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Introduction and Overview

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A Renewable electricity, local production and long-distance trade

Modern societies rely extensively on the supply and consumption of electricity. A multitude of daily life and work activities depend on electricity-powered technology, machinery and infrastructure, the use of which either has transformed or is still transforming the residential, commercial, industrial and transportation sectors.[1] The use of electricity drives economic growth, facilitates international commerce and enhances the welfare of people around the world. Accordingly, global electricity consumption has steadily increased,[2] driven by the ever faster pace of technological innovation and a number of structural factors that include demographic trends, the exceptional growth performances of developing Asian and other emerging economies in recent decades and the rapid electrification of countries that are currently at earlier stages of development.[3] At the same time, approximately two-thirds of the world's electricity is today generated through fossil fuel combustion, and half of this is still produced in coal-fired power plants. Electricity is the principal source of energy-related greenhouse gas (GHG) emissions,[4] which in turn account for two-thirds of

[1] Euroelectric, *A Sector in Transformation: Electricity Industry Trends and Figures* (2015), www.eurelectric.org/media/161808/electricityindustrytrendsandfigures2015_lr-2015-030-0064-01-e.pdf (accessed 8 February 2016).

[2] International Energy Agency (IEA), *World Energy Outlook Special Report: Trade and Climate Change* (2015), www.iea.org/publications/freepublications/publication/WEO2015SpecialReportonEnergyandClimateChange.pdf (accessed 15 December 2015), p. 27.

[3] IEA, *World Energy Outlook Report* (2015), www.worldenergyoutlook.org/media/weowebsite/2015/WEO2015_Chapter01.pdf (accessed 8 February 2016), pp. 37–40; IEA, *World Energy Outlook Electricity Database* (2015), www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/ (accessed 8 February 2016).

[4] IEA, *World Energy Outlook Report*, pp. 300–19.

global GHG emissions.[5] The decarbonisation of the electricity sector has accordingly figured prominently on national and supra-national climate change agendas.[6] Efforts have converged towards the promotion of electricity produced from renewable energy (RE) sources and towards allowing for differential treatment of fossil and RE electricity within the multilateral trading system.[7] The shift to renewables in power generation carries the greatest potential for GHG emissions abatement in the energy sector as a whole.[8]

Climate change and international trade was the subject of a previous World Trade Forum.[9] The present volume turns to international trade in electricity, more specifically addressing the challenges posed by the transition towards renewably produced electricity and the role of international trade in this process, supporting growth as well as decarbonisation and climate change mitigation. Until very recently, electricity itself had been traded rather limitedly compared to the large volumes of primary energy supplies, namely oil and gas, being imported into many countries for electricity production. Electricity generation has mainly occurred locally, regionally and nationally, with international trade essentially limited to trade in surplus production between neighbouring countries. Technical and political constraints hampered long-distance, inter-regional and transcontinental trade in electricity supplies. This has been changing in recent years due to advances in technology, and for a number of other reasons.

[5] IEA, *World Energy Outlook Special Report 2013: Redrawing the Energy-Climate Map* (2013), www.worldenergyoutlook.org/media/weowebsite/2013/energyclimatemap/RedrawingEnergyClimateMap.pdf (accessed 8 February 2016), p. 15.

[6] See, e.g., EurElectric, *Power Statistics and Trends* (2015), www.eurelectric.org/media/249736/power-statistics-and-trends-the-five-dimentions-of-the-energy-union-lr-2015-030-0641-01-e.pdf (accessed 8 February 2016); European Commission, *A Policy Framework for Climate and Energy in the Period from 2020 to 2030* (2014), http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0015&from=EN (accessed 8 February 2016), p. 5; The White House, *President Obama's Climate Action Plan* (2015), www.whitehouse.gov/sites/default/files/docs/cap_progress_report_final_w_cover.pdf (accessed 8 February 2016), p. 6.

[7] See T. Cottier, *Renewable Energy and Process and Production Methods*, E15 Initiative (Geneva: International Centre for Trade and Sustainable Development (ICTSD) and World Economic Forum, 2015), http://e15initiative.org/publications/renewable-energy-and-process-and-production-methods/ (accessed 8 February 2016).

[8] IEA, *World Energy Outlook Report*, pp. 300–3.

