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# Gored by a Cornucopia: The Risks to Climate Change From Laws and Policies That Incentivize Competitive But Divergent Energy Innovations

Roy Andrew Partain\*

## INTRODUCTION

The 1992 United Nations Framework Convention on Climate Change (UNFCCC) is the leading international regulatory effort to reduce the threats and hazards from anthropogenic climate change. The UNFCCC primarily focuses on the means of managing the overall levels of greenhouse gas emissions released into the atmosphere and the means of preventing those emissions. Almost every country in the world has ratified the UNFCCC,<sup>1</sup> and almost as many countries have ratified its Kyoto Protocol.<sup>2</sup> As such, most countries in the world have enacted a variety of domestic regulations to further the goals of the UNFCCC to control and prevent global climate change.

The UNFCCC and the Kyoto Protocol establish certain policy goals to coordinate global efforts to reduce the impact of anthropogenic greenhouse gas emissions. However, concerns have arisen in the recent decades regarding UNFCCC policy failure; questions have arisen as to whether certain green policies could backfire and result in increased greenhouse gas emissions. These concerns are called green paradoxes.<sup>3</sup> Broadly summarized, the

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1. 195 countries have ratified the UNFCCC as of March 24, 2014; contrast that total against the 193 members of the United Nations. See *First steps to a safer future: Introducing The United Nations Framework Convention on Climate Change*. UNFCCC (Jan. 11, 2015, 7:00 PM), [https://unfccc.int/essential\\_background/convention/items/6036.php](https://unfccc.int/essential_background/convention/items/6036.php), archived at <https://perma.cc/544L-2QC3> (last visited Jan. 11, 2015); See also *Member States of the United Nations UN* (Jan. 11, 2015, 7:00 PM), <http://www.un.org/en/members/>, archived at <http://perma.cc/JT8Z-2E2V>.

2. 192 nations and regional organizations have ratified the Kyoto Protocol. See *Status of Ratification of the Kyoto Protocol*, UNFCCC (Jan. 11, 2015, 7:08 PM), [https://unfccc.int/kyoto\\_protocol/status\\_of\\_ratification/items/2613.php](https://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php), archived at <https://perma.cc/D63G-C7RT>.

3. A variety of models have found that under specific circumstances, green paradox results might be obtained. While there are other potential causes of green paradox phenomena, most of the models rely on nuanced economic models that assume some sort of policy implementation delay or failure combined with certain behavioral assumptions on fossil fuel producers. A literature review of green paradox research is provided at Roy A. Partain, *Climate Change, Green Paradox Models, and International Trade Laws*, in RESEARCH HANDBOOK ON CLIMATE

concern is that asynchronous implementation of climate change policies across multiple jurisdictions could be dysfunctional; these sets of problems were originally known as carbon leakage problems. A similar concern arose in review of proposed rising carbon taxes;<sup>4</sup> under certain circumstances, temporal issues in green climate policy implementation could lead to increased greenhouse gas emissions.<sup>5</sup>

The combination of diverse energy policies could lead to increased energy supplies that, when combined with international trade laws that notably support primary product exports such as fossil fuels, could encourage increased emissions of greenhouse gases. *Ergo*, if the present legal measures are left as-is, there is a foreseeable risk that the hazards from anthropogenic climate change could be worsened by higher levels of emissions, even if green energy laws were successful in stimulating green energy innovation.

This article investigates a complementary line of research: whether naïve implementation of the UNFCCC regulatory goals to provide innovation in new and renewable energy sources, *sans* complementary coordination with other measures to provide innovations in other energy technologies, could result in increased greenhouse gas emissions. This article finds that such an implementation could indeed result in increased greenhouse gas emissions;<sup>6</sup> while some of the measures support innovation in green energy sources, other legal measures support innovation in fossil fuels.

Part I analyzes the UNFCCC and its associated agreements such as the Kyoto Protocol. The analysis presented suggests that such international conventions created to limit the risks of anthropogenic climate change do drive innovation in new and

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CHANGE AND TRADE LAW (Panagiotis Delimatsis, ed. forthcoming 2015) [hereinafter Partain, *Climate Change*]. For a critical review of the mathematical structures underlying most green paradox models, see also Roy A. Partain, *Is a Green Paradox Spectre Haunting International Climate Change Laws and Conventions?* 33 *UCLA J. ENVTL. L. & POL'Y* 1 (2014) [hereinafter Partain, *Green Paradox Spectre*].

4. This example was the seminal green paradox example proposed by Sinn. See Hans-Werner Sinn, *Public Policies against Global Warming*, 15 *INT'L TAX PUB. FIN.* 360, 360 (2008).

5. A rising tax rate is mathematically similar to a delayed higher tax rate and is thus analog to asynchronous implementation of the climate change policies across multiple countries. See Partain, *Climate Change*, *supra* note 3. See also the more detailed discussion in Partain, *Green Paradox Spectre*, *supra* note 3.

6. Albeit, these results are differentiable from international carbon leakage or conventional green paradoxes in that the model focuses on the simultaneous application of divergent legal measures.

renewable energy supplies. Such innovations are intended to provide increased volumes of energy supplies at affordable prices in order to displace carbon-emitting energy supplies, thus preventing anthropogenic sources of climate risk. However, the key conclusion is that these legal efforts would increase energy supplies if successful.

Part II inspects select international agreements and concludes that these particular agreements sustain or encourage the development of fossil fuels, including petroleum, coal, and natural gas. Part III examines the role of energy security laws, i.e., those laws that support the secure supply of energy resources against adverse conditions, in driving innovation in energy. Such targets might include securing petroleum volumes or energy alternatives, such as nuclear energy. Motives for energy security laws might be to protect energy prices from market forces or to support militarized forces. Part III looks to laws of the United States as an example.

Part IV considers the role of various international trade conventions in supporting market conditions and free competition conditions. This article will examine the WTO/GATT system of agreements and reveal their support of open trade and competitive market conditions. Part V integrates the previous four Parts into a finding of a potential green paradox event: The combined results of multiple legal policies to encourage energy innovations could result in increased energy supplies that would price compete, potentially resulting in increased greenhouse gas emissions, *ergo*, a green paradox. Finally, this article concludes by evaluating the steps that could be taken to de-bug the scenario.

## I. UNFCCC DRIVES INNOVATION IN NEW AND RENEWABLE ENERGY

The UNFCCC and the Kyoto Protocol provide the foundation for modern legal institutions to mitigate, prevent, and reduce the hazards from anthropogenic climate change. While the Protocol updates and modifies the UNFCCC, the difference is evolutionary not revolutionary. It is important to review the two set of documents separately, however, because Canada and the United States are not currently parties to the Kyoto Protocol.<sup>7</sup> Key among these efforts is the UNFCCC.<sup>8</sup> The UNFCCC provided a broad framework to

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7. An additional document, the Doha Amendment, has been proposed but not widely adopted at the current time. Currently, negotiations are underway to extend the Kyoto Protocol beyond 2015. See *Status of the Doha Amendment*, UNFCCC, [http://unfccc.int/kyoto\\_protocol/doha\\_amendment/items/7362.php](http://unfccc.int/kyoto_protocol/doha_amendment/items/7362.php), archived at <http://perma.cc/X7NR-FW2F> (last visited Feb. 3, 2015).

8. The preliminary efforts began much earlier, with the first World Climate Conference (WCC) having convened in 1979. That meeting ultimately led to the

establish a global means of coordinating regional and domestic efforts to curb and mitigate the potential harms of climate change.

While the UNFCCC was a sound start, it lacked economic incentives and emissions controlling obligations to achieve its climate change policy goals; the Kyoto Protocol of 1997 was developed to provide those missing tools.<sup>9</sup> The Kyoto Protocol established specific obligations for its signatories to reach certain emission targets; it also enabled certain private market methods to coordinate carbon emission reduction plans across actors and jurisdictions.<sup>10</sup> The UNFCCC and the Kyoto Protocol have continued to evolve through the Marrakesh Accords of 2001, the 2005 Nairobi Work Program on Adaption, the 2007 Bali Road Map, the 2009 Copenhagen Accord, the 2010 Cancun Agreements, the 2011 Durban Platform for Enhanced Action, the 2012 Doha Amendment to the Kyoto Protocol, and most recently the 2013 Warsaw Outcomes. Thus, from the initial conference in 1979 to the most recent rounds in Warsaw, the development of climate change policy and carbon emission controls has taken decades to develop, yet it remains a framework with very little power to enforce emission limits.

The UNFCCC and its Kyoto Protocol provide a framework for addressing climate change, but domestic enactment of local laws is required to make the agenda functional. Some countries and regions have developed elaborate regulatory frameworks to coordinate with the UNFCCC and Kyoto Protocols, while other nations developed frameworks disconnected from the UNFCCC and Kyoto Protocols, and still other nations have not made substantial efforts to mitigate carbon emissions.

There are countries and regional areas that coordinate within the obligations of the UNFCCC. For instance, the European Union (EU)

formation of the Intergovernmental Panel on Climate Change (IPCC), which provides the scientific community with a means to collaborate and present consensus on scientific findings related to climate change to the United Nations and its Members.

9. “[T]he Kyoto Protocol is what ‘operationalizes’ the Convention. It commits industrialized countries to stabilize greenhouse gas emissions based on the principles of the Convention. The Convention itself only encourages countries to do so.” *Making those first steps count: An Introduction to the Kyoto Protocol*, UNFCCC (Jan. 11, 2014, 7:21 PM), [https://unfccc.int/essential\\_background/kyoto\\_protocol/items/6034.php](https://unfccc.int/essential_background/kyoto_protocol/items/6034.php), archived at <https://perma.cc/UZW8-8627>.

10. *E.g.*, see the ‘joint commitments’ under art. 4(1), the ‘clean development mechanism’ under art. 12 of the Kyoto Protocol, and the ‘coordination of measures’ under art. 13(4)(d). Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 10, 1997, U.N. Doc FCCC/CP/1997/7/ Add.1, 37 I.L.M. 22 (1998).

and its Member States have created legislation at both the EU and Member State levels to comply with the UNFCCC. The EU legislation has become a template for other countries. Similar enactments have been adopted in both South Korea and Japan. On the other hand, the United States is among those countries that have put in place a variety of emission controls without legal reference to the obligations of the Kyoto Protocol. The United States signed and ratified the UNFCCC, but it has not done similarly for the Kyoto Protocol. However, the United States has put into place a wide range of energy efficiency requirements, emissions controls, and other public campaigns to reduce the causes of anthropogenic climate change. Nonetheless, the point is made that the EU methods and the American methods are materially different in manners that might impact consumer or producer decisions. Finally, there are those countries that either have no effective regulations to follow the guidelines of the UNFCCC and the Kyoto Protocol or lack the enforcement capabilities to ensure the operation of their UNFCCC compliant regulations.

This patchwork of legal regimes has left carbon emissions and climate change regulatory development uneven and inconsistent on a global scale. To further exacerbate potential frustrations, the various regimes have been enacted with equally disjoint time frames; the laws were not harmoniously or simultaneously enacted, and nor have they drifted in unison towards more uniformity.

Thus, while the need for the halting of anthropogenic climate change is broadly understood, global efforts have lacked both coordination and consistent enforcement. As such, there are concerns that certain forms of policy implementation might accidentally enable greater, not fewer, greenhouse gas emissions.

#### *A. Technology for Climate Change Mitigation*

The objective of the UNFCCC is the “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.”<sup>11</sup> Greenhouse gases are defined by their behavior, as gaseous constituents of the atmosphere that absorb and re-emit infrared radiation, regardless of source;<sup>12</sup> the only *per se* greenhouse

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11. UNFCCC, Art. 2. While both the UNFCCC and the Kyoto Protocol have extensive language on the support of climate science and scientific monitoring, these topics do not appear to have substantial bearing on the green paradox concerns, so they have been omitted from the current review framework.

12. UNFCCC, art. 4. sec. 5.

mentioned in the UNFCCC is carbon dioxide.<sup>13</sup> The Kyoto Protocol improves on the UNFCCC's definition of greenhouse gases by providing a list of *per se* greenhouse gases: (i) carbon dioxide, (ii) methane, (iii) nitrous oxide, (iv) hydrofluorocarbons, (v) perfluorocarbons, and (vi) sulphur hexafluoride.<sup>14</sup> The Doha Amendment added nitrogen trifluoride to that listing.<sup>15</sup>

The UNFCCC requires the Parties to “formulate, implement, publish, and regularly update . . . programmes containing measures to mitigate climate change.”<sup>16</sup> Those measures are required to focus on reducing emissions of and providing sinks for greenhouse gases.<sup>17</sup> The Kyoto Protocol spelled out specific obligatory mitigation strategies.<sup>18</sup> Parties are to:

- i. Enhance energy efficiency;<sup>19</sup>
- ii. Provide for greenhouse gas sinks and carbon sequestration;<sup>20</sup>
- iii. Research, promote, develop and increase the use of new and renewable energy sources;<sup>21</sup>
- iv. Reduce the various supports and subsidies that enable greenhouse gas emissions, such as tax breaks for crude oil production; and<sup>22</sup>
- v. Limit or reduce greenhouse gas emissions including methane emissions.<sup>23</sup>

Technological innovations are required to accomplish energy efficiency goals, the development of greenhouse sinks and carbon sequestration, and the potential development of new and renewable energy sources.

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13. See “[A]nthropogenic emissions of carbon dioxide and other greenhouse gases . . .” UNFCCC, art. 4, sec. 2(a).

14. Kyoto Protocol, Annex A. List of Greenhouse Gases, [http://unfccc.int/kyoto\\_protocol/items/3145.php](http://unfccc.int/kyoto_protocol/items/3145.php), archived at <http://perma.cc/JTE6-NE42> (last visited Mar. 13, 2015).

15. Doha Amendment to the Kyoto Protocol, art. 1, sec. B.

16. UNFCCC, art. 4, sec. 1(b).

17. *Id.*

18. Kyoto Protocol, art. 2, sec. 1(a).

19. *Id.* at sec. 1(a)(i).

20. *Id.* at sec. 1(a)(ii) and (iv).

21. *Id.* at sec. 1(a)(iv).

22. *Id.* at sec. 1(a)(v). This concerns the green paradox research directly in that by reducing the tax credits or deductions available to energy producers the requirement effectively requires a net increase on carbon-related taxes. Depending on how those changes are implemented, they could fit well within established areas of green paradox concerns.

