Clean Energy Trade Governance: Reconciling Trade Liberalism and Climate Interventionism?

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Abstract: Scaling up clean energy is vital to global efforts to address climate change. Promoting international trade in clean energy products (e.g. wind turbines, solar panels) can make an important contribution to this end through business and market expansion effects. If ratified, the landmark Paris COP21 Agreement will commit states to firmer climate actions, this necessarily requiring them to strengthen their promotion of clean energy technologies. Well over a hundred countries already have active policies in this area, many including industrial policy measures that impact on the international competitiveness of their clean energy sector. At the same time, governments have gradually liberalised their clean energy trade regimes, and large producers are negotiating an Environmental Goods Agreement (EGA). Clean energy trade is expanding and disputes among nations in this sector are growing. The World Trade Organisation (WTO) still has limited 'policy space' for climate action. Meanwhile, the United Nations Framework Convention on Climate Change (UNFCCC) still had narrow and infrequent connections with trade matters. Moreover, WTO-UNFCCC engagement on trade-climate issues overall has been largely confined to information sharing and secretariat-level dialogue. This paper explores the extent to which clean energy trade is currently governed, where certain governance gaps and deficiencies exists, and argues why addressing them could help expand trade in clean energy products. It also contends that the most fundamental challenge for the future governance of clean energy trade concerns how to reconcile ramped-up interventionist climate action with an essentially liberal trade order.

Key words: clean energy, trade, governance, climate change, World Trade Organisation (WTO), United Nations Framework Convention on Climate Change (UNFCCC).

1. Introduction

Clean energy comprises of a number of decarbonising and other environmentally friendly technologies that are vital to global efforts at tackling climate change. International trade can make a very important contribution to scaling-up clean energy through its business and market expansion effects. Trade not only allows firms to increase production and sell to larger markets but also diffuse clean energy technologies internationally.[1] This is especially important for developing countries where the scope for achieving marginal gains in environmental welfare and energy efficiency are generally greatest. Although internationally transporting products cause higher-level carbon emissions, it is widely acknowledged that trade-generated increases in clean energy applications have significant net emission-saving benefits (E15 Initiative 2013, 2016). The landmark December 2015 Paris COP21 Agreement commits signatory states to embark on faster paced transitions to a low carbon global economy. Although the Paris Agreement does not explicitly state so, its signatory states cannot in effect fulfil their treaty obligations without further promoting clean energy development. This is because fossil fuel combustion accounts for around 80 percent of total carbon emissions and other greenhouse gas emissions (IEA 2013), and therefore decarbonising (i.e. 'cleaning') the world's energy systems is by far the primary method of stabilising global temperatures and tackling climate change. Relevant global governance institutions are also expected to play their part. Regarding clean energy trade this primarily concerns the World Trade Organisation (WTO) and United Nations Framework Convention on Climate Change (UNFCCC).

Most analyses on clean energy trade to date have either been from the trade law field or technical think-tank reports largely devoid of theoretical or conceptual content. Both have very rarely ventured into deep political economic analysis, and have not situated clean energy development in the modern historical context of strategic industry trade competition and governance. This paper discusses the extent to which clean energy trade is currently governed by existing institutions, rules, policies, coalitions, networks and other relevant factors. It argues that certain governance gaps and deficiencies are evident, which if left unchecked could notably constrain the potential for trade to expand clean energy technologies worldwide. Furthermore, at the core of this issue are theoretical and technical debates on reconciling interventionist climate action and an essentially liberal trade order.

The first section examines the nature of the clean energy sector including product classification issues and recent trade trends. The economic theoretical approaches of economic liberalism and interventionism are then applied to debates on promoting clean energy trade. The nature of trade governance is then examined generally and then more specifically from a number of governance task aspects. These frame the analysis that follows on the evolution of policies, governance structures and institutions that have hitherto shaped clean energy trade, allowing us to identify where governance gaps and deficiencies exist. This in turn prefaces considerations of future ways forward for governing clean energy trade as well as obstacles that lay in the path ahead.

2. Clean Energy Trade: Definitions, Significance and Theoretical Perspectives

2.1 Defining Clean Energy Trade and its Growth

A key problem for governing clean energy trade is that the empirical demarcations of the sector itself are somewhat contestable. While the qualification of renewable energy, energy efficiency applications, electric vehicles, pollution abatement equipment and other core sub-sectors are generally indisputable, the case for others (e.g. nuclear power) can be highly contentious. Beyond industry-level considerations there are deeper technical 'product classification' issues regarding Harmonised System (HS) codes[2], dual/multi-use products[3], and relativity issues[4] that as we later note complicate the boundaries of clean energy trade negotiations and governance more broadly. Notwithstanding these empirical domain challenges, clean energy is widely acknowledged as a set of mostly fast emerging and technologically dynamic industries.[5] Empirical trade flow analysis has primarily focused on renewables, not just due to their sub-sectoral significance but also because these possess relatively distinct classifiable products at the 6-digit HS code level. According to the E15 Initiative (2016), 14 major economies[6] dominate renewable energy trade, accounting for 96 percent of total world exports in wind-powered generating sets and 90 percent for solar photovoltaic (PV) equipment in the early 2010s. An earlier E15 Initiative (2013) study revealed that solar PV exports increased over fivefold from 2004 (US$10.3 billion) to 2011 (US$57.6 billion), and that China was the star performer, its exports rising from just US$0.6 billion to US$27.9 billion over this period.[7] Dynamic changes in this industry's trading structure has created tensions. The US and EU's disputes with China during this time led to dramatic falls in the country's

PV exports[8], and worldwide solar energy trade more generally as the dispute spilled over to encompass other countries, including India, Malaysia, South Korea, Taiwan and Vietnam[9] (E15 Initiative 2016, UNEP 2013, Pew Charitable Trusts 2013, Wu and Salzman 2014).

Wind energy sector trade has also increased markedly, exports of wind generating set components almost fivefold from 2004 (US$561 million) to 2011 (US$2.5 billion), and reported imports almost sevenfold from US$588 million to US$3.9 billion[10] (E15 Initiative 2013). In other renewable energy sectors, international goods trade in the hydropower, tidal energy and geothermal industries is primarily in generator turbines and other power generation equipment. Installation development here (e.g. dams, barrages) mainly involves local-sourced construction materials. Meanwhile, the biofuel and biomass sub-sectors entail trade in agricultural and forestry feedstocks (e.g. corn, bagasse, wood pellets) as well as bio-chemical processed products (e.g. biodiesel). Clean energy trade also involves exported renewables-generated electricity across neighbouring states, this being considered more a tradeable service rather than a good.[11] Problems over product classification and the paucity of survey work on sector trade flows has meant that the empirical contours of clean energy trade remain quite weak. It is still an emerging area of study in virtually all aspects.

2.2 Economic Theoretical Perspectives on Clean Energy Trade

Governance institutions and structures are, to varying degrees, founded on certain ideational principles that are in some way derivative from, or closely associated with

a particular social science theory or theories (Bevir 2013, Hoppe 2011). Of special relevance here is are governance goals and their method(s) of realisation. Economic theoretical debates on governing clean energy trade have typically focused on two main schools of thought, the first being the economic liberalist tradition that champions the idea of 'free trade', the second is the interventionist approach involving state actions aimed at both correcting and developing markets. The case for liberalising clean energy trade is grounded in comparative advantage theory. This posits that removing barriers to international trade allows the most efficient, competitive producers to prevail in the market, displacing inefficient rivals that were hitherto protected by import tariffs and other policy measures. Free trade would, it is argued, subsequently lead to increased efficient production in clean energy industries in accordance to each country's specialised comparative (i.e. competitive) advantage. It is fundamentally a market-led process, where states are 'passive' agents, only acting to remove trade barriers they originally erected. Sole responsibility for trade capacity-building (i.e. the aggregated international trading capabilities of firms in an industry or nation) is therefore assigned to private enterprise. Market forces also determine all distributional issues relating to trade-generated welfare gains and losses, e.g. profits, income and employment.

