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Daniel Magraw & Radhika Venkataraman,  
*Virtual Water, Embodied Carbon and Trade  
Law: Conflict or Coexistence?*  
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### VIRTUAL WATER, EMBODIED CARBON AND TRADE LAW: CONFLICT OR COEXISTENCE?

**DANIEL MAGRAW\* & RADHIKA VENKATARAMAN\*\***

*Water shortages and climate change are among the most serious threats facing humanity, and are of immense environmental and human rights significance. This paper addresses the efforts made to deal with these threats under international trade law, with special focus on the General Agreement on Tariffs and Trade (GATT). In the case of water, the input is 'virtual water', i.e., the water that is consumed during the life cycle of a good or service (development, production, transport, etc.) up to the point that it is exported. In the case of climate change, the input is 'embodied carbon', i.e., the carbon that is emitted into the atmosphere during the life cycle of a good or service (development, production, transport, etc.) up to the point it is imported.*

*In each case, countries are likely to increase regulation of these inputs, and may employ measures that affect international trade. In the case of virtual water, countries will be interested in protecting their own water supply from being consumed excessively to produce goods, such as agricultural commodities, for export. In the case of embodied carbon, countries with strict carbon emissions standards will be interested in protecting their domestic producers from competition by goods from countries with less strict, and thus less costly, carbon emissions standards, as well as in preventing carbon leakage.*

*This paper analyses three possible types of control measures for each of virtual water and embodied carbon, which reveals uncertainties in the trade law analysis and demonstrates that good faith efforts to deal with water shortages and climate change might run afoul of international trade regimes, thus setting up a conflict between these areas of law. A particularly important aspect stems*

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*from the fact that both virtual water and embodied carbon have significant human rights implications, thus raising the issue of how human rights should be treated vis-à-vis international trade. In addition to discussing that relationship, the paper identifies four jurisprudential means of avoiding regime conflict, as well as the possibility of a trade waiver for climate change.*

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### I. INTRODUCTION

This paper addresses the treatment under international trade law of two conceptually related phenomena of global environmental and human rights significance: virtual water and embodied carbon. Each involves the fact that producing, processing, and transporting goods and services often entails inputs that are important from environmental and human rights perspectives and do not appear in the final good or service itself. The input that is of interest is surface or ground water in the case of virtual water and carbon in the case of embodied carbon. Thus, the production of a good or service being traded internationally may have involved the use of water that is not contained in the final good or service, or it may have the input of carbon which also is not contained in the final good or service, or both. The development and transportation of internationally traded goods or services may also involve virtual water and typically involve embodied carbon because of the energy consumed by such activities.

The environmental and human rights significance of both water and carbon extend to the transboundary context. Individual States and the international community thus have an interest in both virtual water and embodied carbon, including with respect to their treatment in international trade.

Part II of this paper provides definitions of virtual water and embodied carbon and discusses the environmental and human rights significance of each. Part III addresses the treatment of virtual water and embodied carbon under World Trade Organization (WTO) agreements, including in light of other relevant international law. Finally, Part IV presents conclusions and observations.

## II. EMBODIED CARBON AND VIRTUAL WATER—DEFINITIONS AND ENVIRONMENTAL AND HUMAN RIGHTS SIGNIFICANCE

### A. *Virtual Water*<sup>1</sup>

Some products consist of water (e.g., water transferred in bulk) or contain water (e.g., bottled water). Quite apart from that water, the production and processing of many commodities, whether agricultural, industrial or consumer, involve the use of water as does the performance of services. The term ‘virtual water’ is typically defined as the water used in producing and processing goods and performing services, not including the water remaining in the commodity.<sup>2</sup> Because this paper deals with international trade, the term ‘virtual water’ for our purposes also encompasses the water used in developing a product or service in the exporting country as well as the water used in transporting products and services within the exporting country and from that country to the importing country.<sup>3</sup> For purposes of this paper, therefore, ‘virtual water’ consists of the water utilised in producing or processing a good being exported, in performing a service being exported, in developing the good or service in the exporting country, and in transporting the good or service within the exporting country and between it and the importing country. In other words, virtual water is the total amount of water consumed during all upstream processes, in countries other than the importing country, required to deliver a product or service to the importing country.

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<sup>1</sup> Some of the discussion of virtual water and of virtual water and trade derives, sometimes verbatim, from Daniel Magraw & Deepika Padmanabhan, *Water and International Trade*, in RESEARCH HANDBOOK ON INT’L WATER L. (Stephen C. McCaffrey et al. eds., 2019) (forthcoming 2019).

<sup>2</sup> See, e.g., J.A. Allan, *Virtual Water: A Strategic Resource Global Solutions to Regional Deficits*, 36(4) GROUND WATER 545(1998); Arjen Hoekstra & P.Q. Hung, *Globalisation of Water Resources: International Virtual Water Flows in Relation to Crop Trade*, 15(1) GLOBAL ENVTL. CHANGE 45 (2005), <https://www.sciencedirect.com/science/article/pii/S0959378004000664>.

<sup>3</sup> This paper uses a simple two-country trading model, but the analysis also applies in a multi-country trading context.

The fact that freshwater is not equally distributed among countries leads to a comparative advantage for water-rich countries vis-à-vis water-poor countries. This situation affects international trade; for example, virtual water is strongly related to agricultural trade.<sup>4</sup> There is a massive amount of trade in virtual water. Jordan, for example, imported about five to seven billion cubic metres of virtual water per year as of 2010, which is in sharp contrast with the one billion cubic metres of water withdrawn annually from its domestic water sources.<sup>5</sup> Such voluminous trade makes virtual water a matter of global interest.

Demand for water already exceeds supply in many parts of the world.<sup>6</sup> It is expected to increase globally by roughly 50% from 2018 levels by 2100,<sup>7</sup> on account of increasing population and the increase in goods needed to satisfy demands for higher standards of living by people around the world,<sup>8</sup> particularly in developing countries. Climate change is predicted to place additional stresses on water supply. The use of virtual water, which is already large due to the magnitude of existing international trade, is expected to increase further. Technological advances will hopefully decrease the rate of growth of demand (e.g., through more efficient agricultural practices) and increase the supply of freshwater (e.g., via desalination of brackish or salt water).<sup>9</sup> Such advances, however, are neither likely to stem the growth in demand completely, nor fill that demand with new supply.

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<sup>4</sup>The relative importance of virtual water to a country's agricultural sector can be calculated by subtracting the water saved by importing agricultural crops from the amount of water lost by exporting agricultural crops and dividing that result by the total use of water in the domestic agricultural sector. Results vary greatly. For example, the ratio of net water saving to use of domestic water from 1997–2001 was calculated as: 8% for China, 69% for Mexico, 73% for Morocco, 98% for Italy, 196% for Algeria, and 448% for Japan, A.K. Chapagain, A.Y. Hoekstra & H.H.G. Savenije, *Water Saving Through International Trade of Agricultural Products*, 10(3) *HYDROLOGY & EARTH SYSTEM SCI.* 455 (2006).

<sup>5</sup>Arjen Hoekstra, *The Relation between International Trade and Freshwater Scarcity* 1-25 (World Trade Org. Econ. Res. & Stat. Div., Staff Working Paper ERSD-2010-05), [https://www.wto.org/english/res\\_e/reser\\_e/ersd201005\\_e.pdf](https://www.wto.org/english/res_e/reser_e/ersd201005_e.pdf).

<sup>6</sup>See THE FOOD & AGRIC. ORG. & EARTHSCAN, *THE STATE OF THE WORLD'S LAND AND WATER RESOURCES FOR FOOD AND AGRICULTURE: MANAGING SYSTEMS AT RISK* (2011), <http://www.fao.org/docrep/017/i1688e/i1688e.pdf>.

<sup>7</sup> E.g., UNITED NATIONS, *I WORLD POPULATION PROSPECTS: THE 2012 REVISION, COMPREHENSIVE TABLES* xvi (2013), [http://esa.un.org/wpp/Documentation/pdf/WPP2012\\_Volume-I\\_Comprehensive-Tables.pdf](http://esa.un.org/wpp/Documentation/pdf/WPP2012_Volume-I_Comprehensive-Tables.pdf).

<sup>8</sup> For ease of exposition, this paper thereafter refers only to goods (except when defining 'embodied carbon'), but the analysis herein applies equally to services.

<sup>9</sup> Daniel Magraw & Patsorn Udomrithiruj, *Water and Multilateral Environmental Agreements: An Incomplete Jigsaw Puzzle*, in *RESEARCH HANDBOOK ON INT'L WATER L.* (Stephen C. McCaffrey et al. eds., 2019) (forthcoming 2019).

An example of trade in virtual water is the Saudi Arabian dairy firm Almarai's export of hay from its investment in a farm in Arizona at which up to 22.5 billion gallons of groundwater are pumped annually for the cultivation of water-intensive alfalfa to make hay for export to Saudi Arabia. The firm had been growing alfalfa in Saudi Arabia using water from an aquifer there, but the aquifer depleted. Saudi Arabia banned growing green fodder in order to conserve water. Arizona does not limit the amount of groundwater that may be extracted or the use to which it may be put, and there is no fee for the purpose of extracting groundwater other than an initial United States Dollar (USD) 150 filing fee.<sup>10</sup> The water used to produce the hay in Arizona is virtual water and the export of hay from the United States to Saudi Arabia involves trade in virtual water.<sup>11</sup> As described below, water is unique in many ways, including with respect to its relation to culture and human rights. The danger of sacrificing economic, cultural and environmental interests and human rights in one country for greater economic or political power of another is obvious.<sup>12</sup>

In theory, trade in virtual water has the potential to increase economic efficiency and benefit the environment on a global scale. For example, it has been estimated that trade involving virtual water reduced the global water footprint by 5% in 2014.<sup>13</sup> Edith Brown Weiss has written that currently, water-poor countries are using their resources unsustainably and water-rich countries are not exploiting their water resources to their maximum potential.<sup>14</sup> If development, production, processing, and transportation are efficient in terms of water use, then it is arguable that the export (sometimes referred to as the 'transfer') of virtual water should be encouraged.<sup>15</sup>

In practice, however, using virtual water to increase economic efficiency and benefit the environment worldwide faces formidable hurdles. First and foremost, water typically is under-priced or not priced at all, which makes evaluations of efficiency

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<sup>10</sup> *Groundwater Permitting and Wheels*, ARIZONA DEPT. OF WATER RESOURCES, <http://www.azwater.gov/AzDWR/WaterManagement/Wells/default.htm> (last visited Dec. 19, 2018).