23. Kyoto Protocol, art. 2, sec. 1(a)(vii)–(viii).

Further, the Kyoto Protocol mandates that certain emission targets be reached by specific deadlines—an element that is absent in the UNFCCC.<sup>24</sup>

### *B. Technology Transfer*

The Parties to the UNFCCC are required to develop, apply, and transfer the technologies that can enable them to meet the prior requirements to manage greenhouse gases.<sup>25</sup> Developed Parties have specific historical advantages, and thus have the duty to support Developing Parties in accomplishing their obligations and the broader goals of climate change mitigation.<sup>26</sup> The Annex II Parties are to provide financial resources to better enable the Developing Parties acquire and implement climate change mitigation technologies; this includes “all practicable steps to promote, facilitate and finance.”<sup>27</sup> Similar requirements are found within the Kyoto Protocol.<sup>28</sup>

The Kyoto Protocol has several mechanisms to better ensure the transfer of climate change abatement technologies. The first among these is the “financial mechanism.”<sup>29</sup> The financial mechanism enables the transfer of funds from Developed Parties to Developing Parties to finance the acquisition and operation of green technologies. An example of the financial mechanism is the Green Climate Fund to be operated from Incheon, South Korea. Second, the Kyoto Protocol calls for a “clean development mechanism,” which would enable Developed Parties to engage in green climate projects in a Developing Party’s jurisdiction and enable both parties to benefit from the generation of emission accounting rules.<sup>30</sup> Finally, the Kyoto Protocol enables emission account unit trading in order for Parties to pursue economically efficient pathways of mitigating climate change.<sup>31</sup> Thus, the ultimate diffusion of climate change abetting

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24. *Id.* at art. 3, sec. 1. The targets are to be attained by 2012. The Doha Amendment to the Kyoto Protocol would extend that timeline to 2020 and deepen the emission cuts to be achieved. *See Doha Amendment to the Kyoto Protocol*, art. 1, C, “Article 2, paragraph 1 bis.”

25. UNFCCC, art. 4, sec. 1(c).

26. This is a consistent sustainable development principle applied throughout both the UNFCCC and the Kyoto Protocol. *See* UNFCCC, art. 3, sec. 1 and 2. *See generally* UNFCCC, art. 4, sec. 2. *See also* UNFCCC art. 4, sec. 2(1) (noting that Developed Countries need to demonstrate that they are taking the lead in mitigating climate change).

27. UNFCCC, art. 4, sec. 3, 5.

28. *See* Kyoto Protocol, art. 10.

29. *Id.* at art. 11, sec. 2.

30. *Id.* at art. 12.

31. *Id.* at art. 6.



technologies is mandated by the Kyoto Protocol and economically supported by its Parties.

A third mechanism is the “technology mechanism.” At the Conference of the Parties in Doha, Qatar 2012, Decision 14/CP.18 authorized the implementation and initiation of the Climate Technology Centre and Network under the United Nations Environment Programme; this action followed from Decision 1/CP.16.<sup>32</sup> Thus, the technology mechanism is now operational.

### *C. Common but Differentiated Obligations*

While all Parties remain obligated to the obligations of the Convention, Developing Parties are permitted certain differences in implementation from the Developed Parties. This issue plays a substantial role in when and how emission targets might be achieved; indeed, as discussed later in this article, the Organization of Petroleum Exporting Countries (OPEC) has taken a very specific stand on this issue in particular.

Developing Parties are allowed to set their standards with reference to the attainment efforts of the Developed Parties.<sup>33</sup> Economies in transition are given wider berth.<sup>34</sup> A variety of countries are given pre-emptive understanding to their special needs and concerns; included on the list are countries that will be especially harmed by climate change and countries that rely heavily on revenues from fossil fuels and energy-intensive products.<sup>35</sup> Additionally, the Framework Convention recognizes that the Least Developed Parties will need specific forms of assistance.<sup>36</sup>

The UNFCCC has approximately 200 Parties, but certain Annex I and II Parties bear more burdens than other Parties. Annex I Parties are primarily European countries plus Russia, Japan, the United States, Canada, Australia and New Zealand. Annex II is the same list minus the parties who were formerly a part of the Soviet Union. Annex II is *de facto* a list of Developed Parties, who are held financially responsible for assisting Developing Parties. Annex I Parties assumed obligations to adopt national policies to mitigate climate change.<sup>37</sup> Additionally, Annex I Parties are also required to coordinate economic and administrative policies with each other to

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32. Conference of the Parties, *Report of the Conference of the Parties on its eighteenth session, held in Doha from 26 November to 8 December 2012*, FCCC/CP/2012/8/Add.2 (Nov. 26 to Dec. 8, 2012).

33. UNFCCC, art. 4, sec. 7.

34. *Id.* at sec. 6.

35. *Id.* at sec. 8. *See* Sec. 8(h).

36. *Id.* at sec. 9.

37. *Id.* at sec. 2(a).

enable climate change mitigation.<sup>38</sup> The rest of the Parties, especially those Developing Parties, are not explicitly obligated to specifically pursue the same obligations.

Also, while the Kyoto Protocol calls for “[m]easures to limit and/or reduce emissions of greenhouse gases,”<sup>39</sup> only those countries listed as Annex B have commitments to specific emission reductions.<sup>40</sup> All other countries merely need to enact measures that in some form could be said to limit or reduce emissions. In such cases, legislation to promote new and renewable energy or legislation to promote energy efficiency might suffice.

#### *D. UNFCCC Requires and Supports Energy Innovation*

Thus, the basic policy obligations of the UNFCCC and related legal efforts can be summarized:

1. To reduce the emission of greenhouse gases by several means:
  - a. Energy Efficiency;
  - b. Enhancements of sinks and reservoirs and carbon sequestration;
  - c. Development and promotion of new and renewable forms of energy;
  - d. Elimination of supports and subsidies for activities that enable greenhouse gas emissions; and
  - e. Prevention of methane venting from various activities;
2. To provide means, both legal and financial, to ensure all nations can undertake obligations under the UNFCCC;
3. To provide for broad technology transfer, including intellectual property; and
4. To provide for the transboundary coordination of the above efforts.

The role of both technology and innovations in energy technology to provide the solution is self-evident from the listing. The necessary energy technologies, and thus the needed alternative energy supplies, are not yet in hand, so the Convention called for the support of their development and promotion and the facilitation of their adoption by all Parties. This was a broad request of scientific

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38. *Id.* at sec. 2(e)(i).

39. Kyoto Protocol, art. 2, sec. 1(a)(vii).

40. Kyoto Protocol, Annex B. Also, Annex B’s list of countries has seen some variation of included countries since its enactment.

resources, financial capabilities, and legal coordination between the Parties.

While political discourse has not yet solved the issues of reducing subsidies to carbon fuels and effective reductions in emissions, it is clear that all Parties otherwise strongly support the development of green energy technologies.<sup>41</sup> Given the commitment of the Parties to the positive development of the technologies underlying this call, it would be reasonable to expect green and renewable technologies to provide more energy supplies in the future.

## II. ENERGY TRADE LAWS DRIVE INNOVATION IN ENERGY, MOSTLY IN FOSSIL FUELS

This section examines two international trade agreements that encourage, *inter alia*, innovation in energy technologies. However, contrary to the intent of the UNFCCC, these legal efforts attempt to secure the future of petroleum and other fossil fuels. While both efforts do acknowledge their recognition and support of the UNFCCC, they remain steadfastly committed to protecting and promoting the commercial feasibility of carbon-based fuels to compete alongside renewable energy resources.

The first agreement is the Energy Charter Treaty (ECT) that originally was intended to facilitate the interchange of energy products and investments between Europe and countries emerging from a Soviet era. The second agreement is OPEC, the collective of certain major petroleum producing countries. Both of these arrangements are primarily, if not exclusively, focused on petroleum and natural gas. Both of them also require their Contracting Parties or Member States to provide for research and development to secure future fossil fuel supplies at competitive prices. As such, both agreements oblige their members to provide for innovation in fossil fuel energy technologies to enable continued production, higher rates of production, and market-competitively priced production.

In short, these agreements call for energy innovations to provide sustained high levels of production of low-cost fossil fuels

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41. While few might doubt the EU's and its Member States commitments to renewable energy, others might doubt China or the U.S.; however, such concerns are largely unmerited. China is the world's largest consumer of coal, but it also led investment in carbon-free energy in 2013 by funding \$61,300 million in research, develop, and installation. RICHARD J. CAMPBELL, CONG. RESEARCH SERV., RL41748, CHINA AND THE UNITED STATES – A COMPARISON OF GREEN ENERGY PROGRAMS AND POLICIES, 1 and 4, respectively (2014). For a discussion on the U.S.'s efforts to support carbon-free energy technologies, *see infra* Part III. Even OPEC has reaffirmed its commitments to supporting the Conventions goals, *see infra* Part II.B.3.

at prices competitive to market alternatives. Should they remain in effect, it is reasonably foreseeable that petroleum and other fossil fuels would remain in production at a potentially increasing level of output and thus sustain the provision of large supplies of competitively priced fuels for the global market.

#### *A. The Energy Charter Treaty*

The ECT was originally drafted to facilitate trade in energy supplies and services.<sup>42</sup> It includes within its definition of “energy materials and products” items related to nuclear energy, coal power, various petroleum resources and products, natural gas energy, electrical energy, and certain forms of charcoal.<sup>43</sup> It supports a broad range of energy activities, including exploration, extraction, production, refining, storage, transport, distribution and marketing.<sup>44</sup> Given this coverage, the whole of upstream, midstream, and downstream fossil fuels are addressed by the ECT.<sup>45</sup>

The ECT establishes state sovereignty and that the states have sovereign rights over the energy resources within their jurisdictions.<sup>46</sup> Thus, each state is empowered to decide what areas within its sovereign control are to be “made available for exploration and development.”<sup>47</sup> They may also determine at what rates their resources may be depleted or extracted.<sup>48</sup> Environmental and other

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42. The Energy Charter Treaty [hereinafter ECT] Annex I to the Final Act of the European Energy Charter Conference, Dec. 17, 1994. *See also* ECT, at art. 2, “This Treaty establishes a legal framework in order to promote long-term cooperation in the energy field . . .” Its membership includes, broadly, European countries, Eurasian/Post-Soviet countries, Japan, and Australia. Its observers include Canada, China, the U.S., and others. *See Members and Observers*, ENERGY CHARTER, (Oct. 20, 2014), <http://www.encharter.org/index.php?id=61>, archived at <http://perma.cc/ABA8-EB74>.

43. ECT, art. 1, sec. 4, which references the Harmonized System of the Customs Co-operation Council and the Combined Nomenclature of the European Communities. *See* the listings at ECT, Annex EM, for a complete listing of the various energy resources included within the ECT. The nuclear energy options under Annex EM do not include traditional fusion nuclear energy supplies but only fissile energy supplies and stocks. *See* Annex EM, sec. 26.12 and 28.44.

44. ECT, art. 1, sec. 5.

45. However, not to the exclusion of other energy sources, such as nuclear energy.

46. ECT, art. 18, sec. 1. This recognition is tempered in a subsidiary requirement, also at sec. 1, that such sovereign rights are subject to the rules of international law.

47. *Id.* at sec. 3.

48. *Id.*

safety concerns remain similarly within the sovereign control of the states.<sup>49</sup>

The ECT sought to “develop an open and competitive market, for Energy Materials and Products.”<sup>50</sup> However, many of the signatory parties were not members of the World Trade Organization’s General Agreement on Tariffs and Trade (WTO/GATT) systems regulating international trade; therefore, the ECT references the WTO/GATT agreements as guidelines for its own implementation.<sup>51</sup> For instance, all parties to the ECT may not apply any trade related investment measures inconsistent with article III or XI of the GATT.<sup>52</sup> Each Contracting Party is required to alleviate market distortions and barriers to trade.<sup>53</sup> Further, transit and transportation of products and services covered by the ECT are to be governed by the principle of freedom of transit without distinction to origin, destination, or ownership.<sup>54</sup>

The ECT facilitates innovation in fossil fuel energy industries, as well as in other energy sectors. The transfer of energy technology between Contracting Parties is to be facilitated.<sup>55</sup> Investment in energy sectors of the Contracting Parties is to be encouraged,<sup>56</sup> which may be facilitated by programs and measures of the Contracting Parties.<sup>57</sup>

The ECT provides clarity on how Environmental Impact (EI) should be addressed by the Contracting Parties.<sup>58</sup> EIs are defined to include any given effect on the environment without particular reference to beneficial or harmful impacts.<sup>59</sup> EI might include such factors as human health and safety, air, water, and climate impacts; it may also include a wide range of impacts on socio-economic conditions.<sup>60</sup> Each Contracting Party is obligated to minimize the range of potential EI in economically efficient manners.<sup>61</sup> Such

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49. *Id.*

50. *Id.* at art. 3.

51. *Id.* at art. 4 and 5.

52. ECT, art. 5(1).

53. *Id.* at art. 6.

54. *Id.* at art. 7.

55. *Id.* at art. 8.

56. *Id.* at art. 10, sec. 1.

57. *Id.* at art. 9.

58. ECT, art. 19.

59. *Id.* at sec. 3(b).

60. *Id.* From such a broad perspective on potential EI, the effects of anthropogenic climate change are reasonably includable as EI.

61. ECT, pt. 4, art. 19, sec. 1. Energy Cycle is defined to be the full set of activities associated with a given type of energy resource over the complete life-span of the resource from extraction to final consumption and emissions. ECT, art. 19, at sec. 3(a).

measures to minimize impacts should consider areas both within and without the specific state and consider the whole Energy Cycle of the relevant energy source.<sup>62</sup> Each Contracting Party is to undertake precautionary measures to prevent or minimize environmental degradation.<sup>63</sup> When uncertainty exists over the interpretation of the environmental provisions of the ECT, the primary resort should be to other appropriate international forums a prior to taking ECT-based environmental disputes to review by the Charter Conference.<sup>64</sup>

Perhaps most importantly for the purposes of this article, the Contracting Parties have obligations to promote innovation and adoption of:<sup>65</sup>

- i. Energy efficiency technologies;
- ii. Renewable energy resources; and
- iii. Promotion of the use of cleaner greenhouse gas emitting fuels.

Such technologies and energy innovations must be shared,<sup>66</sup> furthermore, the Contracting Parties are required to promote and cooperate in the research, development, and application of those technologies.<sup>67</sup> Finally, the Contracting parties are obligated to promote public awareness of these new energy technologies.<sup>68</sup> Thus, it is clear that the ECT promotes multiple forms of energy innovations, including fossil fuels and renewable energy sources.

There are specific provisions for losses and expropriations.<sup>69</sup> Investments in energy sectors are not to be nationalized, expropriated, or subjected to measures having similar effects unless four tests are met.<sup>70</sup> First, the only approved purpose for an expropriatory act is one whose purpose is in the public interest.<sup>71</sup> Second, the act of

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62. See Energy Charter Treaty, art. 19(1), *opened for signature* Dec. 17, 1994, 2080 U.N.T.S. 95 (entered into force April 16, 1998). Such measures to include the full Energy Cycle should promote market-oriented prices but also provide for the inclusion of more complete environmental costs from that full Energy Cycle. See ECT, art. 19, at sec. 1(b).