However, free trade theory was originally a 'country-based' trade model, and is premised on assumptions of perfect or near-perfect competition where each world market is composed of very many firms of relatively similar size. When British economist David Ricardo first published his treatise on comparative advantage 200 years ago, world trade was based on very different forms of organised production compared to today. Our ever more functionally integrated global economy is characterised by international supply-chain configured production linked together by

dense intra- and inter-firm networked relationships. The idea of an international trade order based on countries simply exporting and importing purely nation-made whole products is now very outdated. Trade today can be best understood as a function of transnational business and industry organisation. Free trade theory has adapted accordingly, and contemporary economic liberals emphasise how trade liberalisation reduces transaction costs of cross-border supply chain operations. The theory's assumptions on market structure nevertheless became increasingly questionable given that most global industries closely fit models of imperfect competition, where a few firms dominate due to exploiting increasing returns to scale advantages. As Krugman (1987: 21) aptly remarked, "free trade is not passé, but it is an idea that has irretrievably lost its innocence". Around the time Krugman made this comment, he and other scholars (Brander and Spencer 1985, Krugman 1986, Tyson 1992) proposed strategic trade theories in the 1980s and 1990s premised on oligopolistic market structures. They presented a rationale for active state trade and industrial policy support of 'home champion' firms in strategic 'high-tech' industries in particular to help establish dominant positions and extract profits in excess of the original public investments by capturing increasing returns of scale (Stegemann 1996).

Strategic trade theory's roots lay in much earlier ideas on trade-industrial policy linkage first articulated by the late 18th and early 19th centuries thinkers of Alexander Hamilton (1791 'Report on the Subject of Manufactures' essay in the US) and Friedrich List (1841 'Natural System of Political Economy'). Both advocated state intervention to promote domestic manufacturing and trading capacity to compete with then dominant British industry in international trade markets. These ideas found later resonance with German Historical School social scientists and

'institutional economists' of the 19th and 20th century theorising on the pivotal role of the state and other institutions in shaping market and industry development. Special attention has been afforded to 'strategic industries', which possess at least one of the following attributes:

(i) *future growth*: new and fast emerging sectors, usually based on cutting-edge technology, having substantial growth potential and therefore important to generating future prosperity, income and welfare

(ii) *functional*: sectors performing essential functions in the economy such energy and material supply, and thus can have close connections with national security interests

(iii) *foundational*: industries providing a upstream material, process or other kind of foundation on which related downstream sectors are based, for example steel and chemicals for various manufactured products.

What makes an industry 'strategic' is its significant contribution to an economy's underlying long-term development and structural integrity. *Future growth* new technology industries especially generate positive spillovers in the economy not fully captured by market mechanisms, such as cross-firm externalities, inter-industry learning and new skills development (Rodrik 2014). The interventionist approach especially makes a case for state support for strategic industries at their 'infant' stage, when there are various start-up challenges to overcome such as large initial capital costs, establishing research and development (R&D) capacity, and the creation of enabling infrastructures (Chang 1996; Lall 2003; Rodrik 2004, 2007, 2014; Schmitz 2007). Here, the state essentially provides the necessary public goods to facilitate

industry formation to compensate the market mechanism's shortcomings in this respect. This same argument lay the basis for state industrialisation policies across the developing world from the 1950s with often a strong emphasis on export-orientation, especially in East Asia. During the 1970s and 1980s, developed countries had themselves embarked on increasingly ambitious strategic high-tech industry policies, e.g. semiconductors, aerospace and flat screen displays (Hart and Prakash 2000, Krugman and Obstfeld 2000). Strategic trade theorists utilised the empirics of these trade-industry policies (e.g. Airbus in the EU, Sematech in the US, and Japan's VLSI[12] programme) and lent scholarly credence to similar policies pursued into the 1990s and 2000s. Here, interventionism essentially involved (supply-side) trade capacity-building rather than trade protectionism, thus fostering competitive new industry development rather than safeguarding inefficient producers.

Strategic trade theory was predicated on the pursuit of well-defined and integral national economic interests. However, this has become less tenable in a world of transnational business. For example, Chinese state support for its solar PV industry has significantly benefitted foreign supplier firms such as US-based polysilicon producers Strategic trade theory subsequently fell out of favour but ideas of strategic industry promotion remained popular, shifting now towards developing more locally embedded, high value-added activity 'clustered' in home territory (Dicken 2011). Industrial policies on clean energy have been primarily motivated by the first strategic industry attribute (*future growth*)[13], and to a lesser degree the second attribute (*functional*) by addressing the long-term energy security predicament of reliance on depleting fossil fuels. There are some grounds on which clean energy can claim the third attribute (*foundational*) but the evolution of its foundational technologies is bound together with broader innovatory developments, e.g. battery

storage technology, new material science. Even in a world of transnationalised business, governments remain fixated on 'inter-national' competition in clean energy based on strategic industry motives, with trade the key domain of rivalry.[14]

State interventionism on clean energy development is also legitimised on environmental public good and externality grounds. Markets inherently under-price the 'social cost' externalities of GHG emissions, air pollution and other deleterious ecological effects caused by fossil fuel combustion, and conversely do not capture the 'social benefit' externalities of clean energy utilisation. Interventions are therefore required to correct such market failures, assisting clean energy's paths to technological advancement and commercialisation and more broadly address climate change challenges (Cosbey and Mavroidis 2014, Rubini 2012). The economic liberalist counter-argument is that state intervention leaves markets open to political 'rent-seeking' manipulations, confers 'unfair' trade competitive advantages to protagonist states, and leads to sub-optimal welfare outcomes generally, what Stepp and Atkinson (2012) refer to as 'green mercantilism'.

Well over a hundred nations now actively promote clean energy development (REN21 2015, 2016), many deploying industrial policy measures to strengthen the domestic production and technological capacities of home producers, yet most have only indirect trade competitiveness-enhancing effects. Examples include investment subsidies and grants, production tax-credits, soft loans for purchasing equipment, and various forms of support for R&D activity (E15 Initiative 2013). Some countries have used more recognisable trade policy instruments to overtly strengthen the competitiveness of domestic clean energy industries, typically export promotion measures. However, the demarcations between 'industrial policy' and 'trade policy'

can be blurred, not least because policies on industry capacity-building invariably have trade capacity-building effects. This especially applies in internationalised economies where firms are export-oriented and have strong international supply-chain linkages. Consequently, trade disputes frequently arise over industrial policy actions that in some way boost export competitiveness.

Economic liberalism and interventionism may be in theoretical binary opposition to the other but they co-exist in actual policy practice, with most states adopting a pragmatic combination of trade liberalisation and trade capacity-building intervention measures in clean energy sectors. Cheaper clean energy imports and state support for developing competitive domestic clean energy industries both serve similar climate action ends, and both approaches can be pursued simultaneously. Moreover, industrial policy can include lower import tariffs for vital foreign-sourced material and component goods required for domestic production. Here, then, liberalism and interventionism are reconcilable at the national or sub-national (e.g. city or local government) policy level where no international rivalry arises. Completely different circumstances apply when governing the global order of clean energy trade, where tensions and conflicts between competing producers must to be managed. Relatedly, this can prove difficult if relevant governance institutions and structures themselves have dissimilar ideational, ideological or philosophical orientations. As is discussed, WTO governance is largely premised on economic liberalist goals of global free trade, and hence essentially minimising state interference unless this involves fortifying regulations to improve market competition. Conversely, climate change is viewed as an extreme case of market failure (Charnovitz 2003, Hufbauer and Kim 2009). In this context, UNFCCC governance essentially advocates 'market correcting' state and institutional activism.

Reconciling these two broad theoretical-ideological approaches is key to understanding the future path of clean energy trade governance.