[9] T. Cottier, O. Nartova and S. Z. Bigdeli (eds.), *International Trade Regulation and the Mitigation of Climate Change: World Trade Forum* (Cambridge: Cambridge University Press, 2009).

First, local production of renewable electricity based upon hydro, solar, wind, thermal and tidal power offers an important contribution to supplies, but is unable on its own to provide the necessary stable baseload without recourse to oil, gas and coal or nuclear energy. Fluctuations caused by climatic conditions are too strong. The integration of increasing shares of RE electricity is therefore dependent upon the reinforcement of transmission interconnectors and the extension of grids over larger regions.[10] Second, the tremendous progress in electricity transmission technologies achieved in recent times has made long-distance electricity flows possible both technically and economically, facilitating cross-border electricity interconnections.[11] Modern high-voltage, direct current (HVDC) transmission lines, both on land and sea, offer the technology for long-distance transmission without substantial voltage losses. Long-distance transmission lines are able to reduce the requirement for balancing power, especially for fluctuating carbon-neutral sources such as wind and solar energy, from fully dispatchable conventional generators. They therefore contribute to increasing the reliability of supply while avoiding GHG emissions.[12]

The benefits associated with large-scale electricity transmission projects include the expansion of electricity trade areas, the promotion of competition in electricity generation (and thus the reduction of electricity prices) and the enhancement of reliability and security of supply.[13] Extending the grid over larger regions can facilitate the exploitation of comparative advantages in electricity production while carrying the potential to create stable supplies to countries located in those parts of the world that suffer from chronic shortages, by means of international trade. Furthermore, it can help to harvest RE from remote

[10] J. Sauvage and H. Bahar, 'Cross-border trade in electricity and the development of renewables-based electric power', *OECD Trade and Environment Working Papers* 2013/02 (2013), www.oecd-ilibrary.org/trade/cross-border-trade-in-electricity-and-the-development-of-renewables-based-electric-power_5k4869cdwnzr-en (accessed 8 February 2016).

[11] Massachusetts Institute of Technology Energy Initiative, *The Future of the Electric Grid: An Interdisciplinary MIT Study* (Cambridge, MA: Massachusetts Institute of Technology, 2011); T. Gönen, *Electrical Power Transmission System Engineering: Analysis and Design*, 3rd edn (Boca Raton, FL: CRC Press, 2014).

[12] S. Chatzivasileiadis, D. Ernst and G. Andersson, 'The Global Grid', *Renewable Energy*, 57 (2013), 372.

[13] International Energy Agency, *Secure and Efficient Electricity Supply during the Transition to Low Carbon Power Systems* (Paris: IEA, 2013), www.iea.org/publications/freepublications/publication/secureandefficientelectricitysupply.pdf (accessed 8 February 2016).

locations with abundant potential and very low production costs.[14] Accordingly, it could generate new sources of income, for example, from electricity produced from wind energy in the North and solar energy in the South, in regions that have faced difficulties in creating adequate economic growth.

Trends confirm these insights. The increasing global demand for electricity and the need for renewable production reflect the development and expansion of electricity networks and the intensification of cross-border electricity trade.[15] Because electricity trade relies on fixed physical infrastructure, the former is dependent on the latter, as is the case for all other network-bound industries (e.g. telecommunications and railways).[16] The progressive integration of electricity grids at the national level has paved the way for the creation of the first regional electricity systems, with some prominent examples including the European Union (EU) internal electricity market,[17] the Integrated Power System (IPS),[18]

[14] In recent years, various projects have undergone first feasibility assessments and have been launched in Europe, Asia and the Atlantic. For instance, projects such as Medgrid and OffshoreGrid will interconnect Mediterranean states with Europe, permitting the transfer of high shares of solar energy to the major load centres. Initiatives such as Gobitec in Asia and the Atlantic Wind Connection in the United States will interconnect the Asian power grids or transmit offshore wind energy to the US east coast. See Chapter 2.

[15] Energy Charter Treaty Secretariat, *Model Intergovernmental and Host Government Agreements for Cross-Border Electricity Projects*, www.energycharter.org/fileadmin/DocumentsMedia/Legal/EMAs_en.pdf (accessed 8 February 2016).