63. See Energy Charter Treaty, *supra* note 62.

64. See *id.* at art.19(2).

65. See *id.* at art.19(1)(d).

66. See *id.* at art.19(1)(e).

67. ECT, art.19(1)(g).

68. See *id.* at art.19(1)(f).

69. See *id.* at arts. 12 and 13.

70. See *id.* at art. 13(1).

71. See *id.* at art.13(1)(a). Measures undertaken to limit anthropogenic climate change might reasonably be construed as in the public interest, so a reasonable reader might wonder if climate change policies that limited property rights or infringed on free trade principles might be accepted hereunder as in the "public interest." While art. 11 is safe from the application of art. 24, it is of note that art. 24, generally speaking, allows for any Contracting Party to preclude application of

expropriation may not be discriminatory in character.<sup>72</sup> Third, any act of expropriation must be conducted under due process of law.<sup>73</sup> Finally, any such act must be accompanied by the payment of prompt, adequate, and effective compensation; such compensation must be for the fair market value of the asset.<sup>74</sup>

Thus, the ECT provides for the on-going research, development and investment into energy technologies across a spectrum of energy alternatives, but it primarily attempts to provide a legal framework to integrate the energy markets of the Contracting Parties. As such, the primary energy innovations would be in the fossil fuels and nuclear energy sectors.

### *B. Conventions of the Organization of the Petroleum Exporting Countries*

Five countries established OPEC in 1960: Iran, Iraq, Kuwait, Saudi Arabia and Venezuela.<sup>75</sup> Presently, it has one dozen members, including Qatar, Libya, the United Arab Emirates, Algeria, Nigeria, Ecuador, Gabon, and Angola.<sup>76</sup>

#### *1. The OPEC Statute*

OPEC is primarily governed by the OPEC Statute.<sup>77</sup> The “principal aim of the Organization shall be the coordination and unification of the petroleum policies of the Member Countries.”<sup>78</sup> Further, the Statute requires OPEC to determine the best means to protect the Member Countries’ individual and collective interests.<sup>79</sup>

any section of the ECT if a Contracting Party deems it “necessary to protect human, animal, or plant life or health.” *Id.* art. 24(b)(i). Thus, if climate change were found to cause such forms of harm, then it could well be deemed necessary to limit application of the ECT under 24-2(b)(i) or under 13-1(a).

72. ECT, art. 13(1)(b). If climate change measures were to be introduced in alignment with the ECT, then such measures would need to also be non-discriminatory, even if otherwise allowable as a form of expropriation. Similarly, *see id.* at art. 24(2), for limits on disguised restriction or certain forms of trade discrimination.

73. *Id.* at art. 13(1)(c).

74. *Id.* at art. 13(1)(d).

75. *Member Countries*, ORG. OF THE PETROLEUM EXPORTING COUNTRIES (Jan. 10, 2015), [http://www.opec.org/opec\\_web/en/about\\_us/25.htm](http://www.opec.org/opec_web/en/about_us/25.htm), archived at <http://perma.cc/BM69-S73H>.

76. *Id.*

77. OPEC Statute, art. 1, Jan. 1961, 443 U.N.T.S. 247.

78. *Id.* art. 2(A).

79. *Id.*

Thus, OPEC has an active duty to provide for the coordinated planning of the interests of oil exporting countries.

A Member State can be either one of the original five founder countries or any other country that possesses a “substantial net export of crude petroleum” and is otherwise well aligned with the pre-existing members of OPEC.<sup>80</sup> If a country has net exports of petroleum, but not ‘substantial net exports,’ then it is entitled to join OPEC as an Associate Member but not as a Full Member.<sup>81</sup> This means that the voting membership of OPEC is limited to countries that are substantial net exporters of petroleum.<sup>82</sup>

One of the Organization’s primary goals is to ensure the economic viability of petroleum products and investments. OPEC is required to stabilize prices for petroleum products and to eliminate price fluctuations to promote petroleum’s role in international markets.<sup>83</sup> Further, the Organization is tasked with securing steady income for its Member Countries, securing efficient, economic, and regular petroleum supplies for consuming nations, and securing fair returns on investments in the petroleum industry.<sup>84</sup> The Organization is overseen by a Secretary General who must meet certain prerequisites for service, including a minimum of a decade in the “oil industry,” while ministry service or oversight of international business operations are seen as preferable.<sup>85</sup> These requirements have not been amended since the original enactment of the Statute.<sup>86</sup>

The Secretary General of OPEC is assisted in his duties by the Division of Research.<sup>87</sup> The Division of Research is required to research, forecast, and monitor the petro-energy and petro-chemical industries for hydrocarbons and derived products, including non-energy products.<sup>88</sup> The Division of Research is also tasked with maintaining research on economic and financial factors associated

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80. *See id.* at art. 7(A)–(C).

81. *See id.* at art. 7(D).

82. Indonesia was once a Full Member, but it has not only lost its Full Member status it has also lost Associate Member status as well due to its change from a net-exporter to a net-importer of petroleum. It terminated its membership in 2009. *See Member Countries*, *supra* note 75.

83. *See* OPEC Statute, *supra* note 77, at art. 2(B).

84. *See id.* at art. 2(C).

85. *Id.* at art. 28(A)(c).

86. *See generally* OPEC Statute, ORG. OF THE PETROLEUM EXPORTING COUNTRIES (Jan. 10, 2015), [http://www.opec.org/opec\\_web/en/publications/345.htm](http://www.opec.org/opec_web/en/publications/345.htm), archived at <http://perma.cc/NHK9-QJ6B>. *See also* OPEC Statute, *supra* note 77, at Amendments to the Statute.

87. OPEC Statute, *supra* note 77, at art. 32(A).

88. *See id.* at art. 33(A)(2).



with the above industries and products.<sup>89</sup> The Division has a duty to advance data sharing across Member Countries.<sup>90</sup>

Similarly, the Secretary General is assisted by the Division of Support Services.<sup>91</sup> One of the Division's duties is to keep the Secretary General abreast of policy changes in the international petroleum industry, which could affect OPEC or its Member Countries.<sup>92</sup> Further, when OPEC's own resources are insufficient to fulfill the above duties, the Secretary General is to commission consultants as necessary.<sup>93</sup>

## 2. *OPEC Solemn Declaration II of 2000*

OPEC may convene Summits to bring together the collected heads of state of the Member Countries to further refine and clarify the policies and agendas of the Organization.<sup>94</sup> There have been three such Summits: in 1975, in 2000, and in 2007.<sup>95</sup> The second Summit of 2000 was convened against the backdrop of global negotiations on climate change.<sup>96</sup> The third Summit was drawn to support and re-affirm the centrality of natural resources and the sovereign rights of the Member Countries to govern their own resources.<sup>97</sup> The Solemn Declarations are the work products of those Summits; they enhance but do not amend the OPEC Statute.<sup>98</sup>

The Solemn Declaration II is a brief but dense four-page document containing 20 resolutions.<sup>99</sup> The Declaration charges OPEC to continue to preserve and enhance the role of crude oil and natural gas in world energy markets. It calls for a cessation in efforts to discriminate against petroleum products and for the reduction of petroleum or carbon taxes that cause similar trade

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89. *See id.* at art. 33(A)(3).

90. *See id.* at art. 33(A)(4).

91. *See id.* at art. 32(A).

92. *Id.* at art. 33(B)(3).

93. OPEC Statute, *supra* note 77, at art. 34(A).

94. *See Solemn Declarations*, ORG. OF THE PETROLEUM EXPORTING COUNTRIES 1 (2009), [http://www.opec.org/opec\\_web/static\\_files\\_project/media/downloads/publications/Solemn\\_Declaration\\_I-III.pdf](http://www.opec.org/opec_web/static_files_project/media/downloads/publications/Solemn_Declaration_I-III.pdf), archived at <http://perma.cc/38WG-9LEK>.

95. *See id.*

96. *See id.*

97. *See id.*

98. *See id.*

99. *See Solemn Declaration II. The Second Summit of Heads of State and Government of OPEC Member Countries*, ORG. OF THE PETROLEUM EXPORTING COUNTRIES, 13 (2009), [http://www.opec.org/opec\\_web/static\\_files\\_project/media/downloads/publications/Solemn\\_Declaration\\_I-III.pdf](http://www.opec.org/opec_web/static_files_project/media/downloads/publications/Solemn_Declaration_I-III.pdf), archived at <http://perma.cc/BDY3-7Q45> [hereinafter *Solemn Declaration II*].

effects. It also delimits OPEC's support of the UNFCCC's goals; it starkly confronts the global community to recognize poverty and not climate change as the premier environmental tragedy. As such, the Declaration supports the expansion of petroleum consumption as a means to end global poverty; OPEC is to remain on path to provide technological innovations to ensure the supply and affordability of petroleum products and industries.

The Declaration reaffirms the role of OPEC to preserve and enhance the "role oil would play in meeting future energy demand."<sup>100</sup> OPEC has a duty to steward and optimize the economic value recoverable from the Member Countries petroleum assets.<sup>101</sup> In particular, OPEC is to protect the OPEC Member Countries' share of petroleum revenues vis-à-vis other oil exporting countries.<sup>102</sup>

OPEC has a duty to ensure that petroleum products remain remunerative for its owners and investors, stable in supply, and competitive with other energy sources for consumers.<sup>103</sup> Additionally, the Solemn Declaration II calls for increased consumption of crude oil and natural gas when "other fuels are recognized as being damaging to the global environment."<sup>104</sup> The Declaration calls on consuming countries to prevent discrimination against crude oil consumption, stating that they should "adopt fair and equitable treatment of oil in world energy markets."<sup>105</sup> Key among those forms of discrimination are differing forms of petroleum taxes and potential carbon taxes; the Declaration calls these taxes a burden that prevents just and equitable terms of trade.<sup>106</sup>

The Solemn Declaration II delimits OPEC support of the UNFCCC. It does recognize and support OPEC's engagement with the UNFCCC, but it requires special attention to two policies that would limit the overall impact on petroleum producers and certain potential petroleum consumers.<sup>107</sup> First, the UNFCCC should be guided by recognition of the "principle of common but differentiated responsibility," that not all countries should face identical consequences for industrialization and resultant carbon emissions as

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100. *Id.* at RESOL. 1.

101. *See id.* at RESOL. 2.

102. *See id.* at RESOL. 4.

103. *See id.*

104. *Id.* at RESOL. 11. The Declaration does not explicitly state what kinds of fuels these might be, but one might reasonably assume that fuels based in fission nuclear technologies, as seen at Chernobyl or Fukushima, might be such fuels. Additionally, concerns that ecological disturbances might be caused by wind turbines or by wave turbines could similarly be classified in this manner.

105. Solemn Declaration II, *supra* note 99, at RESOL. 14.

106. *See id.* at RESOL. 15.

107. *See id.* at RESOL. 10.

many countries have not yet benefitted from such industrialization and did not yet emit such volumes of greenhouse gases.<sup>108</sup> Additionally, the Declaration urges the countries listed in Annex I of the UNFCCC to promote measures to minimize the adverse social and economic impacts that would occur to countries whose economies are highly dependent on the production and export of fossil fuels.<sup>109</sup>

Additionally, the Declaration warns that OPEC will retain the eradication of poverty, not climate change, as its premier target for economic and social development and sustainability.<sup>110</sup> In fact, the Declaration explicitly challenges the Annex I nations to “recognize that the premier environmental tragedy facing the globe is human poverty,” and not anthropogenic climate change.<sup>111</sup> It states that OPEC will continue to engage in the UNFCCC processes but that OPEC will also continue its advocacy on poverty issues within other UN forums.<sup>112</sup>

### 3. *OPEC Solemn Declaration III of 2007*

The Solemn Declaration III<sup>113</sup> follows and extends the principles of the previous Declaration by developing three themes: stability of energy markets, energy for sustainable development, and energy and the environment.<sup>114</sup>

Under the theme of stability for energy markets, the Declaration promotes increases in investment in both upstream and downstream capacities to enable greater supplies of petroleum to reach the market.<sup>115</sup> The instability of petroleum supplies, petroleum demand, and short-term energy prices are to be improved for the benefit of

108. *Id.*

109. *See id.* at RESOL. 11. Broadly speaking, those countries are highly correlated to the membership listing of the G-20; they include the Member States of the EU and the EU itself, the Russian Federation, Canada, Australia, New Zealand, the U.S., Japan, and other countries in or very close to Europe. *See List of Annex I Parties to the Convention*, UNITED NATIONS, [http://unfccc.int/parties\\_and\\_observers/parties/annex\\_i/items/2774.php](http://unfccc.int/parties_and_observers/parties/annex_i/items/2774.php), archived at <http://perma.cc/K6R3-7LUG> (last visited Jan. 25, 2015).

110. Solemn Declaration II, *supra* note 99, at RESOL. 12.

111. *Id.*

112. *See id.*

113. *Solemn Declaration III. Conference of Sovereigns and Heads of State of OPEC Member Countries. Riyadh, Saudi Arabia*, ORG. OF THE PETROLEUM EXPORTING COUNTRIES, 17 (2009), [http://www.opec.org/opec\\_web/static\\_files\\_project/media/downloads/publications/Solemn\\_Declaration\\_I-III.pdf](http://www.opec.org/opec_web/static_files_project/media/downloads/publications/Solemn_Declaration_I-III.pdf), archived at <http://perma.cc/BDY3-7Q45>. [hereinafter Solemn Declaration III].

114. *Id.* at 17.

115. *See id.* at 18, RESOL. 5.

both producers and consumers.<sup>116</sup> The roles of both technology and innovation in efficiency and sustainability of petroleum production are to be promoted.<sup>117</sup> Finally, the Declaration calls for the adoption of transparent, non-discriminatory, and predictable trade, fiscal, environmental, and energy policies to better enable free trade access to markets. Clearly, this section expects petroleum production to be sustained and expanded upon by support from technology and innovation and rewarded with access to markets without limits posed by environmental or trade barriers.

Within the topic of energy for sustainable development, the Declaration reasserts that the eradication of poverty should be the “first and overriding global priority.”<sup>118</sup> Developed countries are urged to promote the diffusion of technology, especially environmentally friendly technologies, to developing countries.<sup>119</sup> The Declaration announces a plan to eradicate what it refers to as “energy poverty” in the developing world.<sup>120</sup> As a part of that plan, OPEC is called to develop financial tools and measures to ensure that financial cooperation among OPEC members enables those developing countries to obtain the energy products they need.<sup>121</sup>

Under its discussion on energy and environment, the Declaration calls for OPEC to provide “clean, affordable and competitive petroleum resources for global prosperity.”<sup>122</sup> It calls for cost-effective measures to address global environmental problems.<sup>123</sup> It calls for the support of forests and reforestation as a means to sink greenhouse gases.<sup>124</sup>

Yet, the discussion re-addresses the “common but differentiated” paradigm of the previous Declaration.<sup>125</sup> Within the same set of resolutions, it calls for the OPEC countries to promote innovation in petroleum technology with the “objective of increasing the petroleum

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116. *See id.* at RESOL. 6 and 7.