3. Governing Clean Energy Trade

3.1 Governance in Context

Both liberalism and interventionism are concerned with matters of economic governance, especially state (or institution) – market relations. Governance can be generally understood as the governing actions, processes and structures of organisational forms when discharging their responsibilities, whether upholding the interests of their represented groups and societies, managing particular entities (e.g. markets, companies), or realising a set of core goals and objectives. As Stoker (1998) summarises: "Governance is ultimately concerned with creating the conditions for ordered rule and collective action" (page 17). As well as conceived in 'act of governing' verb terms, governance can describe particular structures or frameworks, and in turn their norms of common conduct, ideological and operational principles, decision-making mechanisms and rules-based systems. Governance is often perceived synonymously with its own organisational form, most frequently national governments: their 'policies' are essentially specific governance actions or devices (Bevir 2013, Hoppe 2011, Williamson 1996). However, in both national and international contexts, a governance 'architecture' may comprise various forms of agency – including institutions, networks, enterprises and coalitions – that may compete or co-operate with each other, and where overlapping and multi-level organisational governance is exercised.

Relatedly, governance 'domains' exist in terms of geo-spatial scale (e.g. nation, region, global) as well as defined interests or issues, e.g. trade, security, health, environment. The gradual thickening of global governance over recent decades is closely associated with addressing increasingly acute global-level challenges or collective problems facing humanity (Weiss 2013, Whitman 2009, Wilkinson and Hughes 2002). Governing international trade is most strongly connected with the challenge of globalisation and poverty alleviation, and clean energy with climate change (Evans 2012, Vatn 2015) – widely acknowledged as the most critical challenge. Distinct global governance domains have taken shape around these, and the demarcations tend to be clearest where they involve global-multilateral institutions, such as the WTO and trade (Wilkinson 2000, 2006). Yet challenge issue-linkage requires these institutions to co-operate and co-ordinate to bring about optimal governance outcomes. Problems arise when conflicting goals and objectives are present in the global governance architecture, or where a lack of institutionalisation and inter-institutional co-operation create certain governance 'gaps'.

Clean energy trade which intersects two prime domains of global governance: trade and climate change. We later examine inter-institutional engagements between the WTO and UNFCCC on trade-climate action issues generally, which hitherto have been somewhat weak. The extent which this has posed a governance gap is discussed, including the relevance of other agencies working within and across both institutionalised governance spaces.[15] Both the WTO and UNFCCC exercise governance mechanisms that in turn shape national, sub-national and sometimes regional level (e.g. the EU) policies. The WTO is a more established governance

structure that operates a multilateral rules-based system and operational mechanisms, e.g. disputes settlement. UNFCCC governance is founded on landmark multilateral treaties ratified into domestic legislatures that facilitate concerted national level actions on climate change. The GATT/WTO 'rounds' of global trade talks have worked on a similar basis for advancing trade liberalisation. The respective governance domains presided over by both institutions are complex polities where multiple types of agency shape outcomes. This is particularly evident in climate change governance, which Dyer (2014) characterises as 'anarchic' but in positively constructive, 'bottom-up' participative and innovatory way. Others similarly stress how in the vacuum created by a relatively weak 'state-centric' UNFCCC, various non-nation-state actors (i.e. including local governments) have established their own global climate governance structures of sorts (Corry 2013; Jagers and Stripple 2003; Okereke *et al* 2009; Schreurs 2008, 2010), such as the International Council for Local Environmental Initiatives (ICLEI) and the C40 Cities Climate Leadership Group both at the city government policy level.

Governing clean energy trade essentially involves the same general tasks of trade governance *per se*, which can be summarised as:

1. *Advancing trade liberalisation*: removing barriers that in some way impede or tax (e.g. application of import tariffs) the flow of traded goods and services across borders.
2. *Promoting trade capacity-building*: helping enterprises raise export production levels and compete in international markets.

3. *Upholding trade remedies, safeguards and other 'defensive' measures*: applied against 'unfair' trade practices, most commonly when these are deemed to contravene accepted international rules.

4. *Resolving trade disputes*: deploying established rules and resolution mechanisms to bring about brokered agreements between disputing parties.

5. *Establishing and upholding international norms of trade policy conduct, and the realisation of common goals for the trade system*: to help create and maintain a stable, predictable international trade environment

6. *Managing a rules-based order and other operational governing mechanisms, e.g. dialogue and negotiation processes*: the technical governance mechanics that help serve the above

The first four tasks are issue-specific and the last two of a more general, systemic nature. Conflict can arise between certain tasks, for instance where unilateral trade remedy actions (task 3) are applied by one country against another's industrial policy subsidy support on trade capacity-building (task 2). Most tasks of governing clean energy trade are undertaken through national policies and the WTO. We explore the reasons why the UNFCCC has been largely limited to facilitating background dialogue on trade-climate issues, thus leaving the global-level governance of clean energy trade primarily to the WTO. This governance task structure serves as an analytical tool for exploring the extent to which clean energy trade is being governed, and where gaps and deficiencies arguably exist.

3.2 National Policies and Governance

National policies mainly connect with above governance tasks (1), (2) and (3). Over the last decade or so, governments of most large clean energy producer nations have simultaneously eliminated many conventional trade barriers in this sector (task 1) and built up their governance support structures for clean energy development through industrial policy measures (task 2). Whereas trade liberalisation can help expand clean energy trade through essentially demand-side effects, as noted earlier industrial policies can achieve the same primarily through supply side capacity-building, though not all clean energy policy measures fall into this category. Feed-in tariffs (FiT) are, for example, market-incentive instruments designed to mainly stimulate domestic consumption of clean (renewable) energy that subsequently spur the development of domestic clean energy industry, or indeed that of competitive foreign rivals, with trade effects: a recent German FiT scheme was blamed by some for stimulating a huge influx of affordable Chinese solar panel imports into the country.[16]

National import tariff levels on clean energy products vary enormously, indicative of the sector's inherent diversity. Duty levels on key goods like renewable energy and energy efficiency equipment have steadily decreased to relatively low single-digit figures in major producers including developing countries. They are somewhat higher in more politically sensitive sub-sectors such as biomass feedstock goods (E15 Initiative 2013, Olawuyi 2014).[17] A few years ago, Jha (2009) presented results of a regression analysis on the sensitivity of renewable energy product imports and exports to four variables, namely tariff duty changes, renewables share of the electricity grid, patents registered, and state financial support (i.e. subsidies) for

domestic renewables development. The research revealed that import duty reductions were less significant in comparison to grid share and development subsidy factors in stimulating clean energy trade. It was thus argued that tariff liberalisation alone was insufficient to boost import and export flows: state interventionist policies were also critical. There is a more general point here that liberalism can in certain circumstances lead to climate action but it is not enough.

As previously noted, most industrial policy measures aimed at promoting clean energy development have indirect trade competitiveness-enhancing effects, being principally conceived in domestic production capacity-building terms (task 2 related). Measures with a more direct trade effect are often problematic due to contravening certain WTO rules. This especially concerns local content requirement (LCRs) and various subsidy instruments, which together with alleged export price 'dumping' practices form the main basis of clean energy trade disputes. LCRs are often used for strategic infant industry development purposes, mandating producers to locally source value-added inputs to certain percentage thresholds. They necessitate home and foreign-investing firms alike to work with domestic suppliers rather than overseas counterparts, with potential trade diversion impacts. Of all the industrial policies studied, they could be considered the closest to explicit trade protectionism. Clean energy LCRs disputes first emerged in the early 2000s.[18] Their use is prohibited under WTO laws[19], its Disputes Settlement Body (DSB) being consequently invoked five times over 2009 to 2015 against the use of this measure. Ang (2015) reports over the same period a total of 21 countries had implemented LCRs in the clean energy sector.