[16] P. J. Slot and A. Skudder, 'Common features of community law regulation in the network-bound sectors', *Common Market Law Review*, 38 (2001), 87.

[17] See P. Mäntysaari, *EU Electricity Trade Law: The Legal Tools of Electricity Producers in the Internal Electricity Market* (Heidelberg: Springer International Publishing, 2015); Directive 2009/72/EC of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0055:0093:EN:PDF (accessed 8 February 2016); and Regulation (EC) 714/2009 of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003, http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32009R0714 (accessed 8 February 2016).

[18] The Integrated Power System is an integrated transmission network based on the former Soviet Union electricity system. It currently connects the national grids of Latvia, Lithuania, Estonia, Armenia, Azerbaijan, Belarus, Georgia, Kyrgyzstan, Moldova, Tajikistan, Uzbekistan, Ukraine and Mongolia, while supplying electricity to Finland and some regions of China. See I. Tchakalov, T. Mitev and I. Hristov, 'Bulgarian power relations: the making of a Balkan power hub' in P. Högselius, A. Hommels, A. Kaijser and E. van der Vleuten (eds.), *The Making of Europe's Critical Infrastructure: Common Connections and Shared Vulnerabilities* (Basingstoke: Palgrave Macmillan, 2013), pp. 138–40.

the Southern African Power Pool (SAPP)[19] and the Central American Power System (SIEPAC).[20] Much, of course, remains to be done, and many countries in the developing world continue to suffer from insufficiently connected grids.

B Towards a Global Grid

Based on current and projected power trends and the estimated impact of technological innovations on electricity networks, experts envisage that the gradual implementation of cross-border electricity transmission projects on a large scale and over long distances will lead to the creation of regional supergrids and, eventually, a globally interconnected network.[21] The idea of a so-called global grid, of course, reflects a long-term vision which, if it materialises at all, will do so over a long period of time. It builds upon the philosophy and reality of an increasingly interconnected world, starting with the telegraph and moving through the telephone and now on to the Internet. Although technically feasible, it will require large volumes of investment in highly capital-intensive infrastructure projects, availability of fixed infrastructure and non-discriminatory access to transportation networks and distribution systems, along with mechanisms for transparent and efficient cross-border trading to facilitate the power exchange between regions. We perceive the idea of a global grid as

[19] The Southern African Power Pool is the largest and most advanced power pool in Africa and covers the networks of Democratic Republic of Congo, Tanzania, Angola, Zambia, Malawi, Namibia, Botswana, Zimbabwe, Mozambique, Swaziland, South Africa and Lesotho. See Infrastructure Consortium for Africa, *Regional Power Status in African Power Pools*, African Development Bank (2011), www.icafrica.org/fileadmin/documents/Knowledge/Energy/ICA_RegionalPowerPools_Report.pdf (accessed 8 February 2016).

[20] The Central American Electrical Interconnection System is the largest power system in Latin America and comprises the national electricity grids of Panama, Costa Rica, Honduras, Nicaragua, El Salvador and Guatemala: Proyeto Mesoamerica, *Costa Rica completa línea de transmisión eléctrica SIEPAC*, San José, Costa Rica (16 October 2014), www.proyectomesoamerica.org/joomla/index.php?option=com_content&view=article&id=731&Itemid=85 (accessed 8 February 2016) and Economic Consulting Associates, *The Potential of Regional Power Sector Integration: Central American Electric Interconnection System (SIEPAC) Transmission & Trading Case Study* (2010), www.esmap.org/sites/esmap.org/files/BN004-10_REISP-CD_Central%20American%20Electric%20Interconnection%20System-Transmisison%20&%20Trading.pdf (accessed 8 February 2016).

