be a "sleeping giant" in the electric vehicle market.[102] This trend is likely to implicate copper production, particularly as China expects to have more vehicles on the road than the United States within the next decade.[103] As regulations that seek to reduce carbon emissions continue to permeate the energy[104] and automobile sectors,[105] the stage may be set for a showdown between those advocating for an increase in electric vehicles, and those protesting the environmental impacts of copper mining.

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94. *See* Ben Geier, *Electric Vehicle Sales Charged Up in 2014*, FORTUNE.COM (Jan. 8, 2015), http://fortune.com/2015/01/08/electric-vehicle-sales-2014/; Zachary Shahan, *Electric Car Sales in EU Increase 77%*, CLEAN TECHNICA (Aug. 8, 2014) (showing robust electric car sales robust in the European Union, particularly in France, Germany, and Norway), http://cleantechnica.com/2014/08/08/electric-car-sales-eu-increase-77/.

95. Harpreet Bhal, *Glimmer of Hope for Copper from Europe Green Energy Target*, REUTERS (Aug. 29, 2012) (citation omitted), http://in.reuters.com/assets/print?aid=INL6E8JL7QP20120829 ("Each hybrid car contains roughly 34 kg [75 lbs.] of copper versus 19 kg [42 lbs.] in the average fuel-burning car[.]").

96. *See* Patrick Michaels, *The Environmental Protection Agency Comes-a-Copper*, FORBES (May 12, 2011) http://www.forbes.com/sites/patrickmichaels/2011/05/12/the-environmental-protection-agency-comes-a-copper/print/.

97. *Id.*

98. Chuck Squatriglia, *Tesla's Founder Sues Tesla's CEO*, WIRED (June 11, 2009), http://www.wired.com/2009/06/eberhard/.

99. *Tesla Electric Roadster - Powered by Copper*, COPPER DEV. ASS'N (2007), http:/www.copper.org/publications/newsletters/discover/2007/winter/article.html.

100. Jeff Cobb, *Global Plug-in Car Sales Now Over 600,000*, HYBRIDCARS (Oct. 22, 2014), http://www.hybridcars.com/global-plug-in-car-sales-now-over-600000/.

101. *See Copper in Your Car – Even Hybrids!*, COPPER MATTERS, http://coppermatters.org/copper-powers-electric-cars/ (last visited Mar. 25, 2016).

102. Jim Motavalli, *For the Electric Car, A Slow Road to Success*, YALE ENV'T 360 (Jan. 26, 2012), http://e360.yale.edu/feature/for_the_electric_car_a_slow_road_to_success/2488/.

103. *Id.*

104. *See Clean Power Plan, Regulatory Actions*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/cleanpowerplan/regulatory-actions (last updated Feb. 11, 2016).

105. *See Transportation and Air Quality, Regulatory Actions*, U.S. ENVTL. PROT. AGENCY, https://www3.epa.gov/fueleconomy/regulations.htm (last updated Feb. 23, 2016).

B. WIND FARMS & SOLAR INSTALLATIONS

Wind farms, consisting of multiple turbines across vast expanses, require enormous amounts of copper.[106] One scholar summarized this aberration as follows: "Wind is renewable. Turbines are not."[107] In fact, a single wind turbine requires approximately two tons of total copper within its generator and transformer.[108] Since 1980, wind energy's cost has fallen eighty percent, a decline that has continued as wind energy technology becomes more efficient.[109] From a policy perspective, it is important to consider the implications of escalating copper production that will accompany these advances in wind technology.

According to one study that examined copper usage intensity in the U.S. renewable energy sector, "land-based wind 'farms'. . . require between 5,600 and 14,900 pounds of copper per megawatt (lb/MW)."[110] Similarly, the infrastructure required to facilitate photovoltaic solar installations also requires significant quantities of copper.[111] In comparison, the copper usage intensity of electricity generation from renewable energy sources may be four to six times higher than that of fossil fuels.[112] To generate and distribute electricity, wind and solar farms require electrical conduits in the form of copper wiring that often stretches over vast distances.[113] The basic schematics of wind farms are indicative of further increases in the demand for copper. For instance, a wind farm in Sweetwater, Texas, consumes over one hundred miles of copper wire to maintain and generate electricity from its sixty-one turbines.[114]

Wind farms have two obvious requirements: a sufficient supply of moving air, and expansive areas necessary to sustain a large number of these massive turbines.[115] Because turbines must be sufficient distances apart from one another, these wind farms can spread across expanses up to fifty square miles.[116] Almost every feature in a wind farm implicates copper. The turbine for the Sweetwater wind farm has a copper-wound transformer that uses at least 47,500

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106. *See* Copper Dev. Ass'n, *Copper's Role in Wind Generation,* COPPER ALL., http://www.copper.org/environment/sustainable-energy/pdf/CDA-Wind-Infographic.pdf (last visited Mar. 26, 2016).

107. ZEHNER, *supra* note 56, at 42.

108. *See supra* note 106.

109. *See Copper and Wind Energy: Partners for a Clean Environment: Austin Utility Emphasizes Alternative Energy Sources,* COPPER DEV. ASS'N, 2 [hereinafter *Copper and Wind Energy*], http://www.copper.org/environment/sustainable-energy/renewables/wind/case-studies/a6101/wind_energy_a6101.pdf (last visited Mar. 26, 2016).

110. BBF Associates & Konrad J.A. Kundig, *Market Study: Current and Projected Wind and Solar Renewable Electric Generating Capacity and Resulting Copper-Demand* (July 20, 2011), http://www.copper.org/environment/sustainable-energy/renewables/education/Projected-wind-solar-copper-demand.pdf.

111. *Id.* (footnote omitted) (noting intensity for solar installations is between 5,400 to 15,432 lb/MW).

112. *Copper: Essential in PV Solar Power Growth,* COPPER DEV. ASS'N, http://www.copper.org/environment/sustainable-energy/pdf/CDA-Solar-Infographic.pdf (last visited Mar. 26, 2016).

113. *See* CARTER, *supra* note 6, at 45.