117. *See id.* at RESOL. 8.

118. *Id.* Energy for Sustainable Development, RESOL. 1. In contrast to climate change or other agendas, one might reasonably assume is the intended ranking preference.

119. Solemn Declaration III, *supra* note 113, at RESOL. 4.

120. *Id.* at RESOL. 6.

121. *See id.* at RESOL. 7.

122. *Id.* at 21.

123. *See id.* at RESOL. 1.

124. *Id.* at RESOL. 3. Obviously the primary intent here is to reabsorb released carbon dioxide, as forests are not particularly suited to reabsorb methane or other greenhouse gases.

125. Solemn Declaration III, *supra* note 113, at RESOL. 4. Per se the resolution addresses the UNFCCC to suggest that while OPEC and its Member Countries endorse the UNFCCC and its aspirations, they distinguish between the duties and obligations of developed and developing economies.

resource base.”<sup>126</sup> It also calls for technological innovations to reduce the costs of production.<sup>127</sup> The Declaration calls for policies based on the UNFCCC to take into account the special needs of countries heavily dependent on the production and export of fossil fuels.<sup>128</sup> Finally, the declaration calls for two fields of technological innovation: (i) the transformation of petroleum products into clean energy products and (ii) the development of technologies that address climate change.<sup>129</sup>

### III. ENERGY SECURITY POLICY LAWS DRIVE INNOVATION IN ENERGY, ALL DIRECTIONS

The United States supports innovations in energy resources through multiple measures and toolsets. While the United States is not the only nation to seek energy security, it is perhaps both the largest and most obvious example. The Department of Energy (DOE) is charged with leading civilian efforts and the Department of Defense (DOD) with the military efforts; however, both Departments are dwarfed in spending and are influenced by the effect of tax policies embedded within the United States’ federal income tax code. But the United States’ overall policy is to pursue all directions at once: green energy, conventional hydrocarbons, and innovative nuclear technology are all encouraged by the DOE, the DOD, and by the Internal Revenue Code. The following subsections provide a review of all three approaches to demonstrate that the promotion of energy security provides for innovations and future production of both fossil fuel resources and renewable energy resources.

#### *A. Federal Research Programs*

The United States maintains extensive support for the research and development of energy innovations. This support can be compared in terms of scale to the research programs that supported the development of the atomic bomb and the Apollo moon landings.<sup>130</sup> Whereas the Manhattan Project spent \$22 billion over five years and the greater NASA/Apollo program spent \$98 billion

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126. *Id.* at RESOL. 2.

127. *Id.*

128. *Id.* at RESOL. 5. The Declaration suggests that a balanced agenda is needed between those nations emitting greenhouse gases and those in earlier stages of economic development.

129. *Id.* at RESOL. 7. However, the example of such a climate change technology is carbon capture and sequestration and not a new or renewable energy source.

130. *Id. en passim.*

over 14 years, the broader federal energy innovation projects spent more than \$118 billion over 35 years prior to 2009; the annual rates of expenditure for energy innovation fell between the annual expenditures for the previous two programs.<sup>131</sup>

However, the United States has supported energy innovation for longer than suggested by the above narrative. Arguably, the Hoover Dam Project and the Manhattan Project were energy research projects in that they provided new forms or scales of energy production.<sup>132</sup> Nonetheless, earnest energy innovation support began under the shadow of the 1970s oil supply shocks.<sup>133</sup> This support occurred in two steps. First, the United States government increased coordination on energy innovation oversight by coalescing multiple energy research groups into the Energy Research and Development Administration (ERDA) and the Nuclear Regulatory Commission (NRC).<sup>134</sup> A second focusing of energy innovation efforts resulted in the creation of the DOE by merging the ERDA with 50 other energy offices and programs across the federal government.<sup>135</sup> In the first five years of those focused efforts to drive energy innovations, the federal government spent over \$40 billion.<sup>136</sup>

The DOE has faced declining budgetary support from Congress in recent years; it received \$10 billion in 1980 but only \$3.4 billion in 2012.<sup>137</sup> Most of the DOE's research funding is driven to direct investment in research and development of energy innovations; its capacity for loans and loan guarantees has been effectively defunded by Congress.<sup>138</sup> The DOE supports research programs in fossil fuels, nuclear energy, energy efficiency, and renewable energy sources.<sup>139</sup> Approximately 27% of the DOE's research budget is allocated to

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131. Solemn Declaration III, *supra* note 113, at 6; *see also* Table I.

132. The Hoover Dam began as a federally funded development with the Boulder Canyon Project Act, 43 U.S.C. § 617 (1928). The Manhattan Project was supported by the issuance of Exec. Order No. 8807, 3 CFR 3207 (1941), which created the Office of Scientific Research and Development, a war-time predecessor to today's Defense Advanced Research Projects Agency (DARPA).

133. DEBORAH D. STINE, CONG. RESEARCH SERV., RL34645, THE MANHATTAN PROJECT, THE APOLLO PROGRAM, AND FEDERAL ENERGY TECHNOLOGY R&D PROGRAMS: A COMPARATIVE ANALYSIS 3 (2009).

134. *Id.* The legislative measure was the Energy Reorganization Act of 1974 (P.L. 93-438).

135. *Id.* The legislative measure was the Department of Energy Organization Act of 1977 (P.L. 95-91).

136. *Id.* at 6 (taking note particularly of Table I).

137. In annualized 2011 dollars. Terry Dinan & Philip Webre, CONG. BUDGET OFFICE, *Federal Financial Support for the Development and Production of Fuels and Energy Technologies* 1, 5 (Mar. 2012), <http://www.cbo.gov/sites/default/files/03-12-EnergyTechnologies.pdf>, archived at <http://perma.cc/SPY6-8RM3>.

138. *Id.* at 5 and 6.

139. *Id.* at 5.

renewable energy sources and another 27% is allocated to energy efficiency research.<sup>140</sup> Twenty-three percent of its funds are allocated to nuclear research.<sup>141</sup> Ten percent is aimed at fossil fuel research programs; primarily, programs that reduce greenhouse gas emissions.<sup>142</sup> The remainder is mostly spent on electrical delivery and reliability research.<sup>143</sup>

### *B. United States Department of Defense and Energy Innovations*

While the DOE is the lead executive branch department tasked with stewarding energy innovations, the DOD actually spends more on energy products than any other section of the federal government, thus its policies and measures to impact energy innovation are noteworthy.<sup>144</sup> Reportedly, the DOD might be the world's largest energy consumer.<sup>145</sup> In 2010, the DOD's energy consumption represented 80% of the energy consumed by the federal government; it consumed an estimated 880 trillion BTUs that year.<sup>146</sup> It is also important to note that the legal aspects of these measures are primarily driven by budget requests and their integration in the budgetary measures approved by Congress.

The Defense Production Act provides authority for the DOD and its military branches to engage in support of energy technologies and resources.<sup>147</sup> First and foremost, energy is central to the Act's concept of "national defense:" "[t]he term 'national defense' means programs for military and energy production or construction, military or critical

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140. *Id.* at 7.

141. *Id.*

142. *Id.*

143. Dinan & Webre, *supra* note 137, at 7.

144. Moshe Schwartz, et al., *Department of Defense Energy Initiatives: Background and Issues for Congress*, CONG. RESEARCH SERV. (Dec. 10, 2012), <https://www.fas.org/sgp/crs/natsec/R42558.pdf>, archived at <https://perma.cc/LS98-JX2D> (2012). For a recent article on the U.S. military's climate change measures and responsive planning see Sarah E. Light, *The Military-Environmental Complex*, 55 B.C. L. REV. 879 (2014). *E.g.*, In the United States, its military is the largest consumer of energy products and services, and thus its internal planning with regards to energy products and services would have spill-over impact on the United States' broader efforts to mitigate climate change.

145. Schwartz, et. al, *supra* note 144, at 1.

146. *Id.* at 2. Reporting that after the DOD's 80% share of energy, the next largest user of energy was the postal service which used only four percent of the energy budget. The obvious disparity of the DOD's role on energy planning is stunning yet not generally recognized by the general public.

147. The Defense Production Act of 1950, as amended, is enacted at 50 U.S.C. App. § 2061 (2012).

infrastructure assistance to any foreign nation, homeland security, stockpiling, space, and any directly related activity.”<sup>148</sup>

The Act establishes that the “security of the United States is dependent on the ability of the domestic industrial base to supply materials and services for the national defense and to prepare for and respond to military conflicts, natural or man-caused disasters, or acts of terrorism within the United States,” and that “in order to ensure national defense preparedness, it is necessary and appropriate to assure the availability of domestic energy supplies for national defense needs[.]”<sup>149</sup> The Act requires that “to the maximum extent possible, domestic energy supplies should be augmented through reliance on renewable energy sources (including solar, geothermal, wind, and biomass sources), more efficient energy storage and distribution technologies, and energy conservation measures . . . .”<sup>150</sup>

The DOD and the President of the United States are granted broad powers to economically support and encourage industrial activities under the Act; purchase orders, federal loans, and federally backed loan guarantees are all made available. First, the DOD can move to provide industrial support via directed purchases, enabling private producers to obtain independent financing given secured sales or delivery contracts:<sup>151</sup>

To create, maintain, protect, expand, or restore domestic industrial base capabilities essential for the national defense, the President may make provision—

(A) for purchases of or *commitments to purchase* an industrial resource or a *critical technology* item, for Government use or resale;

(B) *for the encouragement of exploration, development, and mining of critical and strategic materials*, and other materials;

(C) for the development of production capabilities; and

(D) *for the increased use of emerging technologies* in security program applications and the rapid transition of emerging technologies—

(i) from Government-sponsored research and development to commercial applications; and

(ii) from commercial research and development to national defense applications.<sup>152</sup>

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148. 50 U.S.C. § 2152(14) (emphasis added).

149. *Id.* at § 2062(a)(1) and (a)(5) (emphasis added). *See also id.* at § 2076, “[f]or purposes of this Act, ‘energy’ shall be designated as a ‘strategic and critical material[.]’”

150. *Id.* at § 2062(a)(6) (emphasis added).

151. *Id.* at § 2093(a)(1).

152. *Id.* (emphasis added).



Second, energy resource providers can receive direct federal loans when necessary:

[T]he President may make *provision for loans to private business enterprises* (including nonprofit research corporations and providers of critical infrastructure) for the creation, maintenance, expansion, protection, or restoration of capacity, the development of technological processes, or the production of essential materials, including the *exploration, development, and mining of strategic and critical metals and minerals*.<sup>153</sup>

Third, if the commercial producers need financial support to achieve production targets

the President may authorize a guaranteeing agency to *provide guarantees of loans by private institutions for the purpose of financing* any contractor, subcontractor, provider of critical infrastructure, or other person in support of production capabilities or supplies that are deemed by the guaranteeing agency to be necessary to create, maintain, expedite, expand, protect, or restore production and deliveries or services essential to the national defense.<sup>154</sup>

When the United States provides support “to correct a domestic industrial base shortfall, the President should give consideration to the creation or maintenance of production *sources that will remain economically viable after such assistance has ended . . .*”<sup>155</sup> Thus, to the extent that DOD measures under the Act call for additional energy innovations, priority must be given to those technologies that would be economically feasible after establishment under the Act. There are limits to the powers to provide economic incentives and supports for energy innovation under the Defense Production Act, but most of them are waived during periods of declared national emergency. Because the United States is currently in multiple states of declared emergency, those limits may not apply.<sup>156</sup> Thus the DOD, via the Defense Production Act, has extensive capacities to encourage and foster energy innovations outside of the civilian efforts at the DOE.

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153. 50 U.S.C. § 2092(A) (2012) (emphasis added).

154. *Id.* at § 2091(a)(1).

155. *Id.* at § 2062(b)(4) (emphasis added).

156. There are currently over two-score officially declared national states of emergency extent, see Patrick Thronson, *Toward Comprehensive Reform of America's Emergency Law Regime*, 46(2) U. Mich. J. L. Reform 737, 754, at Table I (2013).

The primary fuels consumed by the DOD are products derived from petroleum.<sup>157</sup> The vast majority of that fuel is used to power aircraft.<sup>158</sup> This reliance on liquid fossil fuels is complicated by the fact that the DOD maintains fleets of aircraft and vessels that are expected to remain in service for long-term periods, so while the source of that liquid energy might be novel, e.g., green bio-diesel, the need to combust that fuel in the in-place mechanical assets such as boat engines or jet engines will remain the same.<sup>159</sup> Thus, the DOD financially supports innovations in alternative liquid fuel sources. The United States Air Force (USAF) undertook obligations to acquire 50% of its domestic aviation fuels from alternative fuel blends by 2016.<sup>160</sup> Also notable in the USAF's approach is their apparent intent to drive the innovation by market demand, *i.e.*, their procurement processes will be mandated to obtain such fuels instead of providing pre-market subsidies. This is best reflected in two elements: first, the USAF's primary expenditures on alternative fuels are to upgrade its engine assets to match new fuel blends,<sup>161</sup> and second, the USAF has pre-established a certification program to approve alternative fuels from bio-fuels, alcohol-derived aviation fuels, and Fischer-Tropsch-transformed natural gas stocks of aviation fuel.<sup>162</sup>

The United States Navy (USN) and the United States Marine Corps (USMC) have announced their goals to "lead the Nation in sustainable energy."<sup>163</sup> "[The Department of the Navy] will be protecting the environment with clean energy and lessening our dependence on foreign oil," by increasing reliance on alternative fuels, bio-fuels, solar energy systems and geothermal energy systems.<sup>164</sup> By 2016, they intend to develop and deploy a "Green

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157. Schwartz, *supra* note 144, at 2.

158. *Id.* at 3–4. The USAF consumes 53% of the DOD's energy budget and 90% of that is spent on aviation fuels. The USN similarly maintains flight lines in addition to boats; the Navy consumes 28% of the DOD's energy budget and 54% of their energy needs are met by petroleum derived fuels. The United States Army relies on the USAF and USN to provide the bulk of its heavy lift and transportation needs, so the Army requires less energy overall; it consumes only about 18% of the DOD's energy budget.

159. *Id.* at 15.

160. *Id.* at 16 (citing to a U.S. Air Force Briefing, "Air Force Energy Consumption," Mar. 6, 2012. The primary target is a 50:50 blend of traditional petroleum sources and non-petroleum-based fuels.).