Disputes over alleged subsidisation and price dumping of clean energy products have been much greater in number and significance (Espa and Rolland 2015). The two issues are often linked: state subsidy support can enable exporting firms to 'dump' cheap products in overseas markets.[20] Anti-dumping duties (ADDs) and countervailing duties (CVDs[21]) are the most commonly applied trade remedy counter-measures permitted under WTO rules (tasks 3 and 6).[22] 'Remedy' actions are themselves problematic in that they represent a form of protectionism, albeit in a compensatory manner to uphold the principles of 'fair' trade. Research conducted by Cimino and Hufbauer (2014) found that 41 trade remedy cases (26 ADD, and 15 parallel CVD investigations[23]) were initiated on clean energy exports from 2008 to early 2014 on annual average trade valued at US$32 billion.[24] After the US government applied trade barriers of alleged state-subsidised exports of Chinese solar PV products[25] in 2012, the Chinese government responded the following year by imposing its own barriers on polysilicon imports from US producers.[26] The governance task of resolving clean energy trade disputes (task 4) is mainly assigned to the WTO rules-based system, which more generally seeks to converge national trade policy behaviour to the organisation's norms of conduct (task 5).

3.3 WTO Governance

The WTO is the prime actor responsible for governing clean energy trade globally. It does this in accordance to its cardinal principles of trade liberalism, multilateralism and maintaining trade system stability. Although the organisation's legal framework has no *energy*-specific trade disciplines (task 6), it does cover the field indirectly through generically applied rules, the most relevant of which concern export policy

practice (Cottier *et al* 2009, Selivanova 2011). In the fossil fuel sector, this has typically involved the prohibited use of duties and quantitative restrictions on fossil fuel exports[27], often deployed by countries for revenue generation and energy security motives respectively (ICTSD 2006). As indicated earlier, most clean energy trade disputes centre on alleged export promotion rather than restriction, although in 2012 the EU, Japan and US invoked DSB cases against China's export restrictions of rare earths, mineral elements vital in the production of various clean energy products.[28] Article V of the WTO's rules covers services trade but with no explicit reference to energy or environmental services. Instead, as with trade in goods, these areas are covered by generic disciplines. Moreover, as Marceau (2012) noted, any new energy-specific rules introduced at the WTO would have to be reconciled with existing rules, potentially over multiple disciplines. Cross-border exports of electricity (e.g. Laos' hydroelectric power sales to Thailand) are considered a 'service' by certain states and a 'good' by others, making its trade status under the WTO somewhat ambiguous. Furthermore, WTO governance has no specific rules on third-country transiting of internationally traded electricity, whether produced by renewables, nuclear or fossil fuel combustion (E15 Initiative 2016, Selivanova 2015).[29] In a world where cross-border energy infrastructure links are growing and international 'super-grid' projects are increasingly proposed, this could become a notable gap in the WTO's rules order, governed instead by *ad hoc* international agreements.

Over time, the GATT/WTO has attempted to govern trade-*environment* issue linkages. Article XX allows members to apply 'WTO inconsistent' measures if deemed necessary to protect human, animal or plant life or on health grounds, or in the interests of environmental conservation. Under its provisions, the environmental

welfare gain is weighed against the trade welfare loss in a balancing test, and a ruling made. While environmental policy measures come under Article XX's purview[30], industrial policy measures do not, these being instead covered by other WTO rules discussed later.[31] The 1994 Uruguay Round treaty established the WTO Committee on Trade and Environment (CTE). Negotiations on Environmental Goods and Services (EGS) became part of the Doha Development Round initiated in 2001. Under the CTE's aegis, the EGS was conceived as a sectoral liberalisation agreement akin to the Information Technology Agreement (ITA) brokered in the mid-1990s. By 2005, WTO members had collectively proposed almost 500 products– substantively represented by clean energy goods – for inclusion. Disagreements over aforementioned product classification issues, though, led to a much reduced list of around 150 products by 2007 (World Bank 2008), and into the early 2010s the EGS' progress suffered from ongoing disagreements on product eligibility and general inertia in Doha Round talks.

However, fresh impetus came from the Asia-Pacific Economic Co-operation (APEC) group at their 2011 summit in Honolulu that launched a plurilateral Environmental Goods Agreement (EGA) initiative. The EGA's original aim was to reduce import tariffs to 5 percent or less on a starting list of 54 products on a non-discriminatory, WTO-based 'most favoured nation' (MFN) basis. In July 2014, the EGA was subsumed into the WTO process and its negotiating membership duly expanded to 18 parties (46 countries from the Asia-Pacific and Europe in total, the EU-28 acting as one party[32]), these accounting by then an estimated 86 percent of globally traded environmental goods (E15 Initiative 2016).[33] After 18 rounds of talks by December 2016, negotiating parties had not settled on the final list of clean energy and other environmental goods due to unresolved product classification issues, and talks

stalled thereafter. If ever finalised, an EGA would eventually establish a core consensus on clean energy product classification and thereby help define the empirical domain (and governance) of clean energy trade, as well as represent a landmark trade liberalisation agreement (task 1). Yet the WTO would still have trade rules with no explicit links to climate action.

Introduced in the mid-2000s, the WTO's 'Aid for Trade' programme monitors and share good practice on trade capacity-building (task 2) support in developing countries but this is a general scheme, an any connection here with clean energy trade is coincidental. The WTO's Agreement on Subsidies and Countervailing Measures (ASCM) and Agreement on Anti-Dumping (ADA)[34] – both signed as part of the 1994 GATT Uruguay Round treaty – provide the main legal basis for applying trade remedy measures (principally tasks 3 and 6). The ASCM established the first agreed definition of 'subsidy' among WTO members, this being somewhat broad, including both direct forms of state support (grants and loans) and indirect (e.g. foregoing of tax revenue, preferential terms for supplied inputs) assistance. The connections here with industrial policy make this area governance task 2 related. The ASCM explicitly forbids the use of export subsidies, and subsidies linked to export performance or LCR criteria ('prohibited subsidies'). Most state subsidy support for clean energy development fall into the permissible 'actionable subsidies' category in the ASCM, where support is limited to specific industry sectors and there is no intended 'adverse trade' impact (UNCTAD 2008, Wilke 2011). These can, as previously noted, be challenged by trade partners either through invoking the DSB mechanism (task 4) or applying CVDs and ADDs where relevant evidence of 'injurious competition' on domestic industry can be clearly demonstrated (task 3). A third 'non-actionable' subsidy category once existed (ASCM Article 8) but was

withdrawn in 2000. This had allowed for non-challengeable state support in 'economically disadvantaged regions', for R&D activity and adaptation to environmental requirements (Cosbey and Mavroidis 2014). The new stricter disciplines of the ASCM from 2000 onwards thus made it more difficult in theory to subsidise clean energy development with implications for the sector's trade. Many have argued for the restoration, redrafting and/or expansion of this subsidy category based on 'public good' climate action grounds, although conceding that this could prove very difficult given differences of position taken by key WTO members on the matter, and alternative green industrial policy measures would help avoid trade conflict (Bigdeli 2011, Cosbey 2011, Cosbey and Mavroidis 2014, Epps and Green 2010, Green 2006, Howse 2010, ICTSD 2006, Janzen 2010, Rubini 2012). Furthermore, both the ASCM and ADA have no Article XX-type 'balancing test' that take into account the environmental welfare benefits of industrial policy measures. Thus, if any trade welfare cost is proven under ASCM and ADA rulings then trade remedy counter-measures are deemed permissible. In addition, the DSB's slow elaborate review processes (task 4) are seen as the principal reason why WTO members have instead initiated unilateral trade remedy actions on clean energy and other green industrial policy measures (task 3), which has noted earlier have recently grown in number (Cimino and Hufbauer 2014, Simmons 2014, Wu and Salzman 2014). The first clean energy related DSB case was in 2010 and by mid-2017 a total of 13 cases had been brought the WTO, the last being in September 2016.[35]

3.4 Free Trade Agreements (FTAs)

Whereas a concluded EGA will be a non-discriminatory (MFN) trade treaty, free trade agreements (FTAs) are preferential and *quid-pro-quo* liberalisation based. Their recent rapid proliferation – from around 20 in force in 1990 to around 400 today – make them increasingly relevant to governing clean energy trade because they create, to varying degrees, their own rules regime outside the WTO. Moreover, FTAs may confer market access preferences to relatively inefficient clean energy sector producers over more efficient ones, resulting in trade diversion. Tariff liberalisation has, though, become less significant in modern-era FTAs, which are now centred more on commercial regulation, e.g. investment rules, IPR, government procurement. They have also included environment-related provisions since the 1990s[36], and from the early 2000s some have included energy security provisions (Dent 2010, Wilson 2012). Certain newer agreements contain provisions on clean, sustainable and renewable energy, although these are generally non-legally binding statements of aspirational intent amongst signatory parties to both remove existing, or avoid future use of trade and investment barriers, and to establish new mechanisms devised to mutually promote clean energy trade and development (ICTSD 2015). While FTAs create their own trade governance regimes (potentially across all six task areas), they are nevertheless obliged by international norms of conduct to demonstrate their compatibility and conformity with core WTO trade disciplines.[37] Yet, they could nevertheless undermine efforts to establish coherent multilateral governance of clean energy trade if they establish stronger particularistic rules-based structures here in the future.