<sup>11</sup> *Saudi Hay Farm in Arizona Tests State's Supply of Groundwater*, N.P.R. STAFF (Nov. 2, 2015, 5:07 AM ET), <http://www.npr.org/sections/thesalt/2015/11/02/453885642/saudi-hay-farm-in-arizona-tests-states-supply-of-groundwater>.

<sup>12</sup> Magraw & Padmanabhan, *supra* note 1.

<sup>13</sup> Hoekstra, *supra* note 5.

<sup>14</sup> Edith Brown Weiss & Lydia Slobodian, *Virtual Water, Water Scarcity, and International Trade Law*, 17 J. INT'L. ECON. L. 717, 723 (2014), [http://scholarship.law.georgetown.edu/cgi/viewcontent.cgi?article=2634&context=facpub\\_b\\_\(referring to a study concluding that there is a relatively small difference in water use between water-rich and water-poor countries\)](http://scholarship.law.georgetown.edu/cgi/viewcontent.cgi?article=2634&context=facpub_b_(referring to a study concluding that there is a relatively small difference in water use between water-rich and water-poor countries)).

<sup>15</sup> *See Id.* at 722 (Virtual water trading needs to increase dramatically in order to balance the inequality in distribution of water resources).

highly dubious. For instance, groundwater typically can be extracted in the United States without paying an extraction fee to a government agency. A full discussion of this phenomenon is beyond the scope of this paper. What is necessary here is to recognise that the absence of rational prices for water affects the utilisation of water both domestically and internationally. This can lead to misallocation within and between countries and decreases trade's potential to contribute to efficient allocation of water and water-related goods and services.<sup>16</sup> Alternatives to pricing have been suggested. Brown Weiss, for example, suggests the use of water efficiency regulations as well as labelling based on water intensity and water source to help deal with this.<sup>17</sup> Such alternatives do not exist at present, however, and it is unclear as to how they could completely compensate for the lack of adequate pricing.

Another obstacle is that an adjustment in trading patterns would require embedding a discussion of virtual water into discourse regarding agriculture, subsidies, and other areas requiring international cooperation. These discussions have proven highly contentious in the past and can be expected to encounter difficulties in the future.<sup>18</sup> Also, as with mitigating and adapting to climate change,<sup>19</sup> efforts to ensure just transition for workers and communities,<sup>20</sup> would be required.

Similarly, significant measures to avoid environmental harm would likely be required. At the national level, the export of virtual water inevitably means that the exporting State has less water remaining for its own use. Depending on the relative abundance and hydrological characteristics of water in such a country, as well as other factors, such export may or may not result in shortages of water for preferred national uses. National or local shortages could be devastating because water is integrally related to the provision of many critically important ecosystem services that comprise the infrastructure of human society and human existence.<sup>21</sup>

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<sup>16</sup> Magraw & Padmanabhan, *supra* note 1, at 207.

<sup>17</sup> Weiss & Slobodian, *supra* note 14.

<sup>18</sup> For a discussion of the debates that have arisen in this regard, see Marta Antonelli & Martina Sartori, *Unfolding the Potential of the Virtual Water Concept. What is Still Under Debate?* (School of Int'l. Stud., SIS Working Paper No 2014-11), [http://www.sis.unitn.it/alfresco/download/workspace/SpacesStore/4e8f0ee3-1944-4291-bf70-c3172ea0f6e1/05%202014\\_11\\_antonellisartori\\_2.pdf](http://www.sis.unitn.it/alfresco/download/workspace/SpacesStore/4e8f0ee3-1944-4291-bf70-c3172ea0f6e1/05%202014_11_antonellisartori_2.pdf).

<sup>19</sup> See Preamble to the Paris Agreement (Dec. 13, 2015), in United Nations Framework Convention on Climate Change (UNFCCC), COP Report No. 21, Addendum, at 21, U.N. Doc. FCCC/CP/2015/10/Add.1 (Jan. 29, 2016) [hereinafter Paris Agreement].

<sup>20</sup> Tim Oleson, *Virtual Water: Tracking the Unseen Water in Goods and Resources*, EARTH, <http://www.earthmagazine.org/article/virtual-water-tracking-unseen-water-goods-and-resources> (last visited Dec. 19, 2018).

<sup>21</sup> For a typology of ecosystem services, see UNEP, Millennium Ecosystem Assessment, *Ecosystems and Human Well-Being: Synthesis* 40 (2005),



In addition, increased use of water could cause significant adverse environmental effects even if it does not result in water shortages within the country. For example, extraction of surface or groundwater can harm the recreational and aesthetic value of water bodies. Over-extraction of groundwater can affect local streams and wells and lead to saltwater intrusion into aquifers, the emptying of fossil aquifers, and geologic collapse of aquifers (thereby eliminating the possibility of recharging them). Also, increased water use can allow the conversion of biodiversity-rich grasslands, wetlands or forests to farmland and can lead to increased use of herbicides, pesticides, rodenticides, and fertilisers, each of which can cause environmental harm.<sup>22</sup>

Reliance on virtual water exports may also cause other types of harm. Water-scarce countries rely more on virtual water rather than exploring more sustainable methods of water management.<sup>23</sup> If water-poor countries become too dependent on virtual water trading, they may inefficiently manage their own water resources, which are minimal to begin with. Indeed, local conditions such as how water is used and by whom, water infrastructure, land availability, and other local factors typically are important considerations while determining water policy: water scarcity and water quality aren't global issues. The problems are generated locally, and they need to be solved locally.<sup>24</sup> Furthermore, water is often related to culture and cultural values, especially for indigenous peoples. These cultural interests need to be taken into account including as they relate to the human right to enjoy culture. Other rights of indigenous peoples must also be protected.

All human rights associated with water must be respected, protected, and fulfilled. Water is directly related to human rights. The most immediately relevant human right is likely to be the right to water. Other human rights are also implicated, such as the rights to life (as water is essential to human life), food (the production of which depends on water), and culture.<sup>25</sup> As is discussed in Part III.A below, the

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[http://wedocs.unep.org/bitstream/handle/20.500.11822/8701/Ecosystem\\_and\\_human\\_well\\_being\\_synthesis.pdf?sequence=3&isAllowed=y](http://wedocs.unep.org/bitstream/handle/20.500.11822/8701/Ecosystem_and_human_well_being_synthesis.pdf?sequence=3&isAllowed=y) (last visited Jan. 30, 2019).

<sup>22</sup> See M.A. Sophocleous, *The Impacts of Groundwater Over-Abstraction on the Environment*, AMERICAN GEOPHYSICAL UNION, FALL MEETING (2009).

<sup>23</sup> Erik Gawel & Kristina Bernsen, *UFZ Discussion Papers- What is Wrong With Virtual Water Trading?*, 31(1) ENV'T. & PLANNING GOV'T. & POL'Y 168 (2011).

<sup>24</sup> Dennis Wicheln, *Water Footprints: Policy Relevant or One-Dimensional Indicators?*, GLOBAL WATER FORUM (Oct. 22, 2013), <http://www.globalwaterforum.org/2013/10/22/water-footprints-policy-relevant-or-one-dimensional-indicators/>.

<sup>25</sup> See I. Winkler, *The Human Right to Water*, ch. 14, in RESEARCH HANDBOOK ON INT'L WATER L. (Stephen C. McCaffrey et al. eds., 2019) (forthcoming publication 2019); A. Russell, *The Human Right to Water in a Transboundary Context*, ch. 15, in RESEARCH HANDBOOK ON INT'L WATER L. (Stephen C. McCaffrey et al. eds., 2019) (forthcoming publication 2019).

direct relevance of human rights can significantly affect the treatment of water and virtual water under trade laws.

Analysis and policy-making with respect to virtual water thus involves important local or national issues not necessarily related to efficiency, including perhaps most importantly human rights.

### *B. Embodied Carbon*<sup>26</sup>

The concept of ‘embodied carbon’ parallels that of ‘virtual water’, defined above. Some products are either composed of carbon (e.g., coal or diamonds) or contain carbon (e.g., pencils). Quite apart from that carbon, the production and processing of many commodities, whether agricultural, industrial or consumer, involve the use of carbon, such as the use of energy produced by burning coal, natural gas, or oil. The same applies to the performance of services (such as cross-border education or international legal services). The term ‘embodied carbon’ is typically defined as the carbon used in producing and processing goods and performing services, not including the carbon remaining in the final commodity. Because this paper deals with international trade, the term ‘embodied carbon’ for our purposes also encompasses the carbon used in developing a product or service in the exporting country, as well as the carbon used in transporting products and services within the exporting country and from that country to the importing country.<sup>27</sup> For purposes of this paper, therefore, ‘embodied carbon’ consists of the carbon utilised in producing or processing a good being exported, in performing a service being exported, in developing the good or service in the exporting country, and in transporting the good or service within the exporting country and between it and the importing country. Phrased differently, for purposes of this paper, embodied carbon is the total amount of carbon emissions from all upstream processes, in countries other than the importing country, required to deliver a certain product or service to the importing country.