114. *Id.*

115. *See Copper and Wind Energy, supra* note 109, at 2.

116. *Id.* at 2; *see id.* ("To minimize aerodynamic interference, individual turbines can be spaced as widely as five to nine rotor diameters apart in the prevailing wind direction and three to five diameters apart in the perpendicular direction.").

linear feet of copper cable.[117] Moreover, that same turbine also has a grounding system and conductors bonded to its tower that use an additional 30,000 linear feet.[118] Astonishingly, the Sweetwater wind farm utilizes "more than *35 miles of copper* low-voltage and grounding cable and more than *67 miles of copper* in the neutral conductors of high-voltage power cable."[119] These substantial figures do not even account for the copper sequestered by the turbines and transformers.[120]

The Copper Development Association also suggests that the metal is a "key component of solar energy systems, increasing the efficiency, reliability and performance of photovoltaic cells and modules."[121] Often covering expansive fields, solar panel installations also require substantial amounts of copper cabling to connect the modules and arrays with the system.[122] The demand for copper will likely increase with recent advances in wholesale distributed generation, a concept that functions to connect large-scale solar projects with the energy-distribution grid.[123]

C. "SMART" GRIDS & ENERGY-STORAGE TECHNOLOGY

Copper supports the integration, storage, and distribution of renewable energy.[124] As the technology for grid-storage applications evolves, this may address challenges with intermittency.[125] In other words, energy storage is vital to the "smart" electricity grid, particularly because it is essential to the transmission and distribution of electricity derived from renewable energy.[126] Energy-storage schemes also address the challenge of coordinating an off-peak energy supply, derived from wind and solar energy, with an on-peak energy demand.[127] To connect energy-storage applications with the electric grid, these installations require an array of copper-dependent equipment.[128] The copper demand of these energy storage installations varies based on size and configuration.[129] Although the exact copper content fluctuates among various power transformers, breakers, generators, inverters, grounding wires, and monitoring systems – it is important to consider that, in the aggregate, extensive energy-storage applications will require significant quantities of copper.[130]

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117. *Id.* at 3.
118. *Id.*
119. *Id.*
120. *Id.*
121. *Copper: Essential in PV Solar Power Growth, supra* note 112.
122. *See id.*
123. *See* KEMA, INC., *Market Evaluation for Energy Storage in the United States*, COPPER DEV. ASS'N, at 5-6, 6-4 (Jan. 2012), http://www.copper.org/about/pressreleases/pdfs/kema_report.pdf.
124. *See id.* at 1-6, 6-4.
125. *Id.*
126. *Id.*, at 2-1, 2-7.
127. *Id.*, at 2-7.
128. *Id.*, at 1-4, 1-5.
129. *See id.* at 3-4.
130. *See id.* at 3-4, 3-5.

IV. COPPER'S UTILITY & DESTRUCTION

A. THE UBIQUITOUS HISTORY OF COPPER

Predating written history, the story of copper is one of ubiquity throughout the history of mankind. In fact, human civilizations first used copper almost eight thousand years before the events in the Bible.[131] The Egyptians, Greeks, and Romans all mined for copper, as did the Incas.[132] Even the Native Indians of North America recognized the benefits of copper, as they began utilizing the metal as early as 6000 BCE[133] Described as the "perfect metal," copper is conductive, malleable, recyclable (to a limited extent), and does not decay or rust.[134]

Because of copper's low price, coupled with its high electrical and thermal conductivity, the metal continues to maintain a fundamental role in the modern era.[135] Today, copper is vital to the transport of electrical current, a utility that represents a majority of the metal's yearly demand.[136] Electrical applications of copper includes wiring in buildings, vehicle motors, and appliances, as well as industrial and utility power cables, transmission lines, and transformers.[137] Even the human body depends on balancing the proper amount of copper within our blood and circulatory system.[138] As we seek to embrace the contradiction within the water-energy nexus, maybe the human body best illustrates a framework for sustainability – the body dies without copper, yet the body also dies with too much copper.[139]

As civilization progresses, technological advancements will require vast quantities of raw materials derived from copper mining.[140] This transition to renewable energy will implicate an extensive supply of copper and other minerals.[141] The planet's rapidly increasing population only compounds this challenge.[142] As the nation's energy landscape embarks on this transition, "[t]he switch from the finite store of fossil fuels to renewable sources could involve a huge additional demand for the world's equally finite store of metals and minerals."[143]

131. *See* CARTER, *supra* note 6, at 34; *see also id.* ("[T]he Bible has twenty-seven references to copper, most of which depict God encouraging his people to live a better life in the pursuit of the ore." "*Urudu*, the Sumerian word for the Euphrates, literally translates as 'copper river.'").

132. *Id.*

133. *See id.*

134. *Id* at 32-33 (noting copper's malleability allows people to work copper into its desired shape without ever losing its chemical integrity).

135. *See* Rui Namorado Rosa, *Copper: The Near-Peak Workhorse* 97, *in* BARDI, *supra* note 18, at 97.

136. *See id.*; Trussell, *supra* note 36.

137. *See* Trussell, *supra* note 36.

138. CARTER, *supra* note 6, at 35. Copper also helps the absorption of iron, the nervous and circulatory systems, and the development of muscle and bone. *Id.*

139. *See id.*

140. *Id.* at 46.

141. *See id.* (discussing need for zinc, cobalt, and iron).

142. *See* Dennis Dimick, *As World's Population Booms, will its Resources be Enough for Us?*, NAT'L. GEOGRAPHIC (Sept. 21, 2014), http://news.nationalgeographic.com/news/2014/09/140920-population-11billion-demographics-anthropocene/ (projecting world population will be 9.6 billion by 2050).