3.5 UNFCCC Governance and Trade

Around 20 of the 250 or so multilateral environmental agreements (MEAs) currently in force have provisions affecting trade[38] (WTO 2016). Most of the 20 agreements are on very specific issues, such as endangered species (e.g. CITES[39]), sustainable forestry (ITTO[40]) and aquaculture (e.g. ICCAT[41], CCAMLR[42]), and toxic chemicals (e.g. Basel, Rotterdam and Stockholm Conventions; Montreal Protocol). By addressing climate change – the most potent existential threat facing humanity - the UNFCCC is arguably the most important MEA and global environmental governance institution. It began as an international environment treaty signed at the 1992 UN Conference for Environment and Development (first 'Earth Summit') in Rio de Janeiro that now has 197 signatories (United Nations 1992, 2017). The UNFCCC essentially seeks to broker global agreements on state climate action, thus the introduction of new policy interventions or strengthening existing ones to this effect. While this is conducive to clean energy industry and trade capacity-building (task 2), its connection with trade is largely indirect, and to date has only really engaged in dialogues on international norms of general trade-climate practice (task 5) that have not led to any effective change outcomes.

On coming into force in 1994, the UNFCCC became the main legal framework for global action on climate change, establishing annual Conference of the Parties (COP) meetings and other derivative forms of governance to advance its agenda. Japan's hosting of the 1997 COP3 led to the adoption of the Kyoto Protocol (United Nations 1997), the first global-level endeavour to reduce GHG emissions. Its 'Clean Development Mechanism' established over 6,000 new clean energy installation projects in developing countries by 2013 based on investment valued at almost

US$200 billion (Dent 2014). The Protocol will continue to operate up to 2020 and possibly beyond, thus overlapping with the COP21 Paris Agreement, talks on which were concluded in December 2015. This new UNFCCC treaty became legally binding in November 2016, when at least 55 nations representing a minimum 55 percent of global GHG emissions had ratified the accord in their domestic legislatures. Article 2 of the 'Paris Agreement' (United Nations 2015) sets the goal of limiting "the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels" .[43]

The only explicit reference to clean energy in the original *1992 UNFCCC Treaty* can be found in its preamble, where it reads: "Recognizing that all countries, especially developing countries, need access to resources required to achieve sustainable social and economic development and that, in order for developing countries to progress towards that goal, their energy consumption will need to grow taking into account the possibilities for achieving greater energy efficiency and for controlling greenhouse gas emissions in general, including through the application of new technologies on terms which make such an application economically and socially beneficial" (page 6). There is also just one explicit reference to trade, found in Article 3.5 that states "measures taken to combat climate change, including unilateral ones, should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade" (page 10)[44].

As Chan (2016) observed, this Article 3.5 provision became increasingly relevant in the UNFCCC's 'response measures forum', where signatory states have for some time discussed how the climate action policies generally of one country can impact on

others. Trade-related matters discussed here have concentrated on border carbon adjustments, carbon labelling and higher import tariffs on fossil fuels, and the prime focus of the forum's debate on trade-climate issues have centred on the extent to which such measures – especially deployed by developed countries – constitute green trade protectionism. Chan notes in that sharp disagreements have arisen in these discussions, where developed countries have generally expressed a norms preference for these matters to be addressed solely within the WTO whereas many developing countries have argued that any trade-climate conflicts are best resolved within the UNFCCC process and in accordance with its norms of common but differentiated responsibilities and respective capabilities. Consequently, there has been no international consensus on which global governance institution should best address trade-climate issues. Furthermore, despite greater attention this forum has afforded to trade-related matters, the UNFCCC's work in this area does not appear to have substantively addressed clean energy trade.

The *1997 Kyoto Protocol* may have more direct references to the role of state policies and energy on climate change action but is also weak on trade, with only one minor direct reference to the subject.[45] ‘”“”The *2015 Paris Agreement* contains just a singular explicit note on energy – ‘Acknowledging the need to promote universal access to sustainable energy in developing countries, in particular in Africa, through the enhanced deployment of renewable energy’ (preamble, page 2) – and is completely devoid of any reference to trade for reasons later discussed. The agreement has, moreover, been criticised for its lack of governing mechanisms to realise its goals and being mainly preoccupied with setting flexible conditions for co-ordinating national policy actions.[46] Nevertheless, the Paris Agreement calls for a much faster transition to a lower carbon economy that ultimately depends on more

ambitious state interventions on climate action, and by default will include trade-industrial policy related measures (task 2 related) concerning clean energy development.

3.6 Climate Change and Trade Governance

When there are intersections between two prime global governance domains such as trade and climate change, to what extent does close co-operation between the main international institutions responsible for governing those domains matter? For example, does a lack of co-operation and co-ordination of joint institutional efforts constitute a governance gap, leading to sub-optimal outcomes? Is it better for global institutions to work independently and in accordance to their own agenda, norms and operational mechanisms? Where duplication of governance tasks or even conflict arises between institutions over such linked domains, is this necessarily problematic? Furthermore, what is be done when an apparent conflict of cardinal principles and agendas exists between those institutions? These are important questions to consider regarding the governance of clean energy trade. Thus far, the two most relevant institutional protagonists, the WTO and UNFCCC, have engaged in low-level dialogue for the last two decades or so with reportedly limited outcomes. There have also been long-standing concerns over the compatibility of their global governance agendas (E15 Initiative 2016). For example, the ICTSD (2006) highlighted how WTO rules affecting clean energy trade, such as the ASCM and ADA, may restrict climate action, connecting with the potential wider clash of principles between WTO liberalism and UNFCCC interventionism.

Thus far, governing clean energy trade is viewed more as a trade than a climate change issue from a global institutional perspective. The WTO furthermore has incumbency and functionality advantages over the UNFCCC. The former's institutional history dates back to GATT's creation in 1947, and has functioned as a rules-based governance system for decades. In contrast, the relatively junior UNFCCC still remains a somewhat unproven global governance structure focused primarily on establishing a norms consensus among its parties, and trying to co-ordinate national-level actions on climate change rather than create (as yet) a global-multilateral regulatory framework. It is not institutionally equipped to make global-level rules on climate-related trade or indeed other matters, nor is this on the foreseeable horizon.[47] In the overarching global governance architecture, the WTO's primary competence on all trade-related matters is still widely acknowledged, notwithstanding stalled Doha Round progress and FTA proliferation. Economic liberals would perhaps also argue that the WTO's legitimacy to lead-govern on clean energy trade derives from it being a purely economic institution, making 'rational' economic decisions that result in optimal global welfare outcomes. This, of course, has been critically contested from an international political economy perspective (Wilkinson and Hughes 2002, Wilkinson 2006), this connecting with our earlier debate on wider public good and welfare considerations. The UNFCCC is comparatively a more multi-sector framework charged with co-ordinating actions across a broader policy spectrum, not just on trade and economics despite their centrality to tackling climate change.