Because of current patterns of energy production and consumption, the vast majority of goods in international trade contain embodied carbon. This is of environmental concern for many reasons, depending on the type and source of the relevant carbon, its method of extraction, how it was used in the relevant carbon-consuming activity, and how it and associated by-products were treated thereafter. For example, mining coal and other carbon-containing substances can have many

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<sup>26</sup> Because the amount of embodied carbon associated with a service is likely to be significantly less than that associated with a good, the analysis of embodied carbon herein focuses on trade in goods.

<sup>27</sup> As with virtual water, we use a simple two-country trading model, but the analysis also applies in a multi-country trading context.

harmful environmental effects, including destruction of aesthetically or spiritually valuable landscapes or cultural sites, decimation of biologically diverse ecosystems, obliteration of a watercourse, subjection of a human population to toxic chemicals, and emission of large amounts of carbon dioxide into the atmosphere, thus exacerbating climate change.<sup>28</sup> Burning coal, oil, and natural gas often emits not only carbon dioxide but also other hazardous pollutants such as mercury from burning coal. Run-off from livestock farms can pollute surface and ground water, and the livestock emit methane into the atmosphere which also exacerbates climate change. These are just a few examples. This paper discusses the relation between embodied carbon and climate change, but other environmental effects can also be significant depending on the circumstances and should be included in a full analysis of the environmental implications of embodied carbon.

The relation between carbon emitted into the atmosphere and the climate has been analysed over decades by the Intergovernmental Panel on Climate Change (IPCC). Uncertainties remain, but the connection between anthropogenic emission of carbon-containing greenhouse gasses and climate change has been established beyond any reasonable doubt.<sup>29</sup> Climate change's negative impacts on the environment and human society have also been reported by the IPCC. These include: rising temperatures, rising sea levels, increased intensity and frequency of storms, increased heat waves, droughts, forest fires, and floods, shortened growing seasons, changing ranges for disease vectors, stress on biological diversity, and possible tipping points.<sup>30</sup>

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<sup>28</sup> The tar sands in Alberta, Canada, are an example. See Alan Taylor, *The Alberta Tar Sands*, THE ATLANTIC, Sep. 25, 2014, <https://www.theatlantic.com/photo/2014/09/the-alberta-tar-sands/100820/>.

<sup>29</sup> For the IPCC's latest report, see *Special Report Global Warming of 1.5°C*, IPCC <https://www.ipcc.ch/sr15/> (last visited Jan. 30, 2019) (concluding that transformative actions must be taken now to meet the goal of limiting climate change to 1.5 degrees warming, and even then significant harmful effects will occur).

<sup>30</sup> For a 2018 description of predicted effects in the United States, see U.S. GLOBAL CHANGE RESEARCH PROGRAM, IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES: FOURTH NATIONAL CLIMATE ASSESSMENT, II (Reidmiller et al. eds., 2018), <https://nca2018.globalchange.gov/downloads/>; See also U.S. GLOBAL CHANGE RESEARCH PROGRAM, CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT, I (Wuebbles et al. eds., 2017), [https://science2017.globalchange.gov/downloads/CSSR2017\\_FullReport.pdf](https://science2017.globalchange.gov/downloads/CSSR2017_FullReport.pdf);

For the general website, see *Fourth National Climate Assessment*, U.S. GLOBAL CHANGE RESEARCH PROGRAM, <https://www.globalchange.gov/nca4> (last visited Dec. 20, 2018). Lancet released a report in fall 2018 that discusses the effects of climate change on health globally. *The 2018 Report of the Lancet Countdown on Health and Climate Change: Shaping the Health of Nations for Centuries to Come*, THE LANCET (NOV. 28, 2018), [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(18\)32594-7/fulltext#%20](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)32594-7/fulltext#%20).

Concerted government action will be required to mitigate climate change as every country is a source of greenhouse gases and the impacts of climate change extend across boundaries globally. The Stern Review on the Economics of Climate Change described climate change as the largest and widest-ranging market failure in history.<sup>31</sup> The market will not take care of climate change. Moreover, trade will play a significant role in efforts to combat climate change. One commentator has noted that “trade-related elements feature prominently in climate contributions in the Paris Agreement” and that “around 45 percent of all climate contributions include a direct reference to trade or trade measures”.<sup>32</sup> Some of those measures are likely to include the so-called process and production methods (PPMs) used in production. The legality of those under trade laws has been contentious, especially concerning PPMs that do not affect the end product (non-product-related PPMs). Measures regarding both virtual water and embodied carbon are non-product-related PPMs.

The international community’s approach to mitigating climate change relies thus far on voluntary reductions in carbon emissions on a country-by-country basis. Measurements used for monitoring and verifying emission levels and reductions thereto are typically done on the basis of actual carbon emissions from the territory of the country concerned.

The issue of concern to this paper is that such measurements do not include the embodied carbon in goods imported into and consumed in a country. That would not be a problem if there existed an overarching system of allocating reductions in carbon emissions that took into account embodied carbon. If such a system existed, all carbon emissions would be taken into account and all countries’ national reductions would be set in a coordinated fashion. However, such a system does not currently exist. Similarly, countries typically do not account for embodied carbon in their emissions-reduction commitments pursuant to the Paris Agreement.<sup>33</sup> Thus, a country’s carbon emissions inventory typically does not include the carbon embodied in the imported goods it consumes; one estimate puts this as 20-30% of global carbon emissions.<sup>34</sup> Under the present approach, a country can partly or fully

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<sup>31</sup> Nicholas Stern, *The Economics of Climate Change*, THE STERN REPORT, EXECUTIVE SUMMARY (2007).

<sup>32</sup> CLARA BRANDI, TRADE ELEMENTS IN COUNTRIES’ CLIMATE CHANGE CONTRIBUTIONS UNDER THE PARIS AGREEMENT vii (Int’l Ctr. Trade & Sustainable Dev. Issue Paper, 2017). See Paris Agreement, *supra* note 19, art. 4; *cf.* Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 11, 1997, 2 303 U.N.T.S.162 (the Kyoto Protocol specified mandatory reductions but only for some countries, and it is now superseded).

<sup>33</sup> *Cf.* Paris Agreement, *supra* note 19, arts. 2, 6 &10.

<sup>34</sup> Daniel Moran et al, THE CARBON LOOPHOLE IN CLIMATE POLICY, QUANTIFYING THE EMBODIED CARBON IN TRADED PRODUCTS (Aug. 2018),

fulfil its voluntary commitment to reduce carbon emissions by moving carbon-intensive facilities or operations (such as cement manufacturing or livestock production) abroad and importing the product produced by that facility or operation (which perversely might increase the net amount of carbon emissions because of the additional transportation involved). In either situation just described, failing to account for the embodied carbon in imported goods results in effectively undercounting the carbon-emissions of the importing country and thus its negative impact on climate change.<sup>35</sup>

Because this undercounting undermines efforts to deal with climate change, it has an adverse impact on human rights related to the harm climate change causes to the environment. The relationship between human rights and climate change has been recognised by both the Conference of the Parties to the UNFCCC,<sup>36</sup> and the UN Human Rights Council<sup>37</sup>. Moreover, the Paris Agreement explicitly acknowledges the importance of human rights.<sup>38</sup>

Climate change is related to human rights in three ways. First, governments must respect, protect, and fulfil substantive and procedural human rights in their actions relating to mitigating and adapting to climate change just as they must regarding other actions. Second, climate change can directly affect the realisation of human rights by virtue of its effects on the environment. This is evident, for example, from

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<https://buyclean.org/media/2016/12/The-Carbon-Loophole-in-Climate-Policy-Final.pdf> (last visited Dec. 19, 2018).

<sup>35</sup> The embodied carbon in goods exported by a country does not result in reducing the carbon emissions of the exporting country under the existing measurement system.

<sup>36</sup> Preamble to the Report on the Conference of the Parties on its sixteenth session, held in Cancun from 29 November to 10 December 2010, UN Doc. FCCC/CP/2010/7/Add. 1 (Mar. 15, 2011) (“climate change represents an urgent and potentially irreversible threat to human societies and the planet, and thus requires to be urgently addressed by all Parties”).

<sup>37</sup> See, e.g., Human Rights Council Res. 18/22 (Sept. 30, 2011) (“climate change poses an immediate and far-reaching threat to people and communities around the world and has adverse implications for the full enjoyment of human rights.”); Human Rights Council Res. 28/11 (Mar. 26, 2015); Human Rights Council Res. 29/15 (July 2, 2015).

<sup>38</sup> Paris Agreement, *supra* note 19. The Preamble states:

“*Acknowledging* that climate change is a common concern of humankind, Parties should, when taking action to address climate change, respect, promote and consider their respective obligations on human rights, the right to health, the rights of indigenous peoples, local communities, migrants, children, persons with disabilities and people in vulnerable situations and the right to development, as well as gender equality, empowerment of women and intergenerational equity”

For a detailed exposition, see Daniel Magraw et al., *Human Rights, Labour and the Paris Agreement on Climate Change*, 46 ENV'T. POL'Y & L. 313 (2016).

the situations facing communities such as Inuit in the Arctic,<sup>39</sup> and residents of Maldives,<sup>40</sup> which implicate the rights to life, health, food, culture, and property, among other rights.<sup>41</sup> Third, climate change can cause internal displacement and international migration, affecting the human rights of both climate migrants and local populations in areas in which climate migrants ultimately settle.<sup>42</sup>

### III. COMPARISON OF THE TREATMENT OF VIRTUAL WATER AND EMBODIED CARBON UNDER THE WTO

#### A. Background

##### 1. Trade Law

Trade in goods containing virtual water or embodied carbon implicates many areas of trade law.<sup>43</sup> This paper focuses on the General Agreement on Tariffs and Trade (GATT), the basic WTO agreement dealing with trade in goods. Other WTO agreements, such as the Agreement on Technical Barriers to Trade and the Agreement on Subsidies and Countervailing Measures, may also be relevant; this paper does not address those analyses, though it is important to note that

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<sup>39</sup> Inuit petition to the Inter-American Commission on Human Rights (2005). See *Inuit File Petition with Inter-American Commission on Human Rights, Claiming Global Warming Caused by United States is Destroying Their Culture and Livelihoods*, CENTER FOR INT'L ENV'T. L. (Dec. 7, 2005), <https://www.ciel.org/news/inuit-file-petition-with-inter-american-commission-on-human-rights-claiming-global-warming-caused-by-united-states-is-destroying-their-culture-and-livelihoods/>.