143. Radford, *supra* note 1.

B. "PEAK" COPPER

Despite extracting prodigious amounts of copper throughout the annals of civilization, copper production continues to increase, and we are currently producing more than ever.[144] Between 1956 and 2012, estimated global usage of refined copper has increased from approximately four to twenty-one million metric tons per year.[145] Scientists emphasize that the global production of copper, the "Near-Peak Workhorse,"[146] "will increase until demand cannot be met from much-depleted deposits[,] [and] [a]t that point, *production will peak and eventually go into decline.*[147] This had previously occurred with U.S. oil production in the beginning of the 1970s."[148] Driven by economics, geology, and technology, one copper model projects that production of the finite resource will peak by the year 2040.[149]

As a non-renewable mineral resource, copper ores are inherently finite and exist in limited quantities.[150] During the last half-century, copper production has substantially increased at an annual rate of 2.3 percent.[151] In fact, the global copper market has expanded by thirty percent in the last decade.[152] Although one may recycle copper, "the amount of copper that can be recycled at a certain moment depends on the amount of copper that was put into use decades ago[.]"[153] Researchers predict that recycled copper will only have a minor impact within the growing world economy, suggesting that the mining industry will seek to develop new deposits to meet increasing demand.[154]

Despite increases in production, there are signs of copper's eventual depletion.[155] Most notably, the rate of copper extraction has exceeded the rate of new copper discoveries over the past two decades.[156] Not only have new important copper discoveries been limited, but only a fraction of the world's largest copper mines possess the capability for expansion.[157] Further complicating matters is the fact that copper mining is also becoming more expensive and less profitable

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144. *See* Rosa, *supra* note 135, at 97.

145. Int'l Copper Study Grp., *The World Copper Factbook 2014*, at 39 (2014), http:/copperalliance.org/wordpress/wp-content/uploads/2012/01/ICSG-Factbook-2014.pdf.

146. Rosa, *supra* note 135, at 97.

147. Kerr, *supra* note 7, at 723 (emphasis added).

148. *Id.*

149. *Id.; see also id.* 723-24 (projecting that increasing copper production fifty percent would push the peak to 2045 while quadrupling production would push the peak to 2075); *see also* Tommy Humphreys, *Peak Copper*, MINING.COM (Apr. 8, 2014), http://www.mining.com/web/peak-copper/ (discussing model's projections and its implications for mining projects).

150. *See* Rosa, *supra* note 135, at 97.

151. *Id.*

152. Trussell, *supra* note 36.

153. J.H.M. Harmsen, A.L. Roes & M.K. Patel. *The Impact of Copper Scarcity on the Efficiency of 2050 Global Renewable Energy Scenarios*, 50 ENERGY 62, 72-73 (2013); *see also id.* at 67 (explaining copper recycling).

154. *See id.* at 72-73.

155. *See* Rosa, *supra* note 135, at 98.

156. *Id.*

157. *Id.* (footnote omitted) ("[W]hile the search for new resources has led to a remarkable growth of the known reserves, the reserves-to-production (R/P) ratio has remained close to 30 years of supply.").

primarily because of the declining mineral grades of extractable copper.[158] The copper reserves in many countries have either reached (or are close to reaching) peak production, including those in the United States, Canada, Russia, Zambia, and Zaire.[159]

C. SURFACE WATER CONTAMINATION FROM COPPER MINING

The mining industry has powered our nation's economy, while also dramatically transforming our landscape. Because renewable energy requires substantial amounts of copper, the increased copper demand will result in more open-pit mines, both domestically and internationally.[160] In effect, these mining processes will also instigate a myriad of destructive effects on the environment.[161] Copper mining depletes the non-renewable resource, degrades ecosystems, and yields vast carbon emissions.[162] Although mining technology has improved, "[a]ny process intended to extract a kilogram of metal locked in a ton of rock buried hundreds of meters down inevitably raises issues of energy and water consumption, [and] pollution[.]"[163].

The production of raw materials by the mining industry consumes almost ten percent of the global energy budget.[164] Each stage of the mining process requires energy, including the extraction, beneficiation, smelting, and refining stages.[165] As copper demand intensifies, so too will global mining efforts, increasing both energy expenditures and carbon emissions.[166] The problem becomes magnified if the mining industry seeks to augment production by extracting lower-grade ore.[167] As the higher-quality, more accessible metals become depleted, this will lead to an increasing energy requirement for production.[168] Lower-graded mineral deposits require more energy to extract.[169] In an economic context, lower-graded minerals have a comparatively-high energy requirement, and a lower energy-return-on-investment ("EROI").[170] Copper scarcity exacerbates these dynamics by lowering EROI values – complicating the ability for copper-dependent industries to form long-term strategies based on a predictable mineral availability.[171]

The amount of toxic waste generated across the various stages of the copper mining process is staggering.[172] In comparison to other heavy metals, copper is

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158. *Id.*
159. *See id.* at 100 (noting that Chile, Peru, Australia, Mexico, and Poland appear to not be close to reaching peak copper production).
160. *See* CARTER, *supra* note 6, at 45.
161. *Id.*
162. *See id.*
163. Kerr, *supra* note 7, at 724.
164. BARDI, *supra* note 18, at 114.
165. *Id.*
166. *See id.*; CARTER, *supra* note 6, at 45.
167. BARDI, *supra* note 18, at 115.
168. *Id.* at 115-16; *see also* Harmsen et al., *supra* note 153, at 63-64.
169. BARDI, *supra* note 18, at 116.
170. *See* Harmsen et al., *supra* note 153, at 62-63.
171. *See id.*
172. *See* CARTER, *supra* note 6, at 45; *see also* Andrew Brooks, *Tribal Sovereignty and Resource Destiny: Hydro Resources, Inc. v. U.S. EPA*, 88 DENV. U. L. REV. 423, 424 (2011) (discussing chemical use involved in mineral extraction by in-situ leaching).

among the most toxic in its effect on freshwater and marine species.[173] Each stage in the aforementioned mining process also produces waste.[174] For instance, the mining industry must extract almost three billion tons of total rock and waste to produce fifteen million tons of copper.[175] Surface-mining is a process that removes rock and minerals from an open-pit until the mineral resource is exhausted.[176] As one author explains, "[w]hen they begin to strip the earth. . . [u]tter destruction of what was there is the only possible outcome."[177] In terms of surface degradation, 156 hard-rock mining "Superfund" sites existed in the United States in 2012.[178] In Dr. D. Kirk Nordstrom's succinct formulation, "[d]eaths of fish, rodents, livestock, and crops have resulted from mining activities. . . since the days of the Greek and Roman civilizations."[179] An expert hydrologist in the field of mine water geochemistry, he described the challenges associated with the Superfund designation: "[R]emediation of large inactive mine sites. . . has proven to be extraordinarily difficult, complex, and expensive, not to mention litigious."[180]