161. *Id.* at 17. Over \$800 million in funding over the 2013-2017 fiscal years.

162. *Id.* The Fischer-Tropsch transformation enables natural gas, or other sources of hydrogen, to be converted into a liquid hydrocarbon; it is industrially known as the "gas-to-liquids" process (GTL).

163. Schwartz, *supra* note 144, at 18 (citing to *Highlights of the Department of Navy FY 2013 Budget*, DEP'T OF THE NAVY, Feb. 2012, at 1–8).

164. *Id.* at 18.

Strike Group,” a cluster of ocean vessels and aircraft powered exclusively by biofuels, as a demonstration of the potential of biofuels.<sup>165</sup> They plan to ensure that 50% of USN and USMC fuel needs could be met with biofuels by 2020 by financially supporting innovations in biofuels, alongside the Departments of Agriculture and DOE, with over \$500 million in committed funds.<sup>166</sup>

The net result of the DOD’s powers to support innovation in energy sources, combined with its focus on replacing petroleum-derived aviation fuels, is that both additional capacity in alternative liquid fuels will be created at the same time that large quantities of petroleum-based fuels will no longer be consumed, thus the market will likely have increased quantities of both petroleum-derived and non-petroleum-based liquid fuels available for purchase.

### *C. Federal Income Tax Incentives*

The oil and gas sector has long received certain tax treatments from the United States Tax Code that are either obvious incentives for additional volumes of production, obvious incentives for technological enhancements that maintain the competitive cost structure of oil and gas investments, or are suspected incentives for increased levels of production, such as the depletion allowance. More recently, in 2006, the tax code added tax credits and other incentives for new and renewable energy sources.<sup>167</sup>

Combined, these tax incentives strongly facilitate energy innovations and aid in their commercial feasibility. The combined annual value of the tax code-driven incentives have been estimated at \$20 billion, dwarfing the DOE’s \$3.5 billion in annual supports for the same targets.<sup>168</sup> As such, the tax code incentives represent the lion’s share of the federal government’s efforts to encourage energy innovation.

While support for energy has long been an area of focus within the tax code, it does not suggest that tax policy makers have slowed down their legislative efforts to provide for energy innovation supports. In the last decade, there have been 11 major enactments that addressed energy policy via tax code incentives.<sup>169</sup> Thus, the tax code remains a hot area of energy policy efforts.

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165. *Id.* (citing to USN, *The Department of the Navy’s Energy Goals*, available at [http://www.navy.mil/features/Navy\\_EnergySecurity.pdf](http://www.navy.mil/features/Navy_EnergySecurity.pdf), archived at <http://perma.cc/VV9S-HUS4>).

166. *Id.*

167. Dinan & Webre, *supra* note 137, at 1.

168. *Id.*

169. Sherlock provided a detailed listing and account of the various measures adopted during the 108th, 109th, 110th, 111th, and 112th Congresses. MOLLY F.

### 1. Tax Incentives for Hydrocarbon Energy Production

Reportedly, tax credits and deductions have provided \$470 billion in benefits to petroleum producers since the United States' federal income system began.<sup>170</sup> That estimate includes the forecasted \$4.8 billion in annual benefits in recent years.<sup>171</sup> The scale of these benefits has led to calls for their repeal, including President Obama's recent budget proposal for fiscal year 2014.<sup>172</sup> Repeal of these tax incentives has been estimated to potentially provide \$3.1 billion to \$4.3 billion a year in additional tax revenues.<sup>173</sup>

The Internal Revenue Code (IRC) provides a range of tax credits uniquely applicable to oil and gas producers.<sup>174</sup> IRC § 43 provides tax credits for costs associated with enhanced oil recovery (EOR) methods; EOR methods are used to produce oil from fields where primary production has peaked and begun to decline. Primary production for oil wells is gravity driven and requires little beyond the well and pumps to extract crude oil from the well. EOR techniques enable enhanced recovery and rely on chemical injectants, gaseous pressure-injections, steam, and other means of heat injections into the well bed to stimulate additional production levels. Previously, this credit package sustained production when oil prices were low, but under current pricing levels, the credit is not available. A similar story can be told for IRC § 45(I), wherein wells with substantially low volumes of production were encouraged to remain in production; current pricing prevents the credit from being applicable.<sup>175</sup> The credits would otherwise be \$3 per barrel of crude oil or per 1000 standard cubic feet (scf) of natural gas.<sup>176</sup>

IRC § 45(K) allows for a nonconventional source production credit for qualified fuels; the credit is set at \$3 per barrel-of-oil

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SHERLOCK, CONG. RESEARCH SERV., RL43206, ENERGY TAX POLICY: ISSUES IN THE 113TH CONGRESS, APPENDIX (2013).

170. Andy Kroll, et al., *Triumph of the Drill: How Big Oil Clings to Billions in Government Giveaways*, MOTHER JONES, (Apr. 14, 2014), <http://www.motherjones.com/print/249086>, archived at <http://perma.cc/D8AC-3MHX>.

171. *Id.*

172. ROBERT PIROG, CONG. RESEARCH SERV., RL42374, OIL AND NATURAL GAS INDUSTRY TAX ISSUES IN THE FY2014 BUDGET PROPOSAL 1 (2013).

173. *Id.* at 1.

174. The I.R.C. is enacted as the 26th volume of the United States Code, thus a citation to I.R.C. § 43 is identical to a citation to 26 U.S.C. § 43.

175. I.R.C. § 45I(a).

176. *Id.* at § 45I(b)(1)(A), (B). "Scf" is the industry standard reference for standard cubic feet, implying certain air pressure and temperature conditions.

equivalent.<sup>177</sup> Qualified fuels include oil produced from shale and tar sands, gas produced from geo-pressured brine, Devonian shale, coal seams, a tight formation, or from biomass, and liquid, gaseous, or solid synthetic fuels produced from coal (including lignite).<sup>178</sup>

IRC § 45Q(a)(2) provides tax credits for carbon capture and storage (CCS) facilities that are affiliated with oil and gas production activities.<sup>179</sup> The carbon dioxide sequestration credit is \$10 per metric ton of qualified carbon dioxide, which is captured by the taxpayer at a qualified facility and disposed of by the taxpayer in secure geological storage.<sup>180</sup> The oil and gas production activities need to qualify under the same qualifications as the EOR tax credits.<sup>181</sup>

IRC § 907 provides tax credits for taxes paid on combined foreign oil and gas income derived outside of the United States.<sup>182</sup> Such income is recognized as the sum of both incomes related to oil and gas extraction and to other processing, marketing, and distribution incomes derived from oil and gas activities.<sup>183</sup> It is estimated that this allowance returns over \$1 billion a year to petroleum producers.<sup>184</sup>

There are also a variety of unique income tax deductions allowed for fossil fuel producers. IRC § 167(h) enables the geological and geophysical costs of oil and gas exploration and development to be depreciated on a quicker time schedule than the ordinary rules.<sup>185</sup> It is estimated that this allowance returns \$612 million to \$1.1 billion a year to petroleum producers.<sup>186</sup>

177. *Id.* at § 45K(a)(1), (2). *See also* I.R.C. § 45K(d)(5) noting: “The term ‘barrel-of-oil equivalent’ with respect to any fuel means that amount of such fuel which has a Btu content of 5.8 million . . . .”

178. *Id.* at § 45K(c)(1).

179. *Id.* at § 45Q(a)(2).

180. *Id.* at § 45Q(a)(2)(A), (B).

181. I.R.C. § 45Q(d)(4). “The term ‘qualified enhanced oil or natural gas recovery project’ has the meaning given the term ‘qualified enhanced oil recovery project’ by § 43 (c)(2), by substituting ‘crude oil or natural gas’ for ‘crude oil’ in subparagraph (A)(i) thereof.”

182. *Id.* at § 907(a), (b).

183. *Id.* at § 907(b)(1)(A). “[F]oreign oil gas extraction incomes” and (B) “[F]oreign oil related incomes.”

184. Pirog reported that the elimination of these credits could increase annual tax revenues by up to \$11 billion over the tax decade of FY2014 to FY2023. PIROG, *supra* note 172, at 9. *See also* Daniel J. Weiss & Miranda Peterson, *With Only \$93 Billion in Profits, the Big Five Oil Companies Demand to Keep Tax Breaks*, ENERGY & ENVIRO., CENTER FOR AM. PROGRESS, (Feb. 10, 2014), <http://www.americanprogress.org/issues/green/news/2014/02/10/83879/with-only-93-billion-in-profits-the-big-five-oil-companies-demand-to-keep-tax-breaks/>, archived at <http://perma.cc/3UNB-Q483>.

185. I.R.C. § 167(h)(1) allows for a 24-month recovery of the costs and I.R.C. § 167(h)(5) allows certain major integrated oil companies seven years to recover the costs.

186. Kroll et al., *supra* note 170.

IRC § 263(c) provides for the expensing of the intangible drilling and development costs associated with the development stage of an oil and gas project; this deduction allowance accelerates cost recovery on the investment.<sup>187</sup> It is estimated that this allowance returns \$700 million to \$3.5 billion a year to petroleum producers.<sup>188</sup>

IRC § 193 Tertiary Injectants enables the same-year cost recovery of the chemicals used to increase and facilitate production.<sup>189</sup> The injectants must be injectants that are not recoverable hydrocarbons.<sup>190</sup> The costs of this program are relatively small, estimated at \$50 million over the five-year period beginning in 2013.<sup>191</sup>

IRC § 199 allows a specific deduction of up to nine percent of the costs or incomes resulting from domestic production activities.<sup>192</sup> While the deduction is available to many industries beyond oil and gas, there are specific provisions for oil and gas producers that reduce the deduction by three percent.<sup>193</sup> The production, refining, processing, transportation, or distribution of oil, gas, or any primary product is included as domestic production.<sup>194</sup> It is estimated that this allowance returns \$574 million to \$1.4 billion a year to petroleum producers.<sup>195</sup>

## 2. Tax Incentives for Alternative Energy Production

While the IRC provides a larger economic boost to the fossil fuel industry, it also provides incentives for renewable energy programs; the expected costs of support for renewable energy innovations is

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187. This treatment is in contrast to the regular requirement to capitalize certain investments. Contrast I.R.C. § 263(a) and (c); “(a) General rule: No deduction shall be allowed for [a]ny amount paid out for new buildings or for permanent improvements or betterments made to increase the value of any property or estate[;]” and “(c) . . . regulations shall be prescribed by the Secretary . . . which granted the option to deduct as expenses intangible drilling and development costs in the case of oil and gas wells . . .”

188. Kroll et al., *supra* note 170. Pirog reported a potential increase in tax revenues of \$1 billion a year from the repeal of this provision. PIROG, *supra* note 172, at 4. In 2013, the deduction was seen as a \$1.3 billion cost to tax revenues. SHERLOCK, *supra* note 169, at 8.

189. I.R.C. § 193(a).

190. *Id.* at § 193(b)(1) and (2).

191. SHERLOCK, *supra* note 169, at 14.

192. I.R.C. § 199(a)(1).

193. *Id.* at § 199(c)(4)(A) and (d)(9).

194. *Id.* at § 199(d)(9)(B).

195. Kroll et al., *supra* note 170. *See also* Weiss & Peterson, *supra* note 184. Pirog reported that the elimination of this allowance for domestic oil and gas producers could increase annual tax revenues by up to \$17.4 billion over the tax decade of FY2014 to FY2024. PIROG, *supra* note 172, at 5.

estimated at \$39.5 billion for the five year period beginning in 2013.<sup>196</sup> The dominant focus within renewable energy incentives is on the development of technologies to produce electricity from renewable resources and the development of renewable transportation fuels.<sup>197</sup>

IRC § 40 and IRC § 40A provide tax credits for producers of alternative liquid fuels such as alcohol-based fuels,<sup>198</sup> bio-diesels, and renewable diesel fuels.<sup>199</sup> Bio-diesel,<sup>200</sup> agri-diesel,<sup>201</sup> and renewable diesel producers can receive \$1 per gallon of produced fuels.<sup>202</sup> The cost of this program of tax credits is estimated to be \$2.2 billion a year, with the alcohol component being comparatively small at \$200 million annually.<sup>203</sup>

IRC § 45 enables a renewable electricity production credit to be earned by such producers; it returns \$0.015 per kilowatt-hour produced.<sup>204</sup> The qualified resources are enumerated: wind, closed-loop biomass, open-loop biomass, geothermal energy, solar energy, small irrigation power, municipal solid waste, qualified hydropower production, and marine and hydrokinetic renewable energy.<sup>205</sup> It is estimated that this allowance could return \$1.7 billion a year to producers of electricity from renewable resources.<sup>206</sup>

IRC § 45J enables an advanced nuclear power facility production credit; it returns \$0.015 per kilowatt-hour produced by such

196. SHERLOCK, *supra* note 169, at 14.

197. *Id.* at 15.

198. I.R.C. § 40(b)(2)(A). “The alcohol credit of any taxpayer for any taxable year is 60 cents for each gallon of alcohol which is not in a mixture with gasoline or a special fuel . . . .”

199. *Id.* at § 40A(b)(1)(A). “The biodiesel mixture credit of any taxpayer for any taxable year is \$1.00 for each gallon of biodiesel used by the taxpayer in the production of a qualified biodiesel mixture.” *See also* SHERLOCK, *supra* note 169, at 11.

200. I.R.C. § 40A(d)(1). “The term ‘biodiesel’ means the monoalkyl esters of long chain fatty acids derived from plant or animal matter which meet—(A) the registration requirements for fuels and fuel additives established by the Environmental Protection Agency under section 211 of the Clean Air Act (42 U.S.C. 7545), and (B) the requirements of the American Society of Testing and Materials D6751.”

201. *Id.* at § 40A(d)(2). “The term ‘agri-biodiesel’ means biodiesel derived solely from virgin oils, including esters derived from virgin vegetable oils from corn, soybeans, sunflower seeds, cottonseeds, canola, crambe, rapeseeds, safflowers, flaxseeds, rice bran, mustard seeds, and camelina and from animal fats.”

202. SHERLOCK, *supra* note 169, at 11.

203. *Id.* *See also* MOLLY F. SHERLOCK, CONG. RESEARCH SERV., RL31953, ENERGY TAX INCENTIVES: MEASURING VALUE ACROSS DIFFERENT TYPES OF ENERGY RESOURCES 7 (2012).

204. I.R.C. § 45(a)(1) and (2).

205. *Id.* at § 45(c)(1).