<sup>40</sup> See Daniel Magraw & Kristina Wienhöfer, *The Fundamental Right to an Environment Capable of Supporting Human Society and the Full Enjoyment of Human Rights: The Malé Formulation of The Overarching Environmental Human Right*, in *THE RIGHT TO A HEALTHY ENVIRONMENT* 215 (John Knox & Ramin Pejan eds., 2018).

<sup>41</sup> See generally, INTERNATIONAL BAR ASSOCIATION, *ACHIEVING JUSTICE AND HUMAN RIGHTS IN AN ERA OF CLIMATE DISRUPTION* (Hannah Caddick ed., 2014), <https://www.ibanet.org/Document/Default.aspx?DocumentUid=0f8cee12-ee56-4452-bf43-cfcab196cc04>.

<sup>42</sup> Marris Emma, *A Prisoner of Environment: Is It Time to Leave The West?*, THE GUARDIAN, Oct. 5, 2018, 11.00 BST, <https://www.theguardian.com/environment/2018/oct/05/leaving-the-west-wildfires-smoke-heat>.

<sup>43</sup> For a detailed discussion of various approaches to using trade measures to deal with carbon emissions, see Joost Pauwelyn, *Carbon Leakage Measures and Border Tax Adjustments Under WTO Law* (Mar. 21, 2012), <https://ssrn.com/abstract=2026879> or <http://dx.doi.org/10.2139/ssrn.2026879>; Maria Panezi, *When CO<sub>2</sub> Goes to Geneva: Taxing Carbon Across Borders — Without Violating WTO Obligations* (Centre for International Governance Innovation (CIGI) Paper No. 83, Nov. 2015); JAMES BACCHUS, *SPECIAL REPORT — THE CASE FOR A WTO CLIMATE WAIVER* (Centre for International Governance Innovation, 2017).

uncertainties such as those described below exist with respect to those agreements, as well.

Originally negotiated just after World War II, the GATT was adopted essentially verbatim in 1994 as part of the WTO.<sup>44</sup> The GATT contains several rules (often referred to as ‘disciplines’) limiting what countries can do to affect trade. The most relevant for our purposes are Articles I, II, III, and XI. Article I requires Most Favored Nation treatment, i.e., that a country must treat goods from another GATT member no less favorably than it treats like goods,<sup>45</sup> from any other country. Article II sets limits on tariffs that a country may impose but permits a country to impose a tax on imported products equivalent to an internal tax as long as it is consistent with Article III.2 in respect of a like domestic product or a product manufactured or produced from the like product. Article III requires National Treatment, i.e., that a country’s treatment of a good in trade with a GATT member must be no less favourable than the treatment it accords to like goods of its own, including with respect to taxation of imported goods. Article XI prohibits quantitative restrictions such as bans or quotas on products imported from, or exported to, other GATT members.

Each of these disciplines is subject to the general exceptions in GATT Article XX.<sup>46</sup> In order to qualify for an exception under Article XX, the trade measure at issue must satisfy at least one of the paragraphs in Article XX and both tests in the

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<sup>44</sup> General Agreement on Tariffs and Trade, Oct. 30, 1947, 61 Stat.A-11, 55 U.N.T.5. 194 [hereinafter GATT].

<sup>45</sup> As with other terms in the GATT, there is considerable jurisprudence regarding the meaning of ‘like’ in this context. Explaining that jurisprudence is beyond the scope of this paper. Given the many variables that determine ‘likeness’, it is possible that products might be distinguished and found to be not ‘like’ on the basis of the virtual water or embodied carbon associated with them.

<sup>46</sup> GATT, *supra* note 43, art. XX. (The relevant parts of Article XX are:

“Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures:

- (a) necessary to protect public morals;
- (b) necessary to protect human, animal or plant life or health;
- (j) imposed for the protection of national treasures of artistic, historic or archaeological value;
- (g) relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption . . .”

*chapeau*.<sup>47</sup> Each of the paragraphs deals with a specific exception. The ones that are most relevant for purposes of this paper are (a), (b), (f), and (g). Paragraph (a), which has been relied upon in only one environmental case,<sup>48</sup> concerns measures necessary for protecting public morals. Paragraph (b), which has been relied upon in several cases, concerns measures necessary to protect human, animal and plant life or health. Both paragraphs (a) and (b) require the measure to be ‘necessary’ to achieve the objective. Paragraph (f) concerns measures imposed for the protection of national treasures of historic or archaeological value; this paragraph has been very rarely relied upon and is not usually considered to be ‘environmental’ for purposes of trade law, presumably because it does not deal with health or natural resources.<sup>49</sup> Paragraph (g), which has been used in several environmental cases, concerns measures related to the conservation of exhaustible natural resources. The term ‘related to’ entails simply a genuine relationship of ends and means and is thus less strict than the ‘necessity’ test in paragraphs (a) and (b).

The tests in the *chapeau* are: (1) that measures not be applied in a manner constituting arbitrary or unjustifiable discrimination between countries where the same conditions prevail; and (2) that the measure not be a disguised restriction on international trade.<sup>50</sup> The *chapeau* is thus an anti-circumvention provision aimed at discerning whether the measure is being applied for purposes other than the objectives that justify it under the paragraphs. The WTO Appellate Body has made clear that the *chapeau*’s tests are to be applied only after the measure at issue has been found to be provisionally justified under one of the paragraphs of Article XX (i.e., after the paragraph-by-paragraph analysis has been applied).<sup>51</sup> This increases the likelihood that the tests in the *chapeau* will be applied with an appreciation of the details of the measure in question, such as its purpose, approach, structure, application, and context.

## 2. Approaches to Avoiding Regime Conflict

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<sup>47</sup> See *Id.*; Appellate Body Report, *US — Import Prohibition of Certain Shrimp and Shrimp Products*, WTO Doc. WT/DS58/AB/R (adopted Nov. 6, 1998) [hereinafter *Shrimp/Turtle case*].

<sup>48</sup> See Panel Report, *EC — Measures Prohibiting the Importation and Marketing of Seal Products*, WTO Doc. WT/DS400/R, WT/DS401/R (Nov. 25, 2013); Appellate Body Report, *EC — Measures Prohibiting the Importation and Marketing of Seal Products*, WTO Doc. WT/DS400/AB/R, WT/DS401/AB/R (May 23, 2014).

<sup>49</sup> This paragraph would seem to cover things of cultural value, which falls within some environmental protection measures, e.g., UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage, Nov. 16, 1972, 1037 U.N.T.S. 151 (entered into force on Dec. 17, 1975).

<sup>50</sup> See text of Article XX, *supra* note 45.

<sup>51</sup> *Shrimp/Turtle case*, *supra* note 47.



Some measures relating to virtual water or embodied carbon implicate environmental or human rights treaties or customary international law (general law) regarding those areas. Trade challenges to such measures thus raise the question of how to honour the respective environmental or human rights regime(s) while simultaneously honouring the trade regime. It is to be hoped that countries would attempt to design measures that avoid conflicts with the trade regime, but practical or political realities may prevent that. The following four approaches can potentially serve to avoid regime conflict in a way that allows countries the leeway to conserve water by measures relating to virtual water and to mitigate climate change through measures relating to embodied carbon.

The inclusion of sustainable development in the preamble to the main WTO agreement provides a possible means of avoiding a conflict. The Agreement Establishing the World Trade Organization (WTO Agreement) states:

“Recognizing that [WTO Parties] relations in the field of trade and economic endeavor should be conducted with a view to raising standards of living . . . and expanding the production of and trade in goods and services, while allowing for the optimal use of the world’s resources in accordance with the objective of sustainable development, seeking both to protect and preserve the environment and to enhance the means of doing so in a manner consistent with their respective needs and concerns at different levels of economic development.”<sup>52</sup>

The international community has not agreed on a precise definition of ‘sustainable development’, but it is clear that sustainable development requires integrating economic, social, and environmental policies.<sup>53</sup> The concept also includes the ideas that the interests of future generations must be taken into account and that the environment must be protected to a significant extent.<sup>54</sup> It is clear that the environment in that context includes water resources, given their fundamental importance to the environment. For the same reason, it is beyond doubt that the reference to protecting and preserving the ‘environment’ in the WTO Agreement preamble includes protecting and preserving water resources. Interpreting the

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<sup>52</sup> Preamble to the Marrakesh Agreement Establishing the World Trade Organization, Apr. 15, 1994, 1867 U.N.T.S. 154.

<sup>53</sup> See, e.g., World Summit for Social Development, *Copenhagen Declaration on Social Development*, ¶ 6, U.N. Doc. A/CONF.166/9 (Mar. 14, 1995); cf. United Nations, *Agenda 2030 & Sustainable Development Goals* (2015), <https://www.un.org/sustainabledevelopment/development-agenda/> (last visited Jan. 30, 2019).