Environmental groups actively oppose large-scale mining projects because of pollution to both surface water and groundwater supplies.[181] At the same time, these groups often support a reduction in carbon emissions in an effort to mitigate climate change.[182] This conflict has become more aggravated because "*[w]ind and solar energy require massive amounts of copper, which means more open-pit mines.*"[183]

D. INTERNATIONAL ENVIRONMENTAL RAMIFICATIONS OF RISING COPPER DEMAND

International copper demand will likely increase, as countries like China and India continue to industrialize, expand their respective power grids, and develop massive infrastructure projects.[184] In addition, societal and technological improvements within countries in the periphery further influence the global demand for copper.[185] As third-world countries industrialize and become more-developed, corresponding infrastructure developments will implicate significant quantities of copper.[186] Nevertheless, renewable energy technologies require an

173. David A. Wilkinson, *Using Section 404(c) of the Clean Water Act to Prohibit the Unacceptable Environmental Impacts of the Proposed Pebble Mine*, 2 SEATTLE J. ENVTL. L. 181, 188 (2012).

174. *See* BARDI, *supra* note 18, at 178.

175. *See id.* at 176.

176. *See* Surface Mining Control and Reclamation Act, 30 U.S.C. § 1291(28)(A) (2012) (defining "surface coal mining operations" under the act).

177. CARTER, *supra* note 6, at 45.

178. *Id.* at 44.

179. D. Kirk Nordstrom & Charles N. Alpers, *Negative pH, Efflorescent Mineralogy, and Consequences for Environmental Restoration at the Iron Mountain Superfund Site, California*, 96 PROCEEDINGS NAT'L ACAD. SCIS. 3455, 3455 (1999).

180. *Id.* at 3461.

181. *See id.* at 45.

182. *See id.*

183. *Id.* (emphasis added).

184. *See id.* at 94-95; Trussell, *supra* note 36.

185. *See* Trussell, *supra* note 36.

186. *See id.*

extensive copper supply,[187] which "may also produce further environmental degradation, violence, and social disruption" in these less-developed countries.[188]

Globally, mining for copper and other metals has resulted in significant environmental degradation, in both developed[189] and developing countries.[190] For example, in West Papau, Indonesia, the Grasberg gold and copper mine contributes prodigious quantities of water pollutants into local rivers.[191] As the pollution flows into sensitive wetlands and estuaries, the mine waste is correlated with extensive fish mortalities.[192]

Large-scale mining operations, particularly in less-developed countries, often implicate violence and human rights violations because of conflicts derived from extreme divisions of wealth.[193] Even more atrocious, in an effort to protect mining production at the Grasberg mine, the Indonesian military "has been accused of rapes, extrajudicial killings, and other human rights abuses to suppress the resistance of communities living near the mine."[194] In the Democratic Republic of Congo, the government and a mining company allegedly orchestrated arrests, tortures, and massacres of over one hundred individuals involved in an anti-mining uprising in the city of Kilwa.[195] Similarly, the Peruvian government used violence to forcibly remove citizens from land on the site of the Tintaya copper mine.[196]

Most alarmingly, these water pollution disasters have taken place closer to U.S. borders. More recently, defective "tailings" ponds at the Buenavista del Cobre copper mine in Sonora, Mexico, released over ten million gallons of toxic chemicals into the Bacanuchi River, a tributary of the Sonora River.[197] This 2014 event left approximately twenty-five thousand people without clean water, ruining crops, and contaminating the aquatic ecosystem with extensive heavy metals.[198]

Although it is certainly inferential to suggest that more renewable energy will directly result in these atrocities — something which this paper does not purport to do — one should not ignore the potential for an increased copper demand to exacerbate violence and ecosystem destruction, particularly in regards to energy regulatory schemes.

187. *See* CARTER, *supra* at note 6, at 45.
188. Bonds & Downey, *supra* note 66, at 168.
189. *See* Kerr, *supra* note 7, at 724.
190. *See* Bonds & Downey, *supra* note 66, at 180-81.
191. *Id.* at 177.
192. *Id.*
193. *See id.* at 180-81.
194. *See id.* at 177 (citation omitted).
195. *See id.* at 178.
196. *See id.* at 177-78.
197. Nathaniel Parish Flannery, *Mexican Mining Giant Faces Criticism After Chemical Spill Near U.S. Border*, FORBES (Sep. 29, 2014, 7:46 AM), http://www.forbes.com/sites/nathanielparishflannery/2014/09/29/mexican-mining-giant-faces-criticism-after-chemical-spill-near-u-s-border/ (noting mine is located along the Mexico-Arizona border).
198. *See id.*

V. PEBBLE MINE, ALASKA: THE REGULATORY INTERSECTION OF RENEWABLE ENERGY AND ENVIRONMENTAL LAW

As renewable energy solidifies its role in the U.S. energy portfolio,[199] it is necessary to question where all this copper will come from and whether there will be enough. Illustrating this conundrum, the Pebble Mine conflict perfectly symbolizes the need to embrace contradictions in an effort to solve challenges along the water-energy nexus. Located in southwest Alaska, the controversial Pebble deposit lies adjacent to Bristol Bay, the world's largest sockeye-salmon fishery.[200] Described as "the largest known untapped copper deposit in the world," Pebble Mine's potential impacts on the surrounding ecosystem demonstrates a "classic resource war."[201] As the renewable energy sector expands, Pebble Mine entails a certain dilemma for environmentalists who must determine whether mining this copper deposit is worth the potential damage to a productive (and definitively sustainable) commercial salmon fishery. And if the trade-off is not palatable, can we administer a solution that meets our future energy demands without devastating these economically valuable ecosystems that many claim to protect?