Notwithstanding its limitations and weaknesses, the UNFCCC is still relatively speaking the best positioned and most relevant multilateral environmental

institution to work with the WTO on clean energy trade given its primary responsibility on climate action and co-ordinating international efforts on decarbonising economic activity. ‘’ ‘’ However, UNFCCC-WTO co-operation appears to be mainly confined to information sharing on relevant developments arising independently within each body.[48] There appears to be no agenda for proactive co-operation on forging new forms of governance on trade–climate issues, for example on the possible introduction of new climate-relevant trade rules, strengthening dialogue channels between both institutions, or working in closer co-ordination with mutual stakeholder networks and coalitions. As, Olawuyi (2014: 14) generally observed: ‘As lofty as the objectives of the WTO and the UNFCCC are, the practical reality is that adequate multi-institutional measures have not been put in place to ensure coherent compliance and enforcement of the trade and climate change requirements under both regimes. The result is the proliferation of several international obligations, standards, procedures, and requirements which make international trade more difficult and which also make efforts to combat climate change less concerted’ (page 14).

Trade-related provisions were apparently included in the negotiation texts of the Paris Agreement but parties were in the end unwilling to include any such reference, most likely due to the aforementioned disagreements already evident in the UNFCCC’s response measures forum, and that including any provision that would not repeat the status of quo of Article 3 of the UNFCCC would be impossible. This may be more relevant than weak inter-institutional co-operation between the WTO and UNFCCC over the last 20 years.

4. Conclusion: Future Ways Forward for Clean Energy Trade Governance

This paper has examined the extent to which clean energy trade is governed, where certain gaps and deficiencies are apparent, the reasons or causes for these, and has argued why addressing these gaps and deficiencies is important. The nature and forms of trade governance has been discussed, and how this applies to clean energy industries using the outlined six 'governance task' analytical framework. Most nations now have clean energy policies where states have actively intervened to promote the industry based on strategic industry and environmental motives. This has consequently strengthened clean energy trade governance at the national level, where policy actions have had both direct and indirect impacts on trade. The nature of state interventions on promoting clean energy development has varied, and this has been in some way the crux of the matter. More developed liberal states with a predilection for market-incentive interventions have opposed the use of direct financial support interventions typically deployed in lower-income developmentalist states that have affected trade competition. International disputes regarding clean energy trade have thus centred on what constitutes 'fair/unfair' interventions between nations, and consequently balances of national economic welfare loss/gain rather than net impacts on global environmental welfare. For example, Chinese government support for its solar energy industry over the last decade has helped make solar PV products increasingly affordable worldwide, spur global production and trade levels, and subsequently achieve notable carbon emission reductions. Without this state intervention, it is far from certain whether these outcomes would have been realised even if certain developed country producers had not been competed out of the market by Chinese rivals.

Nevertheless, clean energy trade disputes are likely to increase as the industry expands. The current governance *status quo* situation will not help reduce these disputes and other tensions. Re-evaluating the international norms of state interventionism regarding clean energy trade should be a key priority for the WTO, with input from the UNFCCC and other relevant agencies. There is a strong case for WTO rules allowing more policy space for climate interventionism as part of the organisation developing a new approach on trade-climate action more generally. This does not imply a compromise of WTO liberalism, rather its expanded co-existence with national trade-related industrial policies on promoting clean energy development. Bringing back a revised 'non-actionable' subsidy category (ASCM Article 8) to help trade capacity-building here in developing nations, an environmental welfare 'balance test' for industrial policy measures in Article XX, and maximum time periods and stricter conditions of use applied under revised ASCM and ADA provisions to trade remedy measures on clean energy or environmental goods more widely would be a start. New WTO rules and international agreements along these lines will help reduce the scope for trade conflict, unless nation-states increasingly revert instead to unilateral trade remedy actions and other defensive measures.

More ambitiously, a broad EGA could create the basis for new future rules adopted multilaterally on environmental goods with clean energy at its core that promoted both trade liberalism and trade capacity-building. Support and allowances for the latter could be especially given to developing countries, where the greatest scope for marginal gains in environmental welfare and energy efficiency are achievable. This, though, may be unrealistic to expect in the short-to-medium term especially as the

international norms of policy conduct on clean energy trade are still in a state of considerable flux, and current EGA negotiations are stalled. Notwithstanding convergence towards conventional trade liberalisation, as noted earlier there still exists asymmetric trade-industrial policy practice in the sector. Again, unilateral trade remedy counteractions against 'unfairly competitive' clean energy exports will make achieving a consensus here less realisable.

Regarding global institutional collaboration on clean energy trade governance, both the WTO and UNFCCC ultimately depend on inter-governmental negotiation and co-operation to advance the respective work agendas. Hence, a key area of institutional co-operation relates to convincing national governments to link their international trade and climate policies together in global-level negotiations at the WTO and UNFCCC. Progress in this area would help address problems arising between conflicting interests from each policy perspective. It was shown how each institution has addressed trade-climate issues but largely independent of the other. Closer inter-institutional co-operation could establish more co-ordinated efforts and dialogue among national governments to create new norms, agreements and global rules on how to better govern and promote trade in clean energy products. This constitutes some form of global governance gap. It was argued that despite the different political economic ideational principles and goals of each institution (WTO liberalism and global free trade, UNFCCC interventionism on addressing climate change) that these are actually reconcilable. Trade liberalisation through multilateral EGA-style agreements (rather than discriminatory FTAs) can expand clean energy trade and thus have positive climate action impact. However, it alone is not enough. Supply side trade capacity-building efforts in clean energy sectors are needed, as being albeit indirectly promoted by default through the UNFCCC and other climate action

endeavours. Furthermore, as Charnovitz (2003) notes, both institutions acknowledge the intermeshing of economic and environmental agendas, promote economic efficiency in order to enhance public welfare, are concerned with free rider problems and the need for universal compliance but recognise that developing countries require more adjustment space to comply with regime goals and standards.

While national governments have been powerful players in clean energy trade governance, city government associations and business groups have too proved influential actors. Future governance could come to rest heavily on different coalitions of these agencies working through the WTO, UNFCCC and other structures. The EGA may itself be presently considered a coalition of nation-states advocating clean energy trade liberalisation. Meanwhile at the 2015 Paris COP21 meeting, India launched of its International Solar Alliance initiative with 120 member country governments committed to undertake industrial policy interventions to achieve the 'massive deployment of affordable solar energy' based on a collective investment of US$1 trillion by 2030.[49] Also in advance of COP21, a coalition of 20 large developing and developed country producers announced their Mission Innovation: Accelerating the Clean Energy Revolution venture, each participating government agreeing to at least double state expenditure on clean energy research and development. Similarly, at the meeting a group of almost 30 major investor individuals led by Microsoft's Bill Gates formally established the Breakthrough Energy Coalition, whose goal is to mobilise substantial new climate finance investment into the sector. The aforementioned influential ICLEI and C40 city government associations too have a strong vested interest in promoting clean energy given acute urban air quality predicaments many of their members face.

It is these major coalitional ventures based on alignments of multiple stakeholder advocacy and shared interests that prove vitally important in strengthening the global governance of clean energy development and trade. Although this should be encouraged on as broad a political front as possible, working within the WTO and UNFCCC institutional structures would bring a critical degree of multilateral order to such common efforts. Difficulties may arise when rival coalitions exist but this has not yet transpired internationally at least within the clean energy sector, although the powerful fossil fuel lobby still presents a formidable block to future clean energy development. However, the most fundamental challenge for the future governance of clean energy trade concerns how to reconcile ramped-up interventionist climate action with an essentially liberal trade order. This will particularly require the creation of more 'policy space' for trade-capacity building regarding clean energy industries within the WTO as part of a wider institutional culture change, where the global trade order is more effectively aligned with interventionist climate action.

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Endnotes

[1]The Stern Review (2006) was one of the earliest reports to acknowledge this, stating: "the reduction of tariff and nontariff barriers for low-carbon goods and services, including within the Doha Development Round of international trade negotiations, could provide further opportunities to accelerate the diffusion of key technologies" (pg. xxv).