<sup>54</sup> World Commission on Environment and Development, *Our Common Future*, A/42/427 (Aug. 4, 1987); see Daniel B. Magraw & Lisa D. Hawke, *Sustainable Development*, in THE OXFORD HANDBOOK OF INT’L ENV’T. L. 613, 618-22 (Daniel Bodansky et al. eds., 2007).

GATT in a manner consistent with the WTO Agreement preamble thus should lead to resolving doubts about the application of Article XX in favour of allowing good faith taxes and regulations regarding protecting and preserving water, such as those analysed above.

A second approach that might be used to avoid conflict where potentially inconsistent obligations or rights exist is based on Article 31(3)(c) of the Vienna Convention on the Law of Treaties (VCLT), which concerns interpreting treaties and is considered to be customary international law. When close analysis indicates that a conflict might exist between two rules of international law, Article 31(3)(c) offers a means of reconciling them. It provides with respect to interpreting treaties:

“There shall be taken into account, together with the context: . . . (c) any relevant rule of international law applicable in the relations between the parties”.<sup>55</sup>

Environmental treaties, human rights treaties, and customary international law regarding the environment and human rights would thus be relevant to interpreting the GATT in this context along with other applicable rules of international law. As discussed in Part III.C below, in doing this analysis careful attention should be paid to which treaty or institution has the substantive competence with respect to the matter at issue and deference should be paid accordingly.

Another potentially important approach is based on the doctrine of intertemporal law, which was adopted by the International Court of Justice (ICJ) in the *Gabcikovo* case,<sup>56</sup> and followed in the *Pulp Mills* case,<sup>57</sup> and the *Kishenganga* arbitration.<sup>58</sup> The doctrine of intertemporal law provides that in questions involving the environment (at least) new norms of international law must be taken into account even with respect to continuing activities governed by existing international agreements, which would include the WTO agreements. The Court stated:

“The Court is mindful that, in the field of environmental protection, vigilance and prevention are required on account of the often irreversible

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<sup>55</sup> See United Nations Vienna Convention on the Law of Treaties, art. 31(c)(3), May 23, 1969, 1155 U.N.T.S. 331 [hereinafter VCLT].

<sup>56</sup> *Gabcikovo-Nagymaros Project* (Hung. v. Slov.), Judgment, 1997 I.C.J. Rep. 78, ¶ 140 (Sep. 25).

<sup>57</sup> *Pulp Mills on the River Uruguay* (Arg. v. Uru.), Judgment, 2010 I.C.J. Rep. 14, ¶ 75, 76, 177 (Apr. 20).

<sup>58</sup> *Indus Waters Kishenganga Arbitration* (Pak. v. India), Final Award, ICGJ 478 (PCA 2013) (Dec. 20).

character of damage to the environment and of the limitations inherent in the very mechanism of reparation of this type of damage.

Throughout the ages, mankind has, for economic and other reasons, constantly interfered with nature. In the past, this was often done without consideration of the effects upon the environment. Owing to new scientific insights and to a growing awareness of the risks for mankind - for present and future generations - of pursuit of such interventions at an unconsidered and unabated pace, new norms and standards have been developed, set forth in a great number of instruments during the last two decades. Such new norms have to be taken into consideration, and such new standards given proper weight, not only when States contemplate new activities but also when continuing with activities begun in the past. This need to reconcile economic development with protection of the environment is aptly expressed in the concept of sustainable development.”<sup>59</sup>

The new norms referred to include sustainable development, Stockholm Declaration Principle 21 on transboundary environmental harm,<sup>60</sup> and the requirement to conduct transboundary environmental impact assessments<sup>61</sup>. Especially given the inextricable relation between environmental protection and

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<sup>59</sup> Gabčíkovo-Nagymaros, *supra* note 55, ¶ 140.

<sup>60</sup> United Nations Conference on the Human Environment, *Stockholm Declaration of the United Nations Conference on the Human Environment*, Principle 21, U.N. Doc A/CONF.48/14/Rev.1 (June 1972); see *Kishenganga Arbitration*, *supra* note 57, ¶ 85. Quoting para. 452 of the Partial Award (Feb. 18, 2013), the Court of Arbitration stated:

“It is established that principles of international environmental law must be taken into account even when (unlike the present case) interpreting treaties concluded before the development of that body of law. The Iron Rhine Tribunal applied concepts of customary international environmental law to treaties dating back to the mid-nineteenth century, when principles of environmental protection were rarely if ever considered in international agreements and did not form any part of customary international law. Similarly, the ICJ in *Gabčíkovo-Nagymaros* ruled that, whenever necessary for the application of a treaty, “new norms have to be taken into consideration, and . . . new standards given proper weight.” It is therefore incumbent upon this Court to interpret and apply this 1960 Treaty in light of the customary international principles for the protection of the environment in force today.”

<sup>61</sup> *Pulp Mills*, *supra* note 56, ¶¶ 75, 76, 177, 204. The Court stated:

“In this sense, the obligation to protect and preserve, under Article 41 (a) of the Statute, has to be interpreted in accordance with a practice, which in recent years has gained so much acceptance among States that it may now be considered a requirement under general international law to undertake an environmental impact assessment where there is a risk that the proposed industrial activity may have a significant adverse impact in a transboundary context, in particular, on a shared resource . . .”

human rights,<sup>62</sup> the doctrine of intertemporal law may well also include human rights norms, though it has not yet been applied in this context.

A fourth potential approach is the harmonisation principle set forth by the UN International Law Commission in a report it undertook to address the fragmentation of international law that has resulted from the proliferation of international instruments and institutions since World War II. The report states:

“When several norms bear on a single issue they should, to the extent possible, be interpreted so as to give rise to a single set of compatible obligations.”<sup>63</sup>

The existence of these concepts raises the question of whether the WTO dispute settlement bodies may apply them. According to Article 3.2 of the WTO Dispute Settlement Understanding, they may apply ‘customary rules of interpretation of public international law’.<sup>64</sup> At least Article 31(c)(3) of the VCLT and the doctrine of intertemporal law would appear to fit within this convoluted language, as would sustainable development since it is expressly in the preamble to the WTO Agreement and is one of the concepts that fits within intertemporal law. The status of the harmonisation principle is less clear.

### 3. Hypothetical Measures Considered in This Paper

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<sup>62</sup> See John H. Knox, Rep. of the Special Rapporteur on the Issue of Human Rights Obligations Relating to the Enjoyment of a Safe, Clean, Healthy & Sustainable Env’t, U.N. Doc. A/73/188 (July 19, 2018). In his first report (A/HRC/22/43), presented to the Council in March 2013, the Special Rapporteur emphasised that human rights and the environment are interdependent. A safe, clean, healthy and sustainable environment is necessary for the full enjoyment of a vast range of human rights, including the rights to life, health, food, water, and development. At the same time, the exercise of human rights, including the rights to information, participation, and remedy, is vital to the protection of the environment.

See also John H. Knox, Special Rapporteur on Human Rights and the Environment, Framework Principles on Human Rights & the Environment, 2018, <https://www.ohchr.org/EN/Issues/Environment/SREnvironment/Pages/FrameworkPrinciplesReport.aspx> (last visited Dec. 20, 2018)

<sup>63</sup> Report of the International Law Commission 58<sup>th</sup> Session, ¶ 251, 1(4), U.N. Doc. A/61/10 (2006).

<sup>64</sup> Dispute Settlement Rules: Understanding on Rules and Procedures Governing the Settlement of Disputes, Marrakesh Agreement Establishing the World Trade Organization, Apr. 15, 1994, Annex 2, art. 3.2, 1869 U.N.T.S. 401, 33 I.L.M. 1226 [hereinafter DSU] (“The Members recognize that it serves to preserve the rights and obligations of Members under the covered agreements, and to clarify the existing provisions of those agreements in accordance with customary rules of interpretation of public international law.”)

For purposes of this paper, three types of restriction will be analysed for both virtual water and embodied carbon. Although other types of measures are possible,<sup>65</sup> the three addressed herein provide a sense of the types of issues that will arise in a trade analysis of these areas. The three measures considered are:

- (1) Restricting the production of a good based on the amount of virtual water<sup>66</sup> or embodied carbon the good contains (i.e., associated with that good or category of goods);
- (2) Imposing an export tax (or fee) based on the amount of virtual water a product contains or an import tax (or fee) based on both the amount of embodied carbon a product contains and the differential costs of complying with carbon emission regulations between the importing country and the exporting country; and
- (3) Prohibiting or restricting (other than by using a duty, tax, or other charge) the export of a product based on the amount of virtual water it contains, or the import of a product based on the amount of embodied carbon it contains and the differential costs of complying with carbon emission regulations between the importing country and the exporting country.

It must be emphasised that in any GATT analysis, including analyses regarding Articles I, II, III, XI, and XX, specific facts regarding the measure and its context are determinative. Thus, the discussions below are necessarily illustrative and preliminary.

### B. *Virtual Water*

We address first the use of these measures regarding virtual water. Assuming that the measures are supported by scientific evidence regarding the shortage or impending shortage of water in the country or relevant area(s) of the country and not prompted by underlying trade-protectionist motives, these types of measures can be considered to be intended to conserve water in the country imposing the limit to protect some interest or right or (in the case of a tax or fee) to capture the value of the virtual water being exported.

The first of these measures (restriction on production based on the amount of virtual water contained in (i.e., associated with) a product) would not expressly be

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<sup>65</sup> See, e.g., Joost Pauwelyn, *supra* note 44 (regarding carbon); James Bacchus, *supra* note 44, at 10 (regarding carbon).