206. SHERLOCK, *supra* note 169, at 9.

facilities.<sup>207</sup> The dates of the design and intent to construct are key determinants of qualifying as an advanced nuclear power facility.<sup>208</sup>

IRC § 45Q(a)(1) provides tax credits for CCS facilities that are not affiliated with oil and gas production activities.<sup>209</sup> The carbon dioxide sequestration credit is \$20 per metric ton of qualified carbon dioxide, which is captured by the taxpayer at a qualified facility and disposed of by the taxpayer in secure geological storage.<sup>210</sup>

IRC § 48 Energy Credits, or investment tax credits (ITC), are available to investments in energy production that utilize geothermal sources, micro-turbine sources, or combined heat and power solutions. The ITC may be up to ten percent of the investment in the energy project.<sup>211</sup> The value of the credit program to investors has been estimated at \$500 million annually.<sup>212</sup>

IRC § 25D provides a 30% tax credit for the purchases and installations of a variety home-based solar and wind power systems.<sup>213</sup> The value of those credits has been estimated to be close to \$900 million a year.<sup>214</sup>

The impacts of tax code incentives for renewable energy might best be perceived from an “effective tax rate” (ETR) perspective instead of a bulk dollar perspective. An ETR is the tax rate as experienced after the various incentives have been included within the final tax calculation. Renewable energy projects show stunningly low ETR. Producers of electricity from solar thermal projects benefit from an ETR of -244.7 and wind projects benefit from their ETR of -163.8;<sup>215</sup> the minus sign denotes an effective net tax payment to the producers from the government. Nuclear power producers also benefit from an ETR of -99.5,<sup>216</sup> effectively reducing their tax incidence to incidental levels. Oil and gas producers range in ETR; integrated companies face an ETR of 15.2 while non-integrated operations benefit from an ETR of -13.5.<sup>217</sup> Producers of electricity from natural gas pay the highest ETR of 34.4.<sup>218</sup> Thus, it

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207. I.R.C. § 45J(a).

208. *Id.* at § 45J(d)(2). “[T]he term ‘advanced nuclear facility’ means any nuclear facility the reactor design for which is approved after December 31, 1993, by the Nuclear Regulatory Commission (and such design or a substantially similar design of comparable capacity was not approved on or before such date).”

209. *Id.* at § 45Q(a)(1).

210. *Id.* at § 45Q(a)(1)(A) and (B).

211. SHERLOCK, *supra* at note 169, at 10.

212. *Id.* See also SHERLOCK, *supra* note 204, at 7.

213. I.R.C. § 25D. See also SHERLOCK, *supra* note 203 at 10–11.

214. SHERLOCK, *supra* note 169, at 10.

215. SHERLOCK, *supra* note 203, at 22.

216. *Id.*

217. *Id.*

218. *Id.*



could be argued that renewable energy projects face more favorable net ETR under the tax code.

#### IV. INTERNATIONAL TRADE LAWS DRIVE COMPETITION IN THE MARKETPLACE

The global trading system, as exemplified by the WTO, works to secure the free trade of goods and services without discriminatory tariffs or barriers. The WTO is not the only such effort, as there are many regional trade zones that either provide broad economic alignments, such as the EU, or provide zones of expedited free trade, such as the Association of South East Asian Nations (ASEAN) and the North America Free Trade Agreement (NAFTA) zone. These organizations strive to provide protection to equal terms of trade and open markets with limited exceptions to protect certain national interests.

To the extent that energy resources, their products, and the services that sustain their use are covered by the WTO and its agreements, and similarly by other free trade groups, those energy products and services are likely to benefit from the application of the free trade regimes established by such organizations. As such, the various existing energy products, both fossil fuel and renewables, would benefit from free trade and removal of restraints and discriminations to their flow in the global marketplace. Without other environmental trade agreements to the contrary, this would enable various energy products and services to compete with each other directly on energy content and price structures, fostering additional competition in the energy sector.

##### *A. General Agreement on Tariffs and Trade (GATT)*

The GATT<sup>219</sup> provides a legal framework for the WTO's efforts to reduce barriers to trade and the elimination of discriminatory treatment in international commerce.<sup>220</sup>

##### *1. The GATT Attempts to Achieve the Free Flow and Free Trade of Goods.*

The GATT begins by requiring each contracting party to provide "most favored nation" treatment to all other contracting parties;<sup>221</sup> this

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219. General Agreement on Tariffs and Trade, Oct. 30, 1947, 61 Stat. A-11, 55 U.N.T.S. 194 [hereinafter GATT].

220. *Id.* at Preamble.

221. *Id.* at pt. I, art. I.

treatment enables each contracting party to set its own unique custom or tariff measures while simultaneously enabling all other parties to receive as-good-as terms. Each contracting party is also required to maintain “schedules of concessions” of their measures.<sup>222</sup> Domestic taxes and similar levies are likewise required to offer no benefit to domestic production nor discrimination against foreign production.<sup>223</sup> Freedom of transit, of several varieties, is guaranteed under the GATT.<sup>224</sup>

No quantitative prohibitions or restrictions may be imposed on the importation of goods between contracting parties, other than by duties, taxes, and the like.<sup>225</sup> If a quantitative prohibition or restriction is imposed, then the GATT requires those measures to be equally applied against all third parties.<sup>226</sup> The GATT prohibits domestic regulations of contracting parties from requiring domestic production content, and prohibits domestic regulations from setting guidelines for foreign production content.<sup>227</sup>

Temporary shocks to the free trade system can be accommodated under the GATT. Subsidies to increase exports or reduce imports can be permitted under the GATT, but not without a substantial review of the circumstances.<sup>228</sup> Dumping of products below comparable prices is prohibited and may be responded to by assessment of levies to “correct” for the market price of the dumped goods.<sup>229</sup> Similarly, when unforeseen developments place domestic products at risk of serious injury, then contracting parties may take certain liberties with their GATT obligations with regard to their schedule of concessions.<sup>230</sup>

## *2. The GATT Particularly Promotes Exports of Fossil Fuels from Developing Parties.*

The GATT recognizes that the attainment of its trade policy goals would be best achieved coincident with the progressive development

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222. *Id.* at art. II.

223. *Id.* at pt. II, art. III, sec. 1 and 2. *E.g.*, imposition of carbon taxes would be allowed so long as they did not provide for discriminatory effects, among other issues.

224. *Id.* at art. V.

225. GATT, art. XI, sec. 1.

226. *Id.* at art. XIII, sec. 1.

227. *Id.* art. III, sec. 5–7.

228. *Id.* art. XVI.

229. *Id.* art. VI, sec. 1-2. Valuation of products is set out in art. VII, wherein it is set at the “actual value;” actual value is a defined term meaning the value of “like merchandise . . . sold or offered for sale in the ordinary course of trade under fully competitive conditions.”

230. *Id.* art. XIX, sec. 1(a).

of those contracting parties whose economies can only support low standards of living and are in early stages of development.<sup>231</sup> Such developing contracting parties may apply flexibility to their tariff structures to support a nascent industry, or they may apply quantitative measures to similarly support development.<sup>232</sup>

Contracting parties that qualify as both “low standards of living” and “in early stages of development” shall be free to temporarily deviate from the GATT’s terms under specific requirements.<sup>233</sup> For those countries that depend heavily on exports of a small number of primary commodities<sup>234</sup> such as oil, when those exports are seriously reduced, then those contracting parties may seek Consultation for sympathetic consideration for flexibility under the GATT requirements.<sup>235</sup>

In order to help less-developed contracting parties develop their economies and improve their standards of living, the GATT supports the rapid and sustained expansion of those parties’ export earnings.<sup>236</sup> Since most of those parties rely heavily on the export of primary products such as crude oil or natural gas,<sup>237</sup> the GATT supports recognition of the need to provide favorable and acceptable access to world markets “in the largest possible measure.”<sup>238</sup> Stable, equitable, and remunerative prices are to be achieved by the WTO’s policies and the efforts of contracting parties to support these primary products through expanding their demand on the world market and increasing

231. GATT, art. XVIII, sec. 1. *See also* GATT Annex I, Ad. art. XVIII, wherein it is clarified that the process of market correction to cure overreliance on primary production can also merit an economy as “in the early stages of development.”

232. *Id.* at pt. II, art. XVIII, sec. 2.

233. *Id.* at sec. 4(a) (referencing Sections A, B, and C of art. XVIII). Many energy exporting nations are arguably such states, such as Chad.

234. Primary products include fuels and mining products, coal, crude oil, and natural gas. *See* U.N. DEP’T OF ECON. & SOC. AFFAIRS, STANDARD INTERNATIONAL TRADE CLASSIFICATION, REVISION 4, at sec. 2, divs. 27–28, sec. 3, divs. 32–34, sec. 6, div. 68, U.N. DOC. ST/ESA/STAT/SER.M/34/REV.4, U.N. Sales No. E.06.XVII.10 (2006), *available* at [http://unstats.un.org/unsd/publication/SeriesM/SeriesM\\_34rev4e.pdf](http://unstats.un.org/unsd/publication/SeriesM/SeriesM_34rev4e.pdf), archived at <http://perma.cc/2AJL-SC55>. *See also* World Trade Organization, INTERNATIONAL TRADE STATISTICS 2011, 188–90 (2011) [hereinafter WTO].

235. GATT, pt. II, art. XVIII, sec. 5, with reference to art. 22.

236. *Id.* at pt. IV, art. XXXVI, sec. 1 and 2.

237. Crude oil, natural gas, and coal are considered primary products. WTO, *supra* note 238, at 190. *See also* U.N. Dep’t of Econ. & Soc. Affairs, Standard International Trade Classification, Revision 4, U.N. Doc. ST/ESA/STAT/SER.M/34/REV.4, U.N. Sales No. E.06.XVII.10 (2006), *available* at [http://unstats.un.org/unsd/publication/SeriesM/SeriesM\\_34rev4e.pdf](http://unstats.un.org/unsd/publication/SeriesM/SeriesM_34rev4e.pdf), archived at <http://perma.cc/2AJL-SC55> (crude oil is listed at Division 33, natural gas at Division 34, and coal at Division 32).

238. GATT, pt. IV, art. XXXVI, sec. 4.

the level of trade in these primary resources.<sup>239</sup> Thus, the GATT recognizes an obligation to support the sustained and competitive export of primary products, including fossil fuels, for the social and welfare needs of its lesser-developed contracting parties.

However, this support of primary product exports is to be accompanied with ancillary developments in industrial diversification;<sup>240</sup> this might be in converting primary products to secondary products or the development of industry unrelated to the primary products. Thus, Section 5 could be satisfied in a variety of ways related to energy products; for instance, (i) crude oil sales could be diversified to include refinery products; (ii) fossil fuel revenues could be used to acquire renewable energy technology and sources; or (iii) separate sources of financing could support acquisition of alternative energy sources. In all manners, the path of diversification could foreseeably result in additional energy products, potentially requiring increased levels of domestic primary production to support the diversified export product lines.

To further support the lesser-developed contracting parties, the developed parties under the GATT agree to certain “commitments,” or obligations.<sup>241</sup> Key among these obligations is to refrain from the introduction of non-tariff import barriers that might frustrate the export of primary products targeted in the above discussions.<sup>242</sup> Another obligation is to improve the access to world markets for those primary products of lesser-developed parties.<sup>243</sup> Developed parties are obligated to undertake action to achieve international arrangements to facilitate such results if necessary; parties are encouraged to collaborate to achieve concrete measures to support long-run profitable export of those primary products.<sup>244</sup>

While the original intent of these terms may not have foreseen the needs of climate change mitigation efforts, it appears that the developed countries do bear commitments to protect those critical primary product exports or, under Article XXXVI, to financially support the replacement of those revenues through some means of industrial diversification.

While certain WTO parties are both developed and rich in fossil fuel resources,<sup>245</sup> many countries rich in such assets remain lesser-developed contracting parties to the GATT. To the extent that those countries need the revenues from the exports of their natural

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239. *Id.*

240. *Id.* at sec. 5.

241. *Id.* at art. XXXVII.

242. *Id.* at sec. 1(b).

243. *Id.* at art. XXXVIII, sec. 2(a).

244. GATT, sec. 2(a) and (c).

245. *E.g.*, Norway and the United States.

resources, the developed parties of the WTO have undertaken obligations to not only allow, but to foster and encourage the development of such fossil fuel exports into the global markets. Given the number of lesser-developed states requiring such fossil fuel export revenues and the broader challenges of advancing their economies and standards of living, it is foreseeable that the WTO will need to continue the sustained support of expanding and ensuring the profitability of fossil fuel exports. Given those requirements, it is also reasonably foreseeable that the WTO would continue to ensure that larger supplies of fossil fuels remain on the market and that such products would be priced to remain sustainably competitive.

### *3. Exceptions for Other Situations*

Article XX allows for the imposition of certain critical or necessary measures, so long as the measures themselves are not arbitrary or unjustifiable forms of trade restrictions or trade discrimination.<sup>246</sup> There are several measures that might apply to the export of primary products and to the energy industries.

First, if the imposed measure is necessary for the protection of human, animal, or plant life, then such a measure would not be prevented by the GATT.<sup>247</sup> Given the multitude of concerns about the potential impacts of climate change, it would be reasonable for some parties to present arguments that they need to implement certain measures to mitigate the overall hazards to human life, animal life, and plant life within their jurisdictions. However, while such measures might be applied internally, it appears that no power exists under the GATT to impose such measures on other contracting parties; thus, if one party was concerned about the impact of fossil fuel consumption, it might be able to reduce fossil fuel consumption within its own jurisdiction but have no ability to impose a similar measure on a third contracting party. So, if that third party wanted to produce and export fossil fuel primary products or derivative products, then the GATT would not avail a power to limit that party's choice of production; indeed, as discussed,<sup>248</sup> the GATT might require the first party to support that export of fossil fuel if the first party was developed and the exporting party was a lesser-developed party.

Second, if the measures are necessary to accommodate compliance with other treaties or regulations then the measures would

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246. GATT, pt. II, art. XX.

247. *Id.* at sec. (b).