A. PEBBLE MINE'S SUBSTANTIAL COPPER DEPOSIT

For the past decade, Northern Dynasty Minerals Ltd. has planned to eventually seek permits that propose the development of Pebble Mine, one of the world's largest deposits of copper, gold, and molybdenum.[202] After years of exploration and feasibility studies, the mining operation, known as the Pebble Partnership ("PLP"), has initiated the long process of obtaining the applicable state and federal permits for the project.[203] The deposit contains an estimated 80.6 billion pounds of copper, 5.6 billion pounds of molybdenum, and 107.4 million ounces of gold.[204] The total value of the deposit ranges from $100 billion to $500 billion.[205]

According to PLP, development of Pebble Mine "could help power our nation's green energy initiatives."[206] As justification for its intent to mine the Pebble deposit, and despite the region's ecosystem-sensitivity,[207] PLP references the important role of copper within wind farms, solar panels, and electric cars

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199. *See* Jocelyn Durkay, *State Renewable Portfolio Standards and Goals*, NAT'L CONFERENCE OF STATE LEGISLATURES (Mar. 23, 2016), http://www.ncsl.org/research/energy/ renewable-portfolio-standards.aspx ("States have been active in adopting or increasing renewable portfolio standards, and 29 states now have them.").

200. Warrick, *supra* note 27.

201. Svati Kirsten Narula, *Is Alaska's Pebble Mine the Next Keystone XL?*, ATLANTIC (Mar. 14, 2014), http://theatlantic.com/politics/archive/2014/03/is-alaskas-pebble-mine-the-next-keystone-xl/284251.

202. *Id.*

203. *Plan*, PEBBLE P'SHIP, http://www.pebblepartnership.com/plan.html#section-timeline (last visited Mar. 31, 2016).

204. *Geology: The Deposit*, PEBBLE P'SHIP, http://www.pebbleparnership.com/geology.html #section-deposit (last visited Mar. 31, 2016).

205. *See* Edwin Dobb, *Alaska's Choice: Salmon or Gold*, NAT'L GEOGRAPHIC (Dec. 2010), http://ngm.nationalgeographic.com/print/2010/12/bristol-bay/dobb-text.

206. *What is the Pebble Mine?*, PEBBLE P'SHIP, http://www.pebblepartnership.com (last visited Mar. 31, 2016).

207. *See* Warrick, *supra* note 27.

as a benefit of mining the Pebble deposit.[208] Moreover, PLP argues that this domestic mining operation "has the potential to meet approximately 33% of U.S. annual copper needs for many years."[209] PLP asserts that this operation would promote resource independence, while also reducing the financial and environmental costs of transporting raw materials from foreign sources.[210] According to PLP, any projected growth in the renewable energy sector will also demand an increase in copper production.[211] Without the extraction of additional raw materials, PLP noted that an escalating copper price could detract from the cost-effectiveness of wind energy or electric vehicles.[212] In addition to potentially decreasing the carbon footprint, PLP believes that developing Pebble Mine would also provide many jobs and wealth to local communities.[213]

From a logistical perspective, operations at Pebble Mine will likely require an extensive open-pit mine in the east reaches of the deposit complemented by an equally substantial underground mine on the deposit's eastern edge.[214] The open-pit mine may reach depths of two thousand feet and cover expanses of almost two square miles.[215] The underground mine could extract minerals from depths of up to five thousand feet.[216] Extracting ore from Pebble Mine will require considerable infrastructure during the mine's lifespan of at least twenty-five years.[217] The operation will likely need multiple dams to store toxic mine "tailings," with *each* embankment attaining heights over seven hundred feet and stretching three linear miles.[218] Additional infrastructure requirements will likely include pipelines, deep-water ports, roads, power plants, mills, various stream diversions, and transmission lines.[219] As a porphyry copper deposit, the extracted ore will contain less than one percent copper by volume.[220] This compounds the environmental implications because the mining process at Pebble Mine will likely yield an estimated ten billion tons of excess rock and waste in the massive "tailings" reservoirs.[221]

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208. *See Why Mine?: Green Technology,* PEBBLE P'SHIP, http://www.pebblepartnership.com/why.html (last visited Mar. 31, 2016).

209. *See Why Mine?: Resource Independence,* PEBBLE P'SHIP, http://www.pebblepartnership.com/why.html (last visited Mar. 31, 2016).

210. *Id.*

211. *Id.*

212. *Id.*

213. *See Why Mine?: Jobs,* PEBBLE P'SHIP, http://www.pebblepartnership.com/why.html (last visited Mar. 31, 2016).

214. Wilkinson, *supra* note 173, at 188.

215. *Id.*

216. *Id.*

217. *Id.*

218. *See id.*; *see also* Geoffrey Y. Parker et al., *Pebble Mine: Fish, Minerals, and Testing the Limits of Alaska's "Large Mine Permitting Process,"* 25 ALASKA L. REV. 1, 12–14 (2008).

219. *See* Parker et al., *supra* note 218, at 12-14; Wilkinson, *supra* note 173, at 188.

220. *See Geology,* PEBBLE P'SHIP, http://www.pebblepartnership.com/geology.html#section-deposit (last visited Mar. 31, 2016).

221. *See* Andrew Burger, *Copper, Salmon and Healthy Waters: EPA Puts a Halt to Pebble Mine Project,* TRIPLE PUNDIT (Mar. 3, 2014), http://www.triplepundit.com/2014/03/copper-salmon-healthy-waters-epa-puts-halt-pebble-mine-project/.