<sup>66</sup> This paper hypothesises country-wide measures. A country might also adopt measures that are applied only to products from specified areas, depending on relative availability of water in different areas in the country and the environmental, cultural, social and other characteristics of those areas. Area-specific restrictions might receive greater scrutiny than country-wide restrictions when applying the tests in the *chapeau* of Article XX.

directed to imports or exports and would presumably be beyond serious challenge under the GATT as long as it is country-wide, applies to producers from all GATT members, and does not result in an advantage for national producers. An example is Saudi Arabia's prohibition on growing fodder for livestock in order to protect its aquifers, described in Part II.A above. If the restriction were only on production in some geographic areas, the restriction would also probably be beyond serious WTO challenge, based on the actual circumstances such as the reason for selecting the area(s) in which production is banned.

If a violation of a GATT Article were found regarding the first measure, the analysis turns to Article XX. As mentioned above, analysis of Article XX is highly fact-dependent and would depend on the rationale underlying the imposition of the measure. Based solely on the hypothetical described above, paragraph (g) would be used by the party.<sup>67</sup> The restriction relates to the conservation of an exhaustible natural resource (water). The restriction was made in conjunction with a restriction on domestic production—in fact, it is the same restriction. Continuing the analysis, neither of the two tests in the *chapeau* would appear to be violated based on the facts of the hypothetical (in an actual case, this would depend upon the entire context). In this hypothetical, the restrictions are exactly equivalent, though it would have been sufficient as long as they provided even-handed treatment.<sup>68</sup>

Other paragraphs of Article XX might also be used as an exception. If, for example, the production ban applied only to a specified geographic area, the analysis would depend on the reason the area had been chosen. For instance, paragraph (a) might be used if the area was chosen as necessary to protect public morals, e.g., a spring of cultural or ethical value (for instance, to an indigenous people) or to ensure the human right to water.<sup>69</sup> The inclusion of culture and, especially human rights, under paragraph (a) would be novel, however, and is discussed in Part III.D below. Paragraph (b) might be used if the restriction was necessary to ensure adequate drinking water for animals or plants or a human population in that area.<sup>70</sup> Paragraph (f) might be used if the area was chosen and the restriction imposed to protect a national treasure of archaeological value such as a site in a national park, though there is no case law on this.<sup>71</sup>

The second measure (i.e., export tax) would specifically affect exports. As long as it is applied to exports to all GATT members it would not run afoul of GATT Article

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<sup>67</sup> For the text of paragraph XX(g), see *supra* note 45.

<sup>68</sup> Appellate Body Report, *United States — Standards for Reformulated and Conventional Gasoline*, WTO Doc. WT/DS2/AB/R (adopted May 20, 1996).

<sup>69</sup> See *supra* note 45 for the text of paragraph XX(a).

<sup>70</sup> See *supra* note 45 for the text of paragraph XX(b).

<sup>71</sup> See *supra* note 45 for the text of paragraph XX(f).

I. It would not run afoul of Article III because that provision deals with regulations and taxes imposed on the importation of goods. Assuming the tax does not violate Article III, it would not run afoul of Article II because that Article allows taxes consistent with Article III. It would not run afoul of Article XI because that provision expressly permits export taxes.<sup>72</sup> Two recent GATT cases considered analogous situations and found that paragraphs (b) and (g) did not apply.<sup>73</sup> In one of those, the *Rare Earths* case, China's export duty and export quota on rare earth elements, tungsten, and molybdenum was successfully challenged by the United States, Canada, and Japan.<sup>74</sup> The violation was alleged to be not of the GATT (see discussion above) but of a commitment China made in its WTO accession agreement.<sup>75</sup> The question then became whether Article XX applied. China argued that the duty and quota fell within paragraphs (b) and (g). The WTO panel held that although China had demonstrated that the mining and production of rare earths, tungsten, and molybdenum had "caused grave harm to the environment and to the life and health of humans, animals, and plants in China . . . this does not suffice to demonstrate that the export duties are necessary to protect human, animal or plant life or health"<sup>76</sup> To answer that question, "the Panel must consider China's specific arguments and evidence regarding the design and structure of the export duties, whether they are apt to make a material contribution to their stated objective, and whether there are alternative measures available to China."<sup>77</sup> Simply demonstrating that water is necessary to protect human, animal or plant life or health thus would apparently not suffice, nor would demonstrating that a challenged restriction discouraged foreign producers from using water in country A. Analysis of the other elements identified by the WTO panel, including market effects, would be required which necessitates the examination of facts beyond those assumed in this paper. These considerations are relevant to the analysis of the third measure, below.

The third measure (prohibition on export) would not run afoul of Article I as long as the measure applied equally to exports of like products to all GATT members. It would not run afoul of Article II because it does not involve the type of activity Article II is concerned with (e.g., a tax or a tariff). It would not run afoul of Article III because it would not treat domestic products more favourably than foreign like products. It would, however, run afoul of Article XI's prohibition of restrictions on

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<sup>72</sup> GATT, *supra* note 43, art. XI.1.

<sup>73</sup> Panel Report, *China — Measures Related to the Exportation of Rare Earths, Tungsten and Molybdenum*, WTO Doc. WT/DS431/R (Mar. 26, 2014) [hereinafter *Rare Earths case*]; Panel Report, *China — Measures Related to the Exportation of Various Raw Materials*, WTO Doc. WT/DS394/R (July 7, 2011).

<sup>74</sup> *Id.*

<sup>75</sup> *Id.*

<sup>76</sup> *Id.*

<sup>77</sup> *Id.*

exports of any product destined for the territory of another GATT member.<sup>78</sup> The third measure thus would be prohibited by the GATT unless it qualifies for an exception under Article XX.

Paragraph (g) of Article XX would not apply regarding the export ban: the export ban relates to the conservation of exhaustible natural resources (for the purposes of this paper, water), but there is no indication that the ban is “made effective in conjunction with restrictions on domestic production or consumption”. Other paragraphs might be used, depending on the circumstances, if the export ban applies only to products from a specified area or areas, or if the entire country were affected by those circumstances. The analysis would depend, *inter alia*, on the effects in the area and the corresponding rationale for the restriction. For example, paragraph (f) might be used if the area was chosen and the restriction imposed to protect a national treasure of historical or archaeological value. This might include protection of a historical or archaeological site in a national park, though that is uncertain because there is no case law on this.<sup>79</sup> Paragraph (a) might apply if the area was chosen as necessary to protect public morals. Facts that might give rise to this might include the presence of a spring of cultural value (for instance, to an indigenous people) or the need to ensure the human right to water.<sup>80</sup> The inclusion of cultural sites such as this and human rights under paragraph (a) would be novel, however; the latter is discussed in Part III.D below.

Paragraph (b) could apply if the restriction was necessary to ensure adequate drinking water for animals or plants or a human population in the specified area(s) or in the entire country.<sup>81</sup> Such a situation might occur, for instance, if an aquifer underlay the area(s) or the entire country and export of the product would significantly affect that aquifer. The analysis is more complicated, however, as indicated above in the discussion of the *Rare Earths* case. Based on the facts assumed in this paper, therefore, it is not clear whether this measure would fall within paragraph (b).

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<sup>78</sup> If the restriction were temporary, it might qualify under the exemption in Article XI.2(a). Country A might also try to claim that the restriction is necessary for national security reasons under Article XXI, but none of the paragraphs there would seem to apply. The closest would be paragraph (a)(iii): “taken in time of war or other emergency in international relations”, but that would appear to be a difficult argument on which to prevail unless water was precipitating an international crisis.

<sup>79</sup> See *supra* note 45 for the text of paragraph XX(f).

<sup>80</sup> See *supra* note 45 for the text of paragraph XX(a).

<sup>81</sup> See *supra* note 45 for the text of paragraph XX(b).



Finally, it must be recalled that if one of the paragraphs in Article XX is found to provisionally apply, the analysis would have to continue to consider the two tests in the *chapeau*.

It is useful to step back at this point to consider what is at stake in situations involving water. The discussion in Part II.A demonstrated the unique nature of water. Water is unlike any other substance on earth. It is integrally related to the provision of many critically important ecosystem services that comprise the infrastructure of human society and human existence. Water often plays a central cultural role. Water is essential to the survival of virtually all living organisms, including humans. Indeed, water differs from other substances in the many ways that it is essential to human society and to human and other life. Furthermore, water is directly related to human rights, such as the rights to safe drinking water, life, and food. Finally, there is no known substitute for water.

The way in which the unique aspects of water play out in terms of the application of trade law depend, *inter alia*, on the physical characteristics of the water (or water-related good or service) at issue, the social (including cultural and human rights), environmental and economic significance of the water (or water-related good or service) at issue, the trade law in question, relevant government and private actions, and societal values.<sup>82</sup> Nevertheless, the overarching importance of water and its unique nature imply that the WTO and other trade regimes must be wary of overly restricting countries' ability to govern water.

Avoiding such a conflict would be facilitated if there were a water treaty dealing with the issues described above which specified that it took precedence over other treaties, including trade treaties such as the WTO agreements. Although many multilateral agreements deal with water, no treaty resolving these issues exists.<sup>83</sup>

As described in Part III.A.2, use of the concept of sustainable development, Article 31(3)(c) of the VCLT, the doctrine of intertemporal law, or the harmonisation principle could serve as a means to avoid a trade decision that favours trade laws over good faith regulation of water, with its uniquely critical characteristics.

### C. Embodied Carbon

This paper assumes that country A has imposed measures to reduce carbon-emissions in order to combat climate change and that, as a result, country A has

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<sup>82</sup> Magraw & Padmanabhan, *supra* note 1.