248. *See supra* Part IV.A.2 (discussion on GATT's role to support development of lesser-developed primary product exporting parties).

not be prevented by the GATT, so long as those requirements and measures are not otherwise inconsistent with the requirements of the GATT.<sup>249</sup> Similar to the key logic in the above paragraph, this section would allow parties to enable their own compliance with climate change agreements or energy market agreements, but it would not enable them to expand those measures onto other unwilling parties under the GATT. This section might allow multiple parties to engage in the development and construction of coordinated climate change measures and enable their own reduction of carbon emissions, but again, such measures would first need to be not inconsistent with the goals of the GATT, and second be limited to those volitionally so motivated and not beyond. Given that the GATT requires support of primary product exports from developing parties, climate change management efforts would need to accommodate those needs as well. Indeed, the UNFCCC does call for such assistance and the Technology Mechanism is an instance of such assistance,<sup>250</sup> but the broader requirement to improve the economic development and to improve the standard of living for those lesser-developed parties remains; it is unclear if the UNFCCC measures will result in such changes.<sup>251</sup>

The third and fourth measures are closely related. Third, if the measures are related to the conservation of exhaustible natural resources, then such measures would be allowed so long as they are implemented alongside similar restrictions on domestic production or consumption.<sup>252</sup> Fourth, if a measure is undertaken to comply with any intergovernmental commodity agreement and is not otherwise inconsistent with the requirements of the GATT, then such a measure would be allowed.<sup>253</sup> This is interesting in that a variety of such agreements, such as the ECT and OPEC, do exist for fossil fuel type commodities. OPEC and the ECT clearly call for larger supplies of fossil fuels at sustainable and competitive prices, goals that appear very much in line with the broader goals of the GATT. Also, while commodity exporters might be prevented from dumping oil products on other contracting parties,<sup>254</sup> the GATT does not appear to prevent

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249. GATT, pt. II, art. XX, sec. (d).

250. See *supra* Part I for discussion on UNFCCC. See also *supra* Part I.B. for discussion on technology transfer.

251. Arguably, this is the crux of OPEC's concerns on global poverty and not climate change as the premier global environmental crisis. See *supra* Part II.B.3 for discussion on OPEC's concern on global poverty.

252. GATT, pt. II, art. XX, sec. (g).

253. *Id.* at pt. II, art. XX, sec. (h).

254. *Id.* at pt. I, art. VI.

them from self-constraining their own domestic production.<sup>255</sup> Broadly speaking, it is foreseeable that intergovernmental agreements on commodities, particularly commodities drawn from primary products, would be designed to increase the level of trade and export parties' revenues; thus, it is foreseeable that Article XX(h) may lead to higher levels of fossil fuel production, not less.

*Ergo*, while the GATT itself enables parties to undertake certain measures as general exceptions to the broader requirement of the GATT's obligations, it appears that on balance such exceptions would do little to reduce fossil fuel production, *sans* volitional agreements by the relevant parties, and foreseeably its Article XX rules could lead to increased levels of such production.

### *B. General Agreement on Trade in Services (GATS)*

Energy is not only physical products, energy as an industry also includes a range of service products. This section examines the character of the General Agreements on Trade in Services (GATS) for its influence on international and trans-boundary trade of energy products and services.

The GATS's rules apply to services rendered by a party in one Member to a customer in another Member.<sup>256</sup> It supports the efforts of Members to create and enter into agreements of economic integration; such economic integration agreements both provide substantial sectorial coverage and provide for the absence or elimination of trade discrimination.<sup>257</sup>

Domestic regulation of service industries must be reasonable, objective, and impartial.<sup>258</sup> Technical standards or regulations must be based on objective and transparent criteria,<sup>259</sup> not be more burdensome than necessary,<sup>260</sup> and for licensing procedures, not be themselves a restriction on trade.<sup>261</sup> Also, the GATS provides for the recognition that certain business practices of service suppliers may

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255. On the other hand, to the extent that such Art. XX(g) "conservation efforts" measures were to be adverse to the economic development of those lesser-developed parties, then the GATT might actually require the developed parties to reach out in collaboration to resolve the situation in a manner that led to greater exports and to more sustainable prices. *See* GATT, pt. IV, art. XXXVI.

256. GATT, pt. I, art. I, secs. 1 and 2.

257. *Id.* at pt. II, art. V, sec. 1.

258. *Id.* at pt. II, art. VI, sec. 1.

259. *Id.* at pt. II, art. VI, sec. 4(a).

260. *Id.* at pt. II, art. VI, sec. 4(b).

261. *Id.* at pt. II, art. VI, sec. 4(c).

also restrain competition which results in restrictions in trade of services.<sup>262</sup>

The Members are obligated to support the growth and development of the domestic service capacity of developing Members.<sup>263</sup> Key among these obligations are the requirements to liberalize market access and to liberalize the modes of supply of export interest to the developing Members.<sup>264</sup> Due to the special economic situations, special priority is to be given to the support of least-developed Members.<sup>265</sup> Their development, trade, and financial needs are to be taken account of in the setting of their obligations within the GATS.<sup>266</sup> When developing Members are parties to agreements on economic integration, flexibility shall be allowed to them to support their development.<sup>267</sup>

Article XIV “Security Exceptions” provides for Members to potentially take certain actions to support their obligations under the United Nations Charter for the maintenance of international peace and security;<sup>268</sup> further, Members may take measures to provision a military establishment or to act in time of war or for emergencies in international relations.<sup>269</sup> Arguendo, the impacts of climate change are expected to affect international peace and security, and most Members of the GATS are signatories to the UNFCCC and its subsequent accords, thus Members of the GATS might reasonably be allowed to deviate from the GATS’s rules to ameliorate anthropogenic climate change. Additionally, militaries are becoming increasingly responsive to imminent climate change impacts as part of their near-term planning,<sup>270</sup> and as such, such measures might be well permitted under the GATS.

Nothing within the GATS prevents Members from adopting domestic measures to address the causes of anthropogenic climate change, but it would limit the manner in which said measures were designed; the measures must remain in support of the goals of the GATS to enable free trade in services free from trade discrimination.

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262. GATTs, pt. II, art. IX, sec. 1.

263. *Id.* at pt. II, art. IV, secs. 1(a), (b), and (c).

264. *Id.* at pt. II, art. IV, sec. 1(c).

265. *Id.* at pt. II, art. IV, sec. 3.

266. *Id.*

267. *Id.* at pt. II, art. IV, art. 5, sec. 3(a).

268. GATS, pt. II, art. XIV *bis*, sec. 1(c).

269. *Id.* at pt. II, art. XIV *bis*, secs. 1(b)(i) and (iii).

270. *See supra* Part III.B. for discussion on the U.S. DoD’s climate change planning.



## V. GREEN PARADOX RESULTS FROM CORNUCOPIA OF ENERGY INNOVATIONS

A. *Putting the Parts Together*

There are several conclusions to be drawn from the above discussions. First, legal measures intended to alleviate causes of anthropogenic climate change are providing incentives to stimulate innovation and production of energy from new and renewable energy sources. It is reasonable to expect at least some progress on this front, and if so, then energy supplies will increase. Anecdotal evidence supports the hope that green energy might soon be abundant and affordable.<sup>271</sup>

Second, international legal conventions exist that support the sustained production and marketing of fossil fuels. As a part of their efforts, they also provide incentives for innovations to sustain, extend, and expand the current levels of hydrocarbon production. As seen in the recent shale (“frack”) oil developments, and in potential offshore methane hydrates developments, it is reasonably foreseeable that these efforts will result in additional and sustained hydrocarbon energy supplies; again, anecdotal evidence reinforces this conclusion.<sup>272</sup>

Third, nations are pursuing energy security targets, as modern industrial nations are dependent on energy sources to sustain the

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271. Researchers at Stanford University and University of California at Davis have provided an excellent review of the “feasibility of providing worldwide energy for all purposes” from wind power, solar power, and water power sources by 2030. See Mark Z. Jacobson & Mark A. Delucchi, *Providing All Global Energy with Wind, Water, and Solar Power, Part I: Technologies, Energy Resources, Quantities and Areas of Infrastructure, and Materials*, 39 ENERGY POLICY 1154 (2011). See also Mark A. Delucchi & Mark Z. Jacobson, *Providing All Global Energy with Wind, Water, and Solar Power, Part II: Reliability, System and Transmission Costs, and Policies*, 39 ENERGY POLICY 1170 (2011).

272. Shale oil continues to play a substantial role in the reassessment of potential fossil fuel reserves. The largest shale oil deposit in the United States is the Green River Formation near Wyoming, Colorado and Utah. It is estimated to contain a very large volume of recoverable petroleum. As a Rand Corporation study stated, “the midpoint in our estimate range [for the Green River Formation], 800 billion barrels, is more than triple the proven oil reserves of Saudi Arabia. Present U.S. demand for petroleum products is about 20 million barrels per day. If oil shale could be used to meet a quarter of that demand, 800 billion barrels of recoverable resources would last for more than 400 years.” JAMES T. BARTIS, ET AL., OIL SHALE DEVELOPMENT IN THE UNITED STATES: PROSPECTS AND POLICY ISSUES ix (2005). Similarly, the potential volumes of offshore methane hydrates range nearly 100 fold that of current conventional natural gas reserves. See Roy Andrew Partain, *Avoiding Epimetheus: Planning Ahead for the Commercial Development of Offshore Methane Hydrates* 15 SUSTAINABLE DEV. L. & POL’Y 4, 16–25, 56–58 (2015).

scale of their economies. For example, the United States is pursuing innovation on all fronts: renewables, hydrocarbons, and nuclear energy. Very large subsidies and other incentives are provided to attain these goals; again, it is reasonably foreseeable that energy security needs will result in greater energy supplies. Anecdotal reports support that progress is being made to further develop energy supplies for security.<sup>273</sup>

Fourth, most of the world's economies are connected via international trade law conventions that support free trade, trade without unfair tariffs, and discrimination-free trade. Thus, it would be very difficult to control the flow of energy products for contracting parties of those conventions. Further, the WTO has certain obligations to support the export of primary products and to ensure the growth of economic development and raise the standard of living for its contracting parties, especially its lesser-developed members. As such, these legal conventions will advance the competitive markets of energy products and provide the economic mechanisms that enable market forces to regulate market results.

Clearly, the foreseeable result is the possibility that energy supplies will be expanded on a variety of fronts and that these energy products will face a fairly competitive marketplace. Given the nature of the market and the demand for energy from a growing and developing population, it is likely that more energy will be consumed; *ergo*, there is a risk that higher levels of fossil fuels will also be consumed.

### *1. International Energy Laws are Driving a Cornucopia of Energy Innovations*

The above studies have shown that three major clusters of energy law or energy conventions provide incentives for energy innovations. Those energy innovations include all areas of energy sources: fossil fuels, renewable fuels, and others such as nuclear fuel. Those

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273. For the official perspective on the "Great Green Fleet" at the core of the USN's climate change policies and its progress to achieve a fleet running on new and renewable fuels, see *Energy, Environment and Climate Change*, U.S. NAVY, <http://greenfleet.dodlive.mil/energy/great-green-fleet/>, archived at <http://perma.cc/7QD4-65HP> (last visited Jan. 9, 2015). Prior to its full-time deployment set to begin in 2016, the Great Green Fleet participated in the 2012 Rim of the Pacific (RIMPAC) offshore naval exercise, "the world's largest international maritime exercise." *Id.* For a report from progressive media on the recent developments, including coverage of that debut of the fleet in 2012, see Julia Whitty, *My Heart-Stopping Ride Aboard the Navy's Great Green Fleet -- With Washington Frozen Solid on Climate, the Navy is Breaking the Ice*, MOTHER JONES, (Mar./Apr., 2013), <http://www.motherjones.com/environment/2013/02/navy-climate-change-great-green-fleet>, archived at <http://perma.cc/7JZ8-AZ3R>.

measures are all aimed at increasing the potential amount of energy supply from targeted energy sources and ensuring that the resultant energy supplies are market competitive with other existing or emerging energy supplies.

The UNFCCC provided a framework of strategies to reduce greenhouse gas emissions by multiple approaches.<sup>274</sup> Energy efficiency was called for; however, energy efficiency leaves surplus energy on the market if not consumed, and the Jevons Paradox has long raised doubts of whether energy efficiency ever reduced consumption.<sup>275</sup> Innovations in new and renewable energy sources were called for. With success, the world might soon have abundant supplies of green energy. But those energy products will be fungible and competitive with existing electrical supplies and transportation fuels; global competitive energy supplies will be increased. The prevention of methane emissions and the capture of carbon in sinks and reservoirs is laudable, but the presence of carbon sinks might serve to justify arguments that fossil fuels can be consumed safely. Many sinks and reservoirs, such as forests and wetlands, would not be directly connected to the energy user and would remain somewhat of a public good. Thus, many might claim to use what might only sustain a few in carbon absorption and storage.

The role of the ECT and of OPEC to promote hydrocarbon resources is clearly laid out.<sup>276</sup> Both organizations have contracting parties committed to the sustained development, production, and marketing of their petroleum and natural gas assets. They endeavor to ensure that their products remain price competitive with substitutable goods and that their industries continue to provide reasonable returns on capital investment. They further seek to support their products in international trade. As such, it is reasonable to expect that these states will endeavor to provide continued and expanded levels of energy supplies from fossil resources.

Energy security laws are designed to provide secure sources of energy in a world of instability; it is in the nature of such provisional planning to plan for redundancy—in short to plan and provide for surplus energy supply capacity. The United States has multiple strategies that each support divergent energy sourcing options. The DOE is charged with energy innovation and reliability and provides programmatic incentives to achieve those goals.<sup>277</sup> The DOD has

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274. *See supra* Part I.

275. For an in-depth review of the Jevons Paradox and its nexus with climate change concerns, *see* JOHN M. POLIMENI, KOZO MAYUMI, MARIO GIAMPIETRO, & BLAKE ALCOTT, *THE MYTH OF RESOURCE EFFICIENCY* (Earthscan, London, 2009) (*previously*, *THE JEVONS PARADOX AND THE MYTH OF RESOURCE EFFICIENCY*).

276. *See supra* Part II.

277. *See supra* Part III.A.

distinguishable energy security needs and operates primarily from the Defense Production Act; still, the DOD remains committed to a variety of energy innovation projects.<sup>278</sup> The United States' broader energy agenda, as enunciated by Congress through the tax code, provides a hodgepodge of economic incentives to petroleum energy resources, new and renewable energy sources, and alternative energy sources.<sup>279</sup> Given the scale of the programs and incentives, it is reasonable to expect that additional energy supplies could result.

The WTO's particular support of primary products from lesser-developed parties is of additional note: that a body ostensibly aiming for even and fair trade has taken concern to ensure that lesser-developed countries are able to export their primary products in a manner that leads to their further economic development.<sup>280</sup> As petroleum is a key primary product for certain lesser developed countries, in addition to being a primary export for certain countries, the WTO system supports the growth of fossil fuels in a manner that it likely would be unable to support new and renewable energy supplies *sans* additional growth in the scope of the WTO.

Thus, the variety of energy laws reviewed demonstrates that their policy goals are to increase levels of energy supplies available to the global market and to ensure that those energy supplies are affordable to consumers. Additionally, to the extent that the consumption of most energy products is path-dependent on the installed machine base, energy source alternative will remain compatible to current electrical and transportation fuel norms of production.<sup>281</sup> Thus, if the goals of those legal measures are attained, it is reasonably foreseeable that consumers would be presented with increased levels of energy supplies, that those energy supplies will be competitive goods in character and usage, and that the costs of those energy products and services would likely be competitive with one another.