B. POTENTIAL DEVASTATION TO SALMON SPAWNING TRIBUTARIES

Given its proximity to Bristol Bay, the potential ecological impact of an extensive mining operation has elicited headlines such as "Is Alaska's Pebble Mine the Next Keystone XL?"[222] Perhaps the headline should instead read: "Is Alaska's Pebble Mine the *Renewable Energy Version* of the Keystone XL?"[223] The proposed Pebble Mine's location is in close proximity to the Kvichak and Nushagak rivers' major salmon spawning tributaries, an alarming location because of the region's hydrologic connectivity.[224] The Bristol Bay watershed maintains the largest commercial sockeye salmon fishery in the world.[225] This commercial salmon fishery yields an estimated $120 million in annual revenues, an economic benefit that if managed correctly, will generate considerable income in perpetuity.[226] The large-scale mining endeavor has potential to leach toxic metals into ground and surface waters, threatening this sustainable resource.[227]

Because of its incredible genetic biodiversity, the sockeye salmon population in this region maintains its commercial productivity.[228] Sockeye salmon are anadromous, meaning they are born in freshwater rivers before spending a majority of life at sea, at which point they then return to their freshwater origins to spawn and die.[229] The genetic biodiversity of the population reduces the year-to-year variability of the number of salmon returning to freshwater, thus ensuring that the ecosystem retains its vitality.[230] The watershed also has cultural significance, providing native villages with subsistence resources, while also supporting remarkable opportunities for recreational hunting and fishing.[231] Another cause for concern is the seismically-active nature of the region and the potentially destructive effects of an earthquake to the embankments.[232]

The Pebble Mine conflict has divided Alaskans along unusual party lines. In 2010, an unlikely alliance of commercial fishermen, native tribes, environmentalists, "Redneck Republicans," and worried Alaskans, embraced their sometimes contradictory interests in an effort to resolve a challenge at this contentious intersection of the water-energy nexus.[233] These groups requested that the EPA preliminarily review Pebble Mine's potential ecological impacts.[234] In what has been the source of much litigation, the EPA drafted a report entitled *An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol*

222. Narula, *supra* note 201.
223. *See id.*
224. Wilkinson, *supra* note 173, at 182-83.
225. *Id.* at 183.
226. *See* Dobb, *supra* note 205.
227. Wilkinson, *supra* note 173, at 183.
228. Ray Hilborn et al., *Biocomplexity and Fisheries Sustainability*, 100 PROCEEDINGS NAT'L ACAD. SCIS. 6564, 6564 (2003).
229. *See id.* at 6565.
230. *Id.* at 6567; Daniel E. Schindler et al., *Population Diversity and the Portfolio Effect in an Exploited Species*, 465 NATURE 609, 609 (2010).
231. Id. at app. 1.
232. *Seismic Risk at the Pebble Mine*, OUR BRISTOL BAY, http://www.ourbristolbay.com/fact_sheets/Seismic.pdf (last visited Apr. 1, 2016).
233. Narula, *supra* note 201.
234. *Id.*

Bay, Alaska ("Assessment") to predict the impacts of a hypothetical copper mine in the region[235]

The controversy centers on whether the economic benefits of copper production ultimately outweigh the possible negative costs to Bristol Bay.[236] Many Alaskans are concerned with the fact that Pebble Mine would be the largest mining operation ever attempted in the state because it is "in a place where all the water is interconnected and the well-being of the world's largest salmon run depends on the whole ecosystem remaining intact."[237] These potential environmental implications may be an indirect consequence of the renewable-energy rebound effect[238] and associated increases in copper production.[239] An overarching regulatory approach that chooses between salmon or renewable energy largely misses the point of natural resource management. Instead, the solutions to present and future challenges within the water-energy nexus reside in policy regimes that facilitate decision-making on a case-by-case basis — thereby incorporating all economic, environmental, and political perspectives, and thus embracing the inevitable contradictions.

C. EPA'S "PREEMPTIVE VETO" OF PEBBLE MINE UNDER THE CLEAN WATER ACT

PLP must acquire sixty-seven permits to sufficiently advance Pebble Mine through the permitting stage and into production.[240] Although sixty-six of these are state-level permits, the sole federal permit has been the thus far interminable source of conflict.[241] Pursuant to Section 404 of the Clean Water Act ("CWA"), the regulatory jurisdiction of the EPA and Army Corps of Engineers ("Corps") extends over the "navigable waters" of the United States, which includes navigable rivers, streams, and wetlands.[242] Pebble Mine is within the Section 404 jurisdiction of the Corps and EPA because the potential mining operation would require the construction of stream diversion channels, as well as discharge of "dredged-or-fill material" into regulated waters.[243]

From a procedural standpoint, the Corps issues permits for the disposal of the discharged material.[244] As a precautionary measure, the EPA has oversight

235. *See* Complaint ¶ 8, Pebble Ltd. P'ship v. U.S. Envtl. Prot. Agency, No. 3:14-cv-00199-HRH (D. Alaska, Oct. 14, 2014), 2014 WL 5653282; *EPA Science Inventory*, U.S. ENVTL. PROT. AGENCY, https://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=253500 (last visited Apr. 2, 2016).

236. *See* Warrick, *supra* note 27.

237. Dobb, *supra* note 205.

238. *See* Bronin, *supra* note 33, at 1887 n.47.

239. *See* CARTER, *supra* note 6, at 46

240. Brett Veerhusen, *How Alaska's Proposed Pebble Mine Conflict Could Shape Future Arctic Mineral Development*, ARCTIC INST. (Feb. 1, 2016), http://www.thearcticinstitute.org/2016/02/pebble-mine-alaska.html.

241. *See id.* Interestingly, at least from a state perspective, the Alaska Department of Natural Resources must act pursuant to a statute that elicits a preference for land use that "will be of *greatest economic benefit* to the state and the development of its resources." ALASKA STAT. § 38.05.850(a) (2000) (emphasis added).

242. *See* 33 U.S.C. § 1344(a) (2012); *Solid Waste Agency v. Army Corps of Engineers*, 121 S.Ct. 675, 677 (2001).

243. *See* Parker et. al., *supra* note 218, at 13.