<sup>83</sup> See Hoekstra, *supra* note 5 ("There are no international agreements of the type that have the strength to restrict trade in cases where it negatively affects local water systems."); accord Magraw & Udomritthiruj, *supra* note 9.

more stringent controls on emitting carbon than does country B. This differential leads to producers in country A having higher costs of reducing carbon emissions for production, processing, transporting, and other activities that produce carbon emissions during the life cycle of the product than a producer in country B has for a like product. If country B's product is imported into country A, it thus has a price advantage based on the lower costs of compliance with carbon-emission regulations or taxes in country B. This leads to competitive effects and corresponding political pressure in country A to 'level the playing field' and to the possibilities that exports from country B will replace products produced in country A and that imports from country A will be reduced by products made in country B—sometimes referred to as 'carbon leakage', which undermines the effectiveness in terms of reducing carbon emissions of country A's actions.

As explained above, this paper considers treatment under the GATT of three types of responses by country A to this situation. The GATT analysis reveals significant uncertainties, a situation exacerbated because the WTO regime has not yet considered a carbon-related measure.

The first type of measure under consideration (i.e., a ban on the domestic production of a product based on the amount of domestic embodied carbon) should pose no problems under the GATT. This assumes that it applies equally to producers from all countries and producers in country A.

The second type of measure under consideration is a tax (or fee) imposed by importing country A on like products imported from country B<sup>84</sup> in order to compensate for the differential carbon-emission rules in the two countries.<sup>85</sup> Putting aside the application of Article I (Most Favored Nation treatment) for the moment, there would be no problem with Article XI because it does not cover taxes. Article II will be satisfied if the tax is equivalent to an internal tax imposed consistently with Article III.2 in respect of the like domestic product. This analysis interacts with that of Article III and is quite complicated, however; some commentators have concluded that such a tax scheme can be designed so as not to violate Articles II

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<sup>84</sup> Some commentators point out that such a measure will more likely pass GATT muster if the measure is imposed with relation to the sale, offering for sale, distribution or use of imported products rather than their importation. *E.g.*, Joost Pauwelyn *supra* note 44, at 475.

<sup>85</sup> In this hypothetical, a product that is exported from country A to country B is subject to higher costs than a like product in country B with respect to activities involving carbon emissions. Country A may thus decide to subsidize products being exported to country B in order to make its products competitive with like products in country B, the producer of which does not have to comply with A's stricter carbon-emission rules. The considerations in the main text apply *mutatis mutandis* to this situation.

An alternative would be to exempt goods bound for export from paying the internal carbon tax.

and III.<sup>86</sup> That possibility is more theoretical than real, however, given that any such scheme would be enacted in a crucible of political pressures unlikely to give sole priority to trade analysis.

Even if Articles II and III were satisfied, Article I would have to be complied with to avoid treating WTO members unequally. This could require a highly complicated set of calculations for a specific product, because different exporting countries would likely have different carbon-emissions regimes. To treat all countries equally, therefore, a potentially different tax rate would have to be applied to imports of the product from each such country.

An additional complexity would arise because ‘equal’ treatment in the context of climate change presumably would have to take into account the principle of common but differentiated responsibilities and capacities (CBDR). CBDR is a principle of customary international law,<sup>87</sup> and is expressly contained in Article 3 of the UNFCCC and thus would seem to be compulsory.<sup>88</sup> It requires that all countries cooperate to conserve, protect, and restore the earth’s ecosystem and that developed countries have additional responsibility in the pursuit of sustainable development in light of their capabilities and the pressures they place on the environment. Two points are relevant here. First, less developed countries are less likely to have strong carbon reduction regimes than developed countries because they have fewer resources to devote to this and different pressures and priorities, e.g., in terms of alleviating poverty, so the cost differential described above is more likely to exist with respect to a less developed country. Second, the principle of CBDR may well require developed countries to impose lower import taxes for goods from less developed countries than for goods from similarly situated developed countries.

Even without the complexity resulting from the application of the principle of CBDR, since each product can be expected to have its own amount of embodied carbon and because means of production and regulatory regimes are dynamic, the resulting tax regime would be extraordinarily complicated—perhaps beyond any country’s capability to administer. In the face of that complexity, an importing country might try to do rough justice by setting one or only a few tax rates that are

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<sup>86</sup> E.g., Joost Pauwelyn, *supra* note 44.

<sup>87</sup> The principle is embodied in United Nations Conference on Environment & Development, Annex I, *Rio Declaration on Environment & Development*, Principle 7, A/CONF.151/26 (I) (Aug. 12, 1992).

For the earliest discussion of this, see Daniel Magraw, *Legal Treatment of Developing Countries: Differential, Contextual and Absolute Norms*, 1 COLO. J. INT’L ENVTL. L. & POL’Y 69 (1990).

<sup>88</sup> United Nations Framework Convention on Climate Change (UNFCCC) art. 3.1 & 3.2, *opened for signature* June 4, 1992, 1771 U.N.T.S. 107.

applicable to a product. By its nature, such a scheme would inevitably tax imports from some countries more than they should be based on the differential costs of compliance with carbon-emission regulations while taxing products from other countries less than they should be based on that differential. For several reasons, therefore, one can expect an embodied carbon-based import tax scheme to be challenged under Article I.

If the import tax violated Article I, Article II or Article III, the question becomes whether Article XX provides an exception.

In applying Article XX, two preliminary considerations are relevant. First, in the *Shrimp/Turtle* case,<sup>89</sup> the Appellate Body held that unilateral measures (in that case a prohibition on importing shrimp from countries that did not adopt measures to protect endangered sea turtles) that treated some WTO members more favourably than others were disfavoured but allowed them after the United States made “serious, good faith efforts . . . to negotiate an international agreement on the protection of sea turtles, including with the complainant”.<sup>90</sup> Thus, “although the conclusion of multilateral agreements was preferable, it was not a prerequisite to benefit from the justifications in Article XX to enforce a national environmental measure”,<sup>91</sup> even one that protects resources, and involves activities, outside the borders of the importing country (some territorial linkage existed in the case since the wide-ranging sea turtles sometimes swim in United States waters). It is assumed herein that country A is, in fact, both deeply concerned about the effects of climate change in its own territory and fully engaged in the international instruments and bodies involved in combating climate change. Even then, a WTO tribunal might require that country A engage in efforts to create an international carbon tax scheme that would obviate the need for the type of compensation tax involved in this hypothetical, or in efforts to negotiate bilateral or multilateral agreements specifying the carbon tax regime in effect between relevant countries. Second, the *Shrimp/Turtle* case also held that the United States’ regulatory scheme had to comport with due process.<sup>92</sup> This hypothetical assumes that country A meets this requirement.

Given the risks climate change poses to society, summarised in Part II.A above, it is arguable that several paragraphs of Article XX can be used as an exception. Paragraph (a) might apply because the impacts of climate change may be so

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<sup>89</sup> *Shrimp/Turtle case*, *supra* note 47.

<sup>90</sup> *WTO Rules and Environmental Policies: GATT Exceptions*, WORLD TRADE ORG., [https://www.wto.org/english/tratop\\_e/envir\\_e/envt\\_rules\\_exceptions\\_e.htm](https://www.wto.org/english/tratop_e/envir_e/envt_rules_exceptions_e.htm) (last visited Dec. 20, 2018) [hereinafter *WTO Rules and Environmental Policies*].

<sup>91</sup> *Id.*

<sup>92</sup> *Shrimp/Turtle case*, *supra* note 47.

devastating that the moral fibre of country A is destroyed, the impacts of climate change on the realisation of human rights constitutes an effect on public morals, or other effects are so overwhelming that they affect public morals. Even then, country A would have to show that the tax was ‘necessary’ to protect those interests.

Paragraph (b) might be used because climate change threatens human, animal and plant life and health, as demonstrated by the devastation caused by sea level rise and hurricanes, forest fires, heat waves, floods, etc. arguably worsened or caused by climate change. An issue might arise about whether the tax scheme on imports is ‘necessary’ (as noted above, this argument could also be raised about paragraph (a)). In response, country A could point out that country B could not argue successfully that mitigation measures are never necessary and that countries should instead focus on adaptation. This flows from the *Brazil Retreaded Tyres* case, in which the WTO Appellate Body found that the alternatives proposed by complainant, which were mostly remedial in nature (i.e., waste management and disposal), were not real alternatives to the import ban at issue in the case which would prevent the accumulation of tyres. In addition, the Appellate Body recognised in that case that “certain complex environmental problems may be tackled only with a comprehensive policy comprising a multiplicity of interacting measures”. The Appellate Body pointed out that the “results obtained from certain actions—for instance, measures adopted in order to attenuate global warming and climate change . . . —can only be evaluated with the benefit of time”.<sup>93</sup> Thus, even though one can think of many ways to mitigate climate change, it is probably unlikely, though possible, that a GATT dispute mechanism would decide to second-guess the necessity of good faith measures to combat climate change such as the import on taxes at issue here.

Paragraph (f) might apply given climate change’s likely destructive effects on historical and archaeological sites (e.g., due to floods). There is no requirement of ‘necessity’ for this paragraph. It has not been applied to this type of situation, however, so the outcome is uncertain.

Paragraph (g) might apply given climate change’s devastating effects on exhaustible natural resources of all types, including watercourses and forests. As a mitigation measure, the tax would presumably qualify as ‘related to’ the conservation and preservation of such resources. The requirement that the tax be imposed ‘in conjunction with’ restrictions on domestic production or consumption would presumably be satisfied by the stricter carbon emissions regulations that the tax is designed to compensate for.

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<sup>93</sup> *WTO Rules and Environmental Policies*, supra note 90.