[2] While code harmonisation has been achieved at the HS 6-digit 'sub-heading' classification level generally worldwide, there remains some variance of practice at the more specific 8- and 10-digit levels, where much of clean energy's supply-chain trade in component and parts (e.g. for solar panels and wind turbines) is located.

[3] For example, ball bearings (e.g. HS code 8482.10.20) are a key component in wind turbine generators as well as other industrial applications non-related to clean energy. Similarly, drilling pipes used in geothermal energy exploration may too be used in the oil and gas sector.

[4]These arise when certain parties argue for including 'cleaner' energy technologies in trade talks. During the Doha Round negotiations on environmental goods and services, Qatar proposed that combined-cycle natural gas and advanced gas-turbine systems be considered eligible based on their energy-efficiency credentials (ICTSD 2006). If tariffs are eliminated on such products subsequent difficulties arise when trying to confer trade advantages to more fundamental clean energy sectors like renewables: under WTO rules once it is agreed to lower tariff levels they cannot be raised in future negotiations.

[5] For example, renewable energy currently contributes around a quarter of global power generation but the solar photovoltaic (PV) sector has experienced 30 to 40 percent annual market growth rates over the last decade, and wind energy around 20 percent (REN21 2015, 2016). Electric vehicles may still have a very small share of the global automotive market but annual production and sales growth has averaged at over 100 percent between 2010 and 2014 (IEA 2015a).

[6] Australia, Canada, China, Costa Rica, EU-28, Hong Kong, Japan, New Zealand, Norway, Singapore, South Korea, Switzerland, Taiwan and US.

[7]Up until 2010, the US had a positive trade balance with China in the solar energy sector, exporting high valued-added PV capital equipment and polysilicon and then only relatively small volumes of imported Chinese PV modules and cells. The EU's trade deficit with China in the sector has been far greater, partly because it is not a major polysilicon producer. Europe accounts for around 60 percent of China's PV export market and the sector roughly 7 percent of Chinese total exports to the region (Lewis 2014).

[8]By 2014, this had recovered somewhat, with Chinese exports of PV cells rising to US$14.4 billion and for all solar PV equipment the equivalent of 22GW installed capacity (well over half of that year's 39GW addition to global installed PV capacity) to 192 countries. Japan overtook the EU as the largest importer of Chinese PV products owing to generous new demand side policies introduced by the Japanese government in its post-Fukuyama energy policy. Similar domestic market support provided by the Chinese government around the same time led to sharp rises in imported polysilicon (26 percent in 2014, main sources being South Korea, Germany and the US) and a redirection of sales from export to home markets (IEA 2015b). This involved a mix of state financial incentives and mandatory targets set for China's power generation companies (Dent 2014, Solar Power Europe 2015).

[9] For example, in 2012 the Indian Solar Manufacturers Association filed a petition against the alleged price dumping practices of US, Malaysian, Chinese and Taiwanese solar PV manufacturers (Wu and Salzman 2014).

[10] The discrepancy in export and import figures can be explained by differences in reporting and calculating methods used by governments for the same trade flows.

[11]For example, the Electricity Generating Authority of Thailand were the main investors in new large-scale hydropower dams built in Laos during the 1990s and 2000s, these then supplying the Thai market almost exclusively through cross-border transmission connections between the two national grids (World Bank 2010). By the early 2010s, Kenya was meanwhile planning to export geothermal power to other East African countries. Around the same time, the West Indies Power Holdings companies was devising a strategy to develop a regional interconnection system in the Caribbean for trading in geothermal electricity with World Bank and EU financial assistance. Both Mongolia and Ethiopia were reported to devise plans to become wind energy power exporters (UNEP 2013). For

some time, there have discussions on hugely ambitious solar energy mega-projects such as DESERTEC (Sahara Desert array system supplying Europe) and GOBITEC (similar in conception and supplying Northeast Asian countries), these being enormously expensive but if realised could contribute very significantly to scaling-up the world's clean energy power generation (REN21 2014).

[12] Very Large-Scale Integrated-circuits programme.

[13] For example, three of the seven selected sectors of the Strategic Emerging Industries programme in China's 12th Five Year Plan (2011-2015) were clean energy industries: energy conservation and efficiency technologies, renewables and 'new energy' vehicles.

[14] As political leaders in both the US and China have recently proclaimed: "We're in a competition all around the world, and other countries – Germany, China, South Korea – they know that clean energy technology is what is going to help spur job creation and economic growth for years to come. And that's why we've got to make sure that we win that competition. I don't want the new breakthrough technologies and the new manufacturing taking place in China and India. I want all those new jobs right here … in the United States of America, with American workers, American know-how, American ingenuity" (US President Barack Obama, 6 May 2011, speech given at Allison Transmission Headquarters, Indianapolis, Indiana, cited in Morris *et al* (2012); "We need to… seize the commanding point of having the world's best environmental technology, to win the race between the global industries" (China Vice Premier Li Keqiang, speech given at the 11th Five-Year Plan Environmental Achievement Exhibition, 7th June 2011, Beijing - cited in China Council for International Co-operation on Environment and Development newsletter (www.cciced.net/encciced/newscenter/latestnews/201205/t20120517_229632.html).

[15]Although the International Energy Agency (IEA) covers all areas of energy policy, it has very limited governance functionality, mainly providing analytical and dialogue-based services only. The global governance of energy (security) is arguably the weakest and most fragmented of the major 'global challenge' areas (Florini and Sovacool 2009, Goldthau *et al* 2010, Van De Graaf 2013).

[16]*Clean Technica News*, 17 June 2012 (http://cleantechnica.com/2012/06/17/german-solar-industry-getting-hammered-cheap-chinese-imports).

[17]In the wind energy industry, 2013 MFN duty rates for China, Indonesia, Japan, the Philippines, Singapore and Vietnam were zero percent, Taiwan and Malaysia 5 percent, South Korea 8 percent and Thailand 10 percent. This compared to the EU's 3.3 percent, the US's 2.6 percent, Australia's 5 percent

and India's 7.6 percent rates. A similar pattern is evident for solar PV modules: zero percent MFN duties for Japan, Malaysia, Singapore, South Korea and Vietnam, 2 percent for Taiwan, 7 percent for the Philippines, and 10 percent for China, Indonesia and Thailand, which compared to 1.5 percent for the US, 3.3 percent again for the EU, 5 percent Australia and 7.5 percent India. Low single digit rates apply for both hydropower and biomass power generation equipment, while somewhat higher rates apply in developing countries in the much smaller geothermal sector. Data available from DutyCalcutor.com: http://www.dutycalculator.com.

[18] Quebec provincial government's LCR legislation introduced in 2003 on wind power tenders being frequently cited as the earliest case. Soon thereafter a number of Spain's autonomous regional governments trialled the measure in the same industry, and in Brazil (60 percent threshold), China (40 percent), India (30 percent) and in Ontario province (60 percent, part of its feed-in tariff legislation), Canada plus Ukraine, Malaysia and Turkey (Cosbey and Mavroidis 2014, Cosbey and Rubini 2013, E15 Initiative 2016, Kirkegaard *et al* 2009, Lewis 2014, Wu and Salzman 2014).

[19] When the US requested consultations with India in 2013 over its LCRs on solar PV it cited WTO rules on national treatment, subsidies and intellectual property rights (UNEP 2013).

[20]'Dumped' products are allegedly sold in foreign markets at prices well below their domestic market equivalents.

[21] Also referred to as anti-subsidy duties.

[22] It is normally 'injured' home companies that petition their governments to take trade remedy action against alleged offending foreign exporter companies.

[23] Of these, 18 cases targeted solar PV, 16 biofuels and 7 wind energy products.

[24] This research also estimated that the application of trade remedy measures during this period reduced clean energy trade by US$14 billion a year, thus by US$82 billion over the 6-year study period in question.. Furthermore, studies by the Swedish National Board of Trade (2013) and Prognos (2013) concluded that ADDs and CVDs on clean energy products had net negative impacts on supply chain cost efficiencies, consumer prices, upstream and downstream (e.g. polysilicon producers and PV installers) business and jobs, and led to additional trade retaliatory actions that exacerbated the situation.