244. *See* § 1344(a)-(d).

authority such that the Corps must adhere to EPA regulations when issuing permits to dispose at specified sites.[245] Section 404(c) authorizes the EPA to prohibit specific permits, particularly if the dredging-or-filling "will have an *unacceptable adverse effect on* municipal water supplies, shellfish beds and. . . *fishery areas (including spawning and breeding areas),* wildlife, or recreational areas."[246] Despite the EPA's broad authority under Section 404(c), this preemptive or proactive veto process must follow specific procedures before it can prohibit permitting at a specific site.[247] These procedures include a notice-and-comments-period before the agency's final determination.[248] Since 1980, the EPA has used its veto authority to prohibit only thirteen projects that were permitted under Section 404(c).[249] The EPA, however, has *never* prohibited a dredge-or-fill project *before* the operation even applied for the necessary permits – Pebble Mine would be the first.[250]

In early 2014, the EPA "invoke[ed] section 404(c). . . and temporarily prevent[ed] the Army Corps from issuing any mining permits in Bristol Bay."[251] Amidst controversy, some describe the EPA's actions as "biased" and "beyond federal overreach."[252] PLP responded by filing suit in federal district court, seeking an injunction against the EPA's use of its Section 404(c) veto authority.[253] PLP then initiated litigation against the EPA in mid-2014,[254] alleging that the agency violated both the Freedom of Information Act ("FOIA")[255] and the Federal Advisory Committee Act ("FACA").[256][257] In late 2014, the United States District Court of Alaska ("Court") granted the preliminary injunction to temporarily halt the EPA from proceeding with its Section 404(c) veto process.[258] As of February 2016, the effect of the court's injunction is a de facto standoff on the Alaskan frontier: the EPA cannot move forward to veto and block the mining operation from obtaining the necessary permits, whereas PLP cannot even apply for the necessary "dredge-and-fill" permit pursuant to the CWA.[259]

As part of the 2014 lawsuit concerning FOIA, PLP alleged that the EPA

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245. *See Solid Waste Agency,* 121 S.Ct. at 689 n.10; *see also* § 1344(a)-(d).

246. § 1344(c) (emphasis added).

247. *See* 40 C.F.R. § 231.3(a) (2010).

248. *See* § 231.3.

249. *Clean Water Act: Section 404(c): "Veto Authority,"* U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/sites/production/files/2016-03/documents/404c.pdf (last visited Apr. 1, 2016).

250. *EPA's Expanded Interpretation of Its Permit Veto Authority under the Clean Water Act: Hearing Before the Subcomm. on Water Res. and Env't,* H. Comm. on Transp. & Infrastructure, 113th Cong. (2014) [hereinafter *Hearings*] (testimony of Hal Quinn, President and CEO of Nat'l Mining Ass'n).

251. Narula, *supra* note 201.

252. *Id.* (citations omitted).

253. *See* Elwood Brehmer, *Federal Judge Orders EPA to Halt Pending Pebble Action,* ALASKA J. COMMERCE (Nov. 25, 2014, 11:58 AM), http://www.alaskajournal.com/business-and-finance/2014-11-25/federal-judge-orders-epa-halt-pending-pebble-action#.Vv86tMcoHvk.

254. Complaint, *supra* note 235.

255. *See* 5 U.S.C. § 552 (2012).

256. *See* 5 U.S.C. App. II §§ 1 *et seq* (2012).

257. Complaint, *supra* note 235, at 2, Ex. 1-1 ¶ 1; *see also* Warrick, J., *supra* note 27.

258. *See* Veerhusen, *supra* note 240.

259. *See id.*

improperly withheld documents under the FOIA's deliberative process exemption in response to PLP's discovery request.[260] In its complaint, PLP sought documents and information concerning the Pebble deposit, including internal communications by EPA officials, as well as their communication with alleged anti-mining groups.[261] The purpose of the request, according to PLP, "was to understand and document (i) EPA's surreptitious decision to veto the Pebble Mine in late 2010, and (ii) EPA's non-public and secretive meetings with those dedicated to stopping the project before a permitting process could even start."[262]

The FACA lawsuit stemmed from its belief that the EPA's scientific analysis in the Assessment lacked objectivity and placed undue importance on information submitted by anti-mining groups.[263] PLP argued that the EPA improperly formed and utilized the advisory committees that contributed to the Assessment.[264] In PLP's 138-page *Complaint for Declaratory and Injunctive Relief*, PLP referenced an "Anti-Mine Coalition" that served as an advisory committee in drafting the Assessment.[265] This group included various non-governmental organizations, anti-mine activists, and lobbyists[266]

On January 12, 2016, the Court partially resolved PLP's requests in both of PLP's lawsuits against the EPA.[267] The Court issued a slip opinion based on an in camera review of discovery documents regarding the EPA's discretionary release of documents and PLP's allegation that the EPA improperly withheld other documents.[268] The opinion did not side with one party regarding the documents, and more importantly, it did not resolve the FACA or FOIA claims.[269] Following the Court's order that the EPA reevaluate all of the fully withheld documents, PLP may get the opportunity to further explore the EPA's extensive records pertaining to the Pebble Mine.[270] Presumably, the extensive discovery process will continue for PLP, as the Court did not resolve the EPA's motion for summary judgment on its FOIA compliance.[271]

With regard to navigating these legal hurdles, both parties must be cognizant of the Administrative Procedure Act ("APA") of the more than likely eventual administrative review of the EPA's decision.[272] Moreover, both parties must be cognizant that the EPA's decision is subject to judicial review[273] and that the

260. Complaint, *supra* note 235, ¶ 47.
261. *Id.* ¶¶ 5-10, 13 (including EPA's communication concerning Pebble Mine with Trout Unlimited, National Resources Defense Council, and Alaskan Senator Mark Begich).
262. *Id.* ¶ 14.
263. Complaint ¶ 9, Pebble Ltd. P'ship v. U.S. EPA, No. 3:14-cv-00171-HRH (D. Alaska Sept. 3, 2014).
264. *See id.*
265. *Id.* ¶¶ 10-19.
266. *See id.* ¶ 10.
267. Pebble Ltd. P'ship v. United States Envtl. Prot. Agency, No. 3:14-CV-0199-HRH, 2016 WL 128088 (D. Alaska Jan. 12, 2016).
268. *Id.* at *1.
269. *Id.* at *3.
270. *See id.*
271. *See id.*
272. *See generally* 5 U.S.C. §§ 701-06 (2012) (describing judicial review under APA).
273. *See generally* 33 U.S.C. § 1319 (2012) (describing EPA's enforcement power).