If one or more of these paragraphs can be used, the next step is to apply the two tests in the *chapeau*. In that analysis, it should be relevant that there are several reasons supporting the type of import tax being analysed herein. For example, such a tax promotes the internalisation of the social cost of carbon, discourages carbon leakage or carbon migration of high-emitting industries to less highly regulated countries, enables wider and deeper emissions cuts in country A, and incentivises country B (and other affected countries) to strengthen their own carbon-emissions regulations.<sup>94</sup> On the other hand, the fact that one of the reasons for the border adjustment is competitive, i.e., to level the playing field, does not augur well for satisfying the tests in the *chapeau*. If country B challenges the science regarding climate change or the threats posed by it, the trade dispute mechanism should pay deference to the conclusions of the IPCC,<sup>95</sup> just as the WTO Appellate Body deferred to the Convention on International Trade in Endangered Species in the *Shrimp/Turtle* case,<sup>96</sup> and the arbitral panel deferred to the World Health Organization and Framework Convention on Tobacco Control in the Phillip Morris Brands Sàrl v. Oriental Republic of Uruguay case<sup>97</sup>.

Another consideration relevant to the *chapeau* and also possibly to paragraph (a) is that climate change directly implicates human rights, as discussed in Part II.B and Part III.D of this paper.

If it does appear that a good faith import tax of this type would be held to violate the GATT, the four approaches described in Part II.A.2 should be employed to attempt to avoid a regime conflict. These are: viewing the dispute through the lens of sustainable development, utilising Article 31I(3) of the VCLT, applying the doctrine of intertemporal law promulgated by the ICJ, and using the International Law Commission's harmonisation principle. It is not clear what result such analyses would lead to in the absence of complete details of the context.

The third type of measure (ban on import of products based on the amount of embodied carbon) would not violate GATT Article I as long as it was applied equally to all GATT members. If the CBDR principle is required to be observed here (see discussion above), however, perhaps that outcome is not certain. The ban would not violate Article II because it is not a tax, fee, etc. It would not violate Article III because it would not treat foreign producers less favourably than domestic ones,

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<sup>94</sup> Joost Pauwelyn, *supra* note 44.

<sup>95</sup> See *supra* notes 29, 30.

<sup>96</sup> *Shrimp/Turtle case*, *supra* note 47.

<sup>97</sup> Philip Morris Sàrl, Philip Morris Products S.A. and Abal Hermanos S.A. v. Oriental Republic of Uruguay, ICSID Case No. ARB/10/7, Award (July 8, 2016). This was an arbitration brought under the bilateral investment treaty between Switzerland and Uruguay.

absent other facts. As a ban on imports, this measure would violate Article XI. Thus, the analysis would turn to article XX, the application of which would be similar to that of the second type of measure (tax on imports) above, including both the paragraphs and *chapeau* of Article XX. Similarly, if it appears that a good faith embodied-carbon-based import ban may be held to violate the GATT, the four approaches described in Part III.A.2 should be considered to avoid a regime conflict. It is not certain that the measure would pass GATT muster, however.

These examples indicate some of the uncertainties that would bedevil a trade analysis of schemes to deal with embodied carbon, particularly since no carbon-related measures have been addressed at the WTO. The WTO dispute settlement mechanisms might see their way to resolving those uncertainties in a manner supportive of taking effective action to deal with climate change. Even assuming that is the ultimate outcome (which is obviously not certain), that process would take years given the details of WTO dispute settlement—years that human society does not have if it hopes to continue in its present form. A delay of many years to ascertain which way trade jurisprudence will come out regarding climate change-related measures would be inexcusable. For reasons such as these, James Bacchus has argued for a WTO climate waiver.<sup>98</sup> Such a waiver, which we favour, would presumably need to be adopted by other trade regimes as well to avoid the disputes simply devolving to bilateral or regional levels.

As with the possibility that countries would be prohibited by trade laws from undertaking good faith, otherwise reasonable regulations aimed at protecting their water supply, it is helpful to step back and consider the possibility that trade law would prohibit countries from undertaking good faith, reasonable efforts to deal with embodied carbon. If that were to occur, the trade regime would be in conflict with an important aspect of dealing with one of the greatest threats facing humanity—an outcome that could both interfere with efforts to combat climate change and undermine or destroy the credibility of the trade regime.

#### D. *Human Rights*

The availability of water implicates many human rights, including most directly the human right to safe drinking water and sanitation and also the rights to life, food, health, and culture. Climate change also implicates many human rights, through three pathways: efforts to combat climate change must respect, protect and fulfil human rights;<sup>99</sup> climate change is interfering with the enjoyment of human rights, such as those of the Inuit in the Arctic; and climate migration affects the human rights of the climate migrants and the people living in the territory through which

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<sup>98</sup> James Bacchus, *supra* note 44.

<sup>99</sup> These are the three basic human rights obligations of States under human rights law.

migrants pass or in which migrants settle. These relationships are described in Part II of the paper, and aspects of them arise in the Article XX analysis of various measures. It is thus clear that virtual water and embodied carbon have a direct relationship to human rights and that measures to regulate each can implicate human rights, and thus, a trade analysis of such measures can lead to the question of how to deal with such measures.

The larger issue is how to treat a measure designed to respect, protect, or fulfil human rights that violates a provision of trade law. One approach would be a general rule that the human rights regime trumps the trade regime. Because human rights are prominently mentioned in both the preamble and Article 1 of the United Nations Charter,<sup>100</sup> and because of the breadth and depth of the human rights regime, we believe a convincing argument exists that human rights obligations should take precedence over trade rules if there actually is a conflict.<sup>101</sup> If a conflict can be avoided, of course, one may not need to reach that question. The four approaches explained in Part II.A.2 provide means of avoiding a conflict, i.e., utilising the concept of sustainable development, Article 31(c)(3) of the VCLT, the ICJ's doctrine of intertemporal law, or the International Law Commission's harmonisation principle. Of these, the doctrine of intertemporal law may prove the most powerful as long as it covers human rights and not just environmental norms.

A less universal approach would be, after concluding that there actually is a conflict between the measure at issue and the relevant trade rule, to determine whether there is a human rights treaty that obligates a country to take the measure (or something like it) in question. If there is, the inquiry could then be whether the human rights treaty would take precedence over the relevant trade agreement(s). There are no provisions in either trade or human rights treaties that deal expressly with this question. In the absence of such guidance, the analysis would be unsatisfactory if the outcome were to turn simply on when the relevant agreements were entered into as this would be arbitrary since it is highly unlikely that either set of agreements was negotiated taking the other into account. A blanket rule that measures taken in good faith to protect human rights to fulfil obligations in human rights treaties or in customary international law regarding human rights would thus be a better approach.

A more nuanced approach would be to allow human rights measures protection under trade agreements, such as via GATT Article XX. In Article XX, that might be done via the use of paragraph (a) (necessary to protect public morals) or perhaps

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<sup>100</sup> *Charter of the United Nations*, Preamble, Oct. 24, 1945, 1 U.N.T.S. XVI [hereinafter U.N. Charter]; *Id.*, art. 1.

<sup>101</sup> We can think of no reasonable argument for why the trade regime should take precedence over the human rights regime.



some other paragraph, though fitting human rights under paragraph (a) seems somewhat arbitrary and the application of a necessity test to human rights measures could be excessively intrusive and beyond the institutional competence of trade dispute settlement panels (which are composed of trade experts). Moreover, other trade agreements might not have an exception or rationale that provides even that amount of protection. The general approach relying on human rights' preeminent position in the United Nations Charter and confirming the existence of a human right by reference to human rights treaties and customary international law is thus the best approach.

#### IV. CONCLUSION

Virtual water and embodied carbon relate to issues of paramount importance in today's world: maintaining sufficient water and combating climate change, respectively. Both involve market failures of major proportions, and both implicate human rights in important ways. Efforts to deal with each will almost inevitably involve measures that affect international trade and thus that implicate trade regimes such as the WTO agreements. The application of trade law to exemplative measures that might be taken to deal with virtual water and embodied carbon is complex and can be uncertain and involve difficult questions. Although the analyses differ (primarily because virtual water involves export restrictions and embodied carbon involves import restrictions), some measures considered with respect to them appear to violate trade law. The application of trade law thus may interfere with good faith and otherwise legitimate efforts to deal with water shortages and climate change.

There does not exist any overarching water treaty that would protect efforts regarding virtual water from being invalidated by trade rules. Neither does there appear to exist a climate change agreement that accomplishes that. A possible solution would be to conclude international agreements that deal with relevant issues, including trade issues, regarding virtual water and embodied carbon. In the absence of such clarity and where careful regulatory design cannot avoid an apparent conflict, there are four concepts that might be used to reduce or even eliminate the tension between these areas. These four concepts are: sustainable development, Article 31(3)(c) of the VCLT, the ICJ's principle of intertemporal law, and the International Law Commission's harmonisation principle. At least the first three of these fall within the law that WTO dispute settlement tribunals are permitted to apply. In addition, a climate waiver in the trade regime would be the best way to deal with embodied carbon and other climate change-related trade issues.

The fact that efforts to deal with both virtual water and embodied carbon implicate human rights raises the question of how the trade regime relates to human rights. Trade law, such as Article XX of the GATT, does not expressly mention human

rights. There may be ways of fitting human rights within trade law. A more satisfactory way would be for human rights law to take precedence over trade law based on the fact that the United Nations Charter emphasises human rights in its preamble and Article 1, as well as on the existence of many human rights treaties, customary international law norms, and institutions regarding human rights. Current law is unsettled regarding the relation of human rights and trade law.

It is evident that legal uncertainties exist regarding the treatment relating to virtual water and, even more, embodied carbon under trade law, uncertainties that raise the possibility that trade law will conflict with efforts to deal with good faith water shortages and climate change, two of the most urgent threats facing humanity. Such a conflict could not only impede those critical efforts but also result in serious damage to the international trade regimes.