[25]This was specifically on the Chinese government's 'Demonstration Bases-Common Service Platform' programme, which was alleged to offer subsidy support for firms meeting export performance criteria.

Bridges News, 21st April 2016 (http://www.ictsd.org/bridges-news/bridges/news/ustr-washington-beijing-clinch-deal-in-export-subsidy-disput).

[26]*Washington Post*, 13th August 2013 (http://www.washingtonpost.com).

[27] This relates to GATT/WTO Article XI.

[28] WTO DSB cases 431 (United States), 432 (European Union) and 433 (Japan), all initiated on 13 March 2012.

[29]The Energy Charter Treaty, initiated by the EU in early 1990s to primarily manage imported pipeline gas, is currently the world's largest governance structure and rules-system for international energy transit trade, with membership extending from West Europe to Central Asia (Australia is also a member), and hence is not global.

[30] For example, the tuna/dolphin and shrimp/turtle cases of the 1990s.

[31] Export restrictions for environmental reasons are, though, potentially permissible under Article XX, for example as applies to the rare earths case due to the notable environmental impacts generated from mining these minerals.

[32]EGA parties are Australia, Canada, China, Costa Rica, the EU-28, Hong Kong, Iceland, Israel, Japan, Liechtenstein, New Zealand, Norway, South Korea, Switzerland, Singapore, Taiwan (Chinese Taipei), Turkey and the US.

[33] This more or less satisfied the precedent set by the aforementioned ITA whose threshold of 90 percent global market share was designed to avoid free-riding by non-signatory countries.

[34] Officially known as the Agreement on Implementation of Article VI.

[35] The last case (DS510) was initiated by the US against India's renewable energy sector, and the previous two before this (DS473 and DS480) were initiated by respective complainants Argentina (December 2013) and Indonesia (June 2014) concerning the EU's application of ADDs on biodiesel exports from these two countries..

[36] The 1994 North American Free Trade Agreement (NAFTA) and Canada's agreements with certain Latin American states being early examples.

[37] For example, the EU-Korea FTA (in force from July 2011) utilises an Article XX-type exception regarding trade facilitation for "legitimate policy objectives such as the protection of national security, health and the environment" (Article 6.1[g]). More significantly, the EU-Singapore FTA (negotiated in 2014 but not in force at time of writing by mid-2016) text contains a whole chapter on sustainable

energy with ASCM-relevant provisions on 'Prohibited Subsidies' (Article 12.7), a "best endeavours" commitment to address adverse competition effects caused by 'Other Subsidies', and an annex (12-A) listing permissible subsidy actions under certain circumstances, e.g. meeting specific environmental objectives. In addition, Chapter 7 of this agreement includes obligations on 'Non-Tariff Barriers to Trade and Investment in Renewable Energy Generation', most notably: avoiding the use of LCRs; transparent and objective certification and licencing procedures; mutual recognition of compliance testing on solar PV, wind energy and other environmental goods (E15 Initiative 2016). Meanwhile, the Trans-Pacific Partnership (Negotiated in 2015 between 12 APEC member economies but not fully ratified at time of writing by mid-2016) comprises measures for all parties to remove tariffs on environmental goods and enhance trade facilitation on environmental services. Its Environment chapter contain provisions on NTB elimination, while its 'Transition to a Low Emissions and Resilient Economy' section (Article 20.15) includes non-legally binding statements of intent on mutual co-operation among parties, making explicit reference to energy efficiency, low energy emission technologies, renewable energy and sustainable transport systems. In a similar 'aspirational' vein, Article 13.6 of the EU-Korea FTA commits both sides simply to "strive to facilitate trade" in environmental goods and services, while in the EU's FTAs with Colombia, Peru and Central America parties "agree to consider" areas where eliminating trade barriers would support endeavours on climate change mitigation and sustainable development.

[38] *WTO website*: 'The Doha mandate on multilateral environmental agreements', https://www.wto.org/english/tratop_e/envir_e/envir_neg_mea_e.htm.

[39] Convention on International Trade in Endangered Species of Wild Fauna and Flora.

[40] International Tropical Timber Organisation.

[41] International Commission for the Conservation of Atlantic Tunas.

[42] Convention for the Conservation of Atlantic Marine Living Resources.

[43] As yet, no timetable – country-specific or otherwise – has been incorporated into the accord. However, the scientific consensus is that we have already reached the 1°C mark, and that zero net emissions globally will need to be realised around mid-century for achieving the 1.5°C goal.

[44] Singapore is one of the very few nations to have acted on Article 3.5, when in its October 2011 submission to the UNFCCC's Subsidiary Body for Scientific and Technological Advice (UNFCCC 2011) criticised the then emerging trend of trade remedy measures being applied on clean energy and other

environmental goods, noting that: "The UNFCCC provides flexibility to its Parties to adopt domestic actions as part of their efforts to combat climate change. However, experience in area of Antidumping and Safeguard Measures in trade tells us that even permitted measures can be abused. Hence, as required by the UNFCCC Article 3.5 and the WTO Agreements, all Parties, both developed and developing, have a responsibility to adhere fully to their UNFCCC and WTO obligations in maintaining a supportive, open and rules-based multilateral trading system" (page 8).

[45] Article 2.1(a) contains policy recommendations on enhancing energy efficiency (i); research on, and promotion of "new and renewable forms of energy, of carbon dioxide sequestration technologies and of advanced and innovative environmentally sound technologies" (iv); and the "progressive reduction or phasing out of market imperfections, fiscal incentives, tax and duty exemptions and subsidies in all greenhouse gas emitting sectors that run counter to the objective of the Convention and application of market instruments" (v). Later, Article 2.3 commits Annex I parties (i.e. developed countries) to "strive to implement policies and measures …in such a way as to minimise adverse effects, including… effects on international trade".

[46] *The Guardian*, 14 December 2015; *New Scientist*, 12 December 2015; *BBC News*, 13 December 2015.

[47] An October 2011 submission made by Singapore to the UNFCCC's Subsidiary Body for Scientific and Technological Advice (UNFCCC 2011) summed up the case for the WTO's primacy over the UNFCCC on governing climate-related trade matters by stating: "Parties should ensure that any outcome at the UNFCCC does not undermine the delicate balance of rights and obligations contained in the WTO Agreements. As a general principle, discussions in the UNFCCC should respect the competencies of other multilateral bodies. The WTO remains the only competent multilateral body with the requisite expertise to deal with trade rulemaking. The UNFCCC is not competent to review, rewrite nor reinterpret the WTO Agreements (page 8)."

[48] A reciprocal observer status arrangement between the WTO and UNFCCC has operated since 1995. WTO officials attend COP meetings and the UNFCCC Secretariat is sits in on CTE meetings. At the 2002 World Summit on Sustainable Development in Johannesburg, its resulting Plan of Implementation called for strengthened global institutional co-operation on trade and environment between the WTO and other relevant multilateral bodies (WSSD 2002). A UNFCCC (2003) document also specifically highlighted paragraph 98 of the Plan, which in addition committed governments to "promote mutual supportiveness between the multilateral trading system and the multilateral

environmental agreements, consistent with sustainable development goals, in support of the work programme agreed through WTO, while recognizing the importance of maintaining the integrity of both sets of instruments" (page 2). The last time the UNFCCC produced an official document overviewing its working relationship with the WTO was 2003, and conversely the WTO regarding the UNFCCC in 2007 (UNFCCC 2003, WTO 2007). In the run-up to the Paris COP21 meeting, the UNFCCC Secretariat made three presentations at the WTO between June 2014 and October 2015 on the status of climate change negotiations (WTO 2016).

[49] *UNFCCC Newsroom*, 30 November 2015: http://newsroom.unfccc.int/clean-energy/international-solar-energy-alliance-launched-at-cop21.