## *2. International Trade Laws and Market Forces Could Result in Higher Consumption*

International trade regimes, as exemplified by the WTO, strive to enable idealized conditions for trade: free transit of goods and services, tariff free marketing, and the absence of market discrimination. Commodities and services can freely enter into a

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278. See *supra* Part III.B.

279. See *supra* Part III.C.

280. See *supra* Part IV.A.2.

281. This problem is most clearly revealed in the DOD's green energy planning. See *supra* Part III.B.

variety of markets; indeed, the concept of a global market is correlated with the success of the GATT parties to reach to such a high percentage of the world's states.

When all other things stay the same,<sup>282</sup> additional quantities of otherwise “competitive products”<sup>283</sup> into a common market should result in lower prices if the overall demand function also remains unchanged.<sup>284</sup> That lower price enables the market to clear and to consume all of the products. In this case, the products would be the whole mix of energy products, including fossil fuels and renewable energy sources. If the market did clear all of the energy products placed into it, that clearing would require the purchase and expected consumption of the fossil fuel products; such consumption would result in greenhouse gas emissions, as the fossil fuels are combusted for energy release.

### *3. Higher Energy Consumption Could Lead to Increased Greenhouse Gas Emissions*

If only the legal measures that address the support and sustained production and future remunerative nature of fossil fuel industries are successful in their efforts, the world would likely encounter increased quantities of hydrocarbon production, at least for the next several decades, or potentially much longer.<sup>285</sup>

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282. The economic modelling phrase of *ceteris paribus* is the targeted meaning herein.

283. The economic parlance would be ‘similarly priced, highly substitutable (or *close* substitutes) goods’ in lieu of ‘competitive goods.’

284. N. GREGORY MANKIW, *PRINCIPLES OF MICROECONOMICS*, FIFTH EDITION (South-Western, 2009), *see* Table 4, at 82. *See also* ROBERT H. FRANK, *MICROECONOMICS AND BEHAVIOR*, EIGHTH EDITION, 37–41 (2010). In more formal terms, *see* ANDREU MAS-COLELL, MICHAEL D. WHINSTON, & JERRY R. GREEN, *MICROECONOMIC THEORY* (1995). The references here are to several popular textbooks at the undergraduate and post-graduate level of economics courses. The original concept(s) was pioneered by Alfred Marshall, who called it “scissors analysis,” building on its previous discovery of “supply and demand” theory by Antoine Augustin Cournot.

285. While many might expect that hydrocarbons are running into short supply, such is not the actual case. While arguments could be presented that the costs to explore and develop crude oil assets are increasing, technology has continued to develop, and certain costs of previously unproducible hydrocarbon assets have come in recent range. The development of the shale oil industry, colloquially referred to as “frack oil,” has dramatically reset the global markets in crude oil. Another potential hydrocarbon resource, offshore methane hydrates, were only recently the subject of pure research; however, Japanese researchers demonstrated the production potential of those resources in 2013. For an in-depth discussion on the centuries-long potential production profile of offshore methane hydrates, *see* Partain, *supra* note 272.

Increased consumption of those fossil fuels could result from several scenarios. First, if the global population continues to increase its standard of living,<sup>286</sup> it will likely have higher demands for energy. Second, if the world's population continues to increase in size, and at least maintains its current standard of living, then the additional humans would require additional energy consumption. Third, if the increased supplies were subject to traditional supply and demand analysis, then even when no increases in the demand function were to be observed, we would expect the prices of such fuels to drop until they were all purchased.<sup>287</sup> It is likely that standard of living will continue to improve; it is likely that the world's population will continue to increase in count, and it is likely that prices will be adjusted to ensure that the products are consumed.

Green energy innovations might not be sufficient to cure this result. First, the creation and production of highly substitutable energy sources, biofuels to replace conventional diesel, and solar plants to replace coal power plants does not ensure the elimination of fossil fuel consumption globally but does reduce the previous consumption of those fuels, effectively rendering more fossil fuels into the marketplace, *i.e.*, avoiding the consumption of fossil fuels effectively increases their supply for other consumers.

#### 4. *Gains in Efficiency Might Not Help*

One might expect gains in energy efficiency to reduce overall energy demand by technologically requiring less energy for each task, as mandated by the UNFCCC.<sup>288</sup> However, gains in energy efficiency seldom result in lower levels of energy consumption. The UNFCCC and related regulatory efforts encourage the promotion of energy efficient technologies as a complement to encouraging renewable and carbon-free energy sources.<sup>289</sup> The basic concept is that if engines and machines needed less energy, then less conventional fossil fuels would be consumed.

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286. A *per se* requirement of GATT and its contracting parties, *see supra* Part IV.A.2.

287. This discussion is a gross simplification of the underlying economic processes required, but it makes the effort to suggest that such results and events are potential outcomes of current legal policies. It does not make an effort to prove or extensively demonstrate any sense of specific likelihoods, but instead, it merely posits that such scenarios might be feasible under current legal measures. To the extent that they are potential future risks or hazards is sufficient for the present legal analysis, no demonstration of proof or certainty is made herein.

288. *See supra* Part I.D.

289. *Id.*

However, as Jevons first wrote nearly two centuries ago, energy efficiency does not necessarily lead to a reduction in energy demand and may well encourage increased energy demand.<sup>290</sup> There are several motivations for the traditional Jevons' Paradox and the related theories of "rebound effects."<sup>291</sup> While the economic phenomena related to energy efficiency, Jevons' Paradox, and the potential for energy efficiency to increase energy could engage very lengthy discussions,<sup>292</sup> here is a quick sketch of several known related phenomena:

- i. The inelasticity of demand plays a key role; if a market is able to absorb all of the energy provided to it at high prices, then it will likely absorb greater supplies of energy at lower prices.
- ii. Efficiency gains can create a virtual increase in supply. Considered from a unitized perspective:<sup>293</sup> assume a task originally took two parts of energy to complete and then was made more efficient to require only one part of energy; although the overall supply of energy was left unchanged, the user of the machine will observe twice as much supply vis-à-vis his operational needs. From the perspective of the consumer, energy efficiency would make the supply of energy appear increased.
- iii. Reducing the necessary energy for any particular task brings that task in range of more numerous populated but

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290. "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 . . . . [E]very . . . improvement of the engine, when effected, does but accelerate anew the consumption of coal." B. Alcott, *Jevons' Paradox*, 54 *ECOLOGICAL ECON.* 9, 12 (2005).

291. The Khazzoom-Brookes Postulate states that improvements in energy efficiency will increase energy consumption, *ceteris paribus*; the Postulate specifically assumes fixed real energy prices. Lorna A. Greening, et al., *Energy efficiency and consumption — the rebound effect — a survey*, 28 *ENERGY POL.* 389, 389 (2000). As the Postulate assumes no change in energy prices, the quantity demanded necessarily reflects a new demand function for energy after the achievement of energy efficiency. Greening, Greene, and Difiglio proposed a four-part typology to separate the various mechanisms responsible for the effects postulated by Khazzoom-Brookes. *Id.* at 390. They recognized the four mechanisms as (i) direct rebound effects, (ii) secondary fuel usage effects, (iii) energy market clearing mechanism effects, and (iv) transformational effects. *Id.* at 390. The authors noted that their typology took the perspective that demand for energy *cum* fuels was actually demand for a services product instead of a stock product, but for the purposes of this comment, the nuance causes no significant difference.

292. See POLIMENI ET AL., *supra* note 275.

293. In economics literature this has been described as the rebound effect of efficiency gains or as the backfire effect when policy goals of efficiency were to enable budget maintenance or reduction.

smaller energy budgets; energy efficiency puts more tasks in range of more people.<sup>294</sup> By enabling more people to consume energy, it is possible that energy efficiency can lead to additional economic activity and potentially economic growth.<sup>295</sup>

Lower prices, increases in effective supply, and reduced scale of energy needs per activity all could lead to sustained or higher levels of energy consumption. Higher energy consumption could lead to higher levels of greenhouse gas emissions.

#### CONCLUSION

##### BETTER CHOICES IN INNOVATION: THE STONE AGE DID NOT END FOR LACK OF STONE<sup>296</sup>

Thus, in the present situation, without some form of change in law and legal conventions, the world is faced with the imminent possibility of increased greenhouse gas emissions as additional energy supplies from both fossil fuels and new and renewable energy sources respond to the incentive to innovate. There are several ways to prevent this from happening.

First, the existing laws and legal conventions could be altered, and such efforts are indeed in progress. The UN hopes for a major update to the UNFCCC in 2015 at what is tentatively referred to as Paris 2015.<sup>297</sup> However, it is already some three plus decades since the international legal negotiations have been underway, starting with the original talks that led to the UNFCCC itself. Major economies have recently reduced their engagement with certain UNFCCC/Kyoto targets, namely Australia and Canada. Another major economy, the

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294. Assuming a Pareto distribution of income would suffice, that every level of wealth has fewer members than the level immediately below it.

295. Also known as the Khazzoom–Brookes postulate. Khazzoom and Brookes, separately and not as co-authors, provided a series of articles on the variations of this concept, e.g. in 1978, 1980, 1982, 1987, and 1989. See Greeninga, et al., *supra* note 291, at 390.

296. “The Stone Age did not end for lack of stone, and the Oil Age will end long before the world runs out of oil.” Often attributed to Sheikh Zaki Yamani. See *The End of The Oil Age*, THE ECONOMIST (Oct. 23, 2003), available at <http://www.economist.com/node/2155717>, archived at <http://perma.cc/6656-JDCR>.

297. See *21st Conference of the Parties on Climate Change 2015*, FRANCE DIPLOMATIE (July 14, 2014), <http://www.diplomatie.gouv.fr/en/french-foreign-policy-1/climate-7436/2015-paris-climate-conference/>, archived at <http://perma.cc/Q3MP-XEZG>. See also Nick Nuttall, *Negotiations Towards New Universal Climate Agreement in 2015 Get Underway*, UNFCCC (Mar. 14, 2014), [http://unfccc.int/files/press/press\\_releases\\_advisories/application/pdf/20141403\\_adpclose.pdf](http://unfccc.int/files/press/press_releases_advisories/application/pdf/20141403_adpclose.pdf), archived at <http://perma.cc/V349-BW3E>.



United States, never joined in the Kyoto obligations.<sup>298</sup> The world remains without a united governance paradigm to achieve global reductions in greenhouse gases.

Second, failing to achieve coordinated measures, governments might attempt unilateral movements in domestic legal measures to try to cobble together movement towards reductions in greenhouse gas emissions. Such efforts have been undertaken, indeed much of the green policies in place—certainly those of the United States—have been undertaken from such a perspective. However, any effort to provide incentives for green energy innovation *sans* other acts of energy law coordination merely adds to global energy supplies as discussed in this article<sup>299</sup> and perhaps enables international carbon leakage problems.<sup>300</sup>

Third, the general public could be persuaded to shift their priorities and consumption preferences to create stronger market demand for new and renewable energy products. An example of such an effort is Al Gore's slideshow *cum* book *cum* movie "An Inconvenient Truth" and its worldwide media coverage, which ensured that most people today are aware to some extent of the issues.<sup>301</sup> However, as green energy products are designed as close substitutes for traditional energy products, their consumption might merely relocate the consumption of fossil fuels to those consumers either unaware or indifferent to the concerns of climate change, and indeed, some might be prioritizing purchases of green energy products; but nowhere are fossil fuels abandoned, nowhere are there piles of fuel abandoned for use.<sup>302</sup>

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298. At the time of writing in early November 2014, the Republican Party had just gained control of Congress, both the House and the Senate. Such control will likely limit the ability of the Obama Administration to overtly agree to the Paris 2015 agreements. For more on the limits of the American government to agree to international climate accords, see Roy A. Partain & Sanghyun Lee, *Article 20 Obligations under the KORUS FTA: The Deteriorating Environment for Climate Change Legislation in the U.S.*, 24 AM. CONST. STUD. 441 (2013).

299. See *supra* Part V.

300. For a discussion on international carbon leakage, see Partain, *Green Paradox Spectre*, *supra* note 3.

301. See AL GORE, *AN INCONVENIENT TRUTH: THE PLANETARY EMERGENCY OF GLOBAL WARMING AND WHAT WE CAN DO ABOUT IT* (2006). See also Kakutani's review of the book, Michiko Kakutani, *Al Gore Revisits Global Warming, With Passionate Warnings and Pictures*, N.Y. TIMES (May 23, 2006), [http://www.nytimes.com/2006/05/23/books/23kaku.html?pagewanted=all&\\_r=](http://www.nytimes.com/2006/05/23/books/23kaku.html?pagewanted=all&_r=), archived at <http://perma.cc/8V6B-5BX5>.

302. Perhaps recent price adjusts to oil, as of November 2014, reflect increased supplies on the market, but still, the market appears to be clearing at the lower prices. Details on the potential for oil prices to drop much further and remain above their marginal costs of production are discussed in Partain, *supra* note 3, at Part III.

So the best answer, barring global legal solutions at the 2015 Paris convention, is hidden in that simple term of “perfect substitutes.” As long as the green energy innovations are designed and implemented as mere substitutes, they will not be effective at eliminating fossil fuels from the marketplace, but will merely enable the continued means of fuel and energy delivery. As long as the systems remain similar, and as long as the relevant parties remain engaged in maintaining and sustaining price competitiveness, the price of fossil fuels will only face pressure to drop and thus become available for a greater range of consumption options. Perfect substitutes lead to competition, which can only be won on pricing, *ceteris paribus*.

*Ergo*, the innovations that are needed are either those innovations that so transform the cost structure of new and renewable energy sources as to make them consistently preferable to the substantial totality of global customers, and those innovations that make the character of new and renewable energy sources so sufficiently superior that few would want to consume fossil fuels.

Instead of simply attempting to encourage all new and renewable energy alternatives, energy policies that encourage innovation should be focused on these two agendas: (i) dominant cost superiority and (ii) dominant energy character. More energy, more readily accessed, at lower costs, all while providing superior environmental and climate protection.

Focusing on those policies that seek to squeeze fossil energy out from one area will only encourage its consumption elsewhere. Policies that attempt to deny the property rights of those that currently own and derive their livelihoods from those resources is also ethically and practically fraught with complexity and other hazards.<sup>303</sup> New technologies that accomplish the task better and at cheaper costs displace the old technologies. The world needs those innovations in energy; legal measures to suppress fossil fuels likely will not work.

Does the world need an era of *fossil fuel prohibitionism*? Or, should the world seek better choices? The answer lies in better choices. Selective innovation should be the goal of future energy policies.

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303. Sinn was very concerned with this topic of property rights and their impact on accelerated depletion rates. See Partain, *Green Paradox Spectre*, *supra* note 3.