[21] See, in particular, Chatzivasileiadis, Ernst and Andersson, 'The Global Grid'; C. Barker, 'Practical management of variable and distributed resources in power grids' in L. E. Jones (ed.), *Renewable Energy Integration: Practical Management of Variability* (Amsterdam: Elsevier Academic Publishing, 2013), pp. 189–202.

a long-term perspective, an agenda for change. A global grid may eventually be, and should be, built upon existing national and inter-regional grid structures. As this will necessitate interfacing different systems, the legal framework, both domestically and internationally, should respond to this challenge by fostering and allowing the development of the necessary structures of multilevel governance. While it is often felt that progress in RE electricity is a matter of creating domestic policy space, it is more a question of properly allocating regulatory powers at the different levels of governance in order to produce the public good of safe and abundant supplies.[22]

In this perspective, this volume aims at identifying and discussing the regulatory challenges that the changing landscape of electricity trade (from neighbouring through contiguous to distant states) poses to the international trade and investment regimes as a way of preparing the tools for inter-regional interfaces in the future. Because international trade and investment rules were not drafted with electricity in mind,[23] the main overarching question, which is woven through the analyses in this book, is whether the trade and investment legal frameworks are sufficiently well equipped to enable, facilitate and possibly encourage long-distance electricity trade and, in particular, trade in electricity produced from RE sources.

In attempting to answer this question, this volume breaks new ground in several respects. First, the role of international trade and investment law in the field of electricity, as already indicated, has until recently been a limited one: for a long time, electricity – and the energy sector in general – has been regulated through a sovereignty-based approach, classically falling within the scope of national jurisdictions.[24] Second, despite the gradual expansion of cross-border electricity trade, the still predominant regional dimension has so far delayed the discourse on the extent to which international trade and investment rules can facilitate the

[22] T. Cottier, 'Renewable energy and WTO law: more policy space or enhanced disciplines?' *Renewable Energy Law and Policy Review*, 1 (2014), 40–52.

[23] T. Cottier, G. Malumfashi, S. Matteotti-Berkutova, O. Nartova, J. de Sépibus and S. Z. Bigdeli, 'Energy law and policy' in T. Cottier and P. Delimatsis (eds.), *The Prospects of International Trade Regulation: From Fragmentation to Coherence* (Cambridge: Cambridge University Press, 2011), pp. 214–5.

[24] J. Pauwelyn, 'Global challenges at the intersection of trade, energy and the environment: an introduction' in J. Pauwelyn (ed.), *Global Challenges at the Intersection of Trade, Energy and the Environment* (Geneva: Centre for Trade and Economic Integration, 2009), p. 3.

reinforcement of transmission interconnections and increase their security and stability along with the share of renewables fed into the grid.[25] Moreover, the focus on the EU international electricity market has left other regional experiences in the shade and contributed to putting EU law centre-stage in the debate on cross-border electricity trade.[26] Discussions in the international trade and investment domains have focused on the question of the policy space left to national governments with regard to introducing and/or terminating RE public support schemes, as well as trade remedies aimed at levelling the playing field in response to such measures.[27] Yet, the expansion of international trade in electricity and, in particular, RE electricity inevitably raises electricity-specific issues related to the physical peculiarities of electricity transmission and trade.[28]

C The Goals and Structure of This Study

Against this backdrop, the purpose of this volume is to explore the implications of the most recent technical, geopolitical and economic developments affecting international trade in electricity for the multilateral legal framework on trade and investment. The book will also provide suggestions on how to improve the existing framework in a way that ensures there is coherence throughout the various levels of governance which are going to be affected by the expansion of the electricity grid over

[25] In recent years, discussions on the importance of a multilateral legal framework for trade in energy have gradually gained prominence. See, e.g., Y. Selivanova (ed.), *Regulation of Energy in International Trade Law* (Alphen aan den Rijn: Kluwer Law International, 2011). Yet, none have focused on electricity-specific issues.

[26] So far, the most comprehensive analyses of the electricity sector, including regulatory aspects of trade and investment, have focused on the European experience. See, e.g., M. Roggenkamp, C. Redgwell, A. Rønne and I. del Guayo (eds.), *Energy Law in Europe: National, EU and International Regulation* (Oxford: Oxford University Press, 2007), and J. Bielecki and M. G. Desta (eds.), *Electricity Trade in Europe: Review of the Economic and Regulatory Challenges* (Alphen aan den Rijn: Kluwer Law International, 2004).

[27] Many challenges have recently been filed against RE public support programmes before the WTO Dispute Settlement Body and many claims have been initiated by investors under international investment treaties. For an overview see, among others, J. Salzman and M. Wu, 'The next generation of trade and environment conflicts: the rise of green energy policy', *Northwestern University Law Review*, 108 (2014), 401; K. Talus (