court will likely review under the arbitrary and capricious standard.[274] Considering that the EPA has never before issued a preemptive veto in this context,[275] this matter may have potential for a successful appeal. PLP's best chance to proceed with the mining operation is to not only prohibit the EPA's preemptive veto, but also to promote the traditional Section 404 permit application process under the purview of the Corps[276] and corresponding review under the National Environmental Policy Act.[277]

The Pebble Mine saga depicts a conflict at the confluence of energy and environmental law, especially in the context of the EPA's overarching regulatory schemes. "Pursuant to its environmental agenda," as Daniel Kish, an executive at the Institute for Energy Research, describes, "the EPA should consider the effects of a limited copper supply on renewable energy development and electric cars."[278] Kish further stated that "[i]f the EPA truly cares about environmental protection, it should promote, rather than restrict copper development."[279] These conflicts may become more prevalent as evidenced by a 2014 global mining survey ranking Alaska in the top ten most favorable jurisdictions for investment attractiveness based on mineral endowment and favorable policy for natural resource development.[280]

VI. CONCLUSION: RECONCILING REGULATORY CONTRADICTIONS

The Pebble Mine conflict, in the context of the water-energy nexus, even elicits a personal contradiction. As an ecologist, I appreciate the potential danger associated with a mining operation in the sensitive Alaskan watershed. But at the same time, I find equally intriguing the remarkable investment opportunities at Pebble Mine, especially in relation to an expanding market for renewable energy.[281]

In 2012, a political columnist lambasted the Obama administration for its apparently inconsistent energy policies, suggesting that "at the same time that it is promoting wind energy, the [administration] and its environmentalist allies are seeking to scuttle the development of a crucial component in wind turbines: copper."[282] In contrast, those who promote a case-by-case approach to the nation's energy policy should instead embrace this apparent contradiction. Aspects of the Pebble Mine conflict illustrate the type of beneficial compromise

274. *See* Chevron, U.S.A., Inc. v. Nat. Res. Def. Council, Inc., 467 U.S. 837, 842-43 (1984).

275. *See Hearings*, *supra* note 250.

276. *See* 33 U.S.C. § 1344(a)-(d) (2012) (describing permitting process).

277. *See* STEVEN FERREY, ENVIRONMENTAL LAW: EXAMPLES & EXPLANATIONS 518-19 (5th ed. 2010).

278. Daniel Kish, *Another Alaska Overreach by the EPA*, U.S. NEWS & WORLD REPORT (May 3, 2013, 5:15 PM), http://www.usnews.com/opinion/blogs/on-enegy/2013/05/03/epa-stifles-alaskas-pebble-copper-mine.

279. *Id.*

280. *See* Taylor Jackson, *Annual Survey of Mining Companies 2014*, 1, 3 (2014), FRASER INST., https://www.fraserinstitute.org/sites/default/files/survey-of-mining-companies-2014.pdf.

281. *See* Powers, *supra* note 36, at 605-06.

282. Grover G. Norquist & Patrick Gleason, *W.H. All Talk on Wind Energy*, POLITICO (Sept. 24, 2012, 9:05 PM), http://www.politico.com/news/stories/0912/81603.html.

that arises when our regulatory schemes embrace the water-energy contradiction.[283] When groups from seemingly irreconcilable ends of the spectrum can find their interests aligned in opposition of Pebble Mine – including organizations such as Natural Resources Defense Council,[284] Delta Waterfowl,[285] Dallas Safari Club,[286] and even Tiffany & Co. Jewelers[287] – it becomes conceivable that the United States can better prepare for future energy challenges by acknowledging these regulatory ambiguities.

Moreover, particular aspects of the current national energy regulatory scheme may be "oblivious to *positive* facts about fossil fuels and. . . susceptible to negative *fabrications* about fossil fuels[.]"[288] In the alternative, perhaps society should question the ramifications if the inverse is also true – and inquire whether the United States is actually oblivious to negative facts about renewable energy, while being more susceptible to their positive fabrications. With regards to the national energy policy, regulations should consider cumulative impact on land and ecosystems by crafting law that deliberately avoids "rushing to rank priorities."[289]

Renewable energy's dependence on non-renewable copper[290] portrays the fact that most energy technologies maintain benefits and drawbacks, as evidenced by the ongoing Pebble Mine conflict.[291] Taken even further, particularly in light of reconciling these pervasive water-energy challenges,[292] perhaps there should at least be an inquiry as to the benefits of an energy policy that does not outright vilify fossil fuels. For example, examining the potential economic and ecological prosperity within a scheme that embraces another distinct contradiction could be beneficial, such as between fossil fuels and climate change regulations. Nevertheless, as technological advancements continue to implicate novel challenges along the water-energy nexus, recognizing potential contradictory solutions may yield lasting benefits.

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283. *See supra* Part V.

284. *See* Robert Redford, Opinion, *Robert Redford's Plea: Save Bristol Bay*, L.A. TIMES (May 24, 2013), http://articles.latimes.com/2013/may/24/opinion/la-oe-redford-bristol-bay-mining-20130524.

285. Letter to Senate Members of Committee on Appropriations Concerning Proposed Pebble Mine, WILDLIFE.ORG (Apr. 3, 2015), http://wildlife.org/wp-content/uploads/2015/04/TWS News-BristolBayLetter.pdf.

286. *See id.*

287. *See* Blaine Harden, *Ripples from Pebble Felt Far from Alaska*, GUARDIAN (July 23 2012, 12:28 PM), http://www.theguardian.com/environment/2012/jul/23/pebble-mine-alaska-environment-salmon-indigenous-people.

288. ALEX EPSTEIN, THE MORAL CASE FOR FOSSIL FUELS 193 (2014).

289. Outka, *supra* note 38, at 244.

290. *See* CARTER, *supra* note 6, at 45.

291. *See supra* Part V.

292. *See* Kerr, *supra* note 7, at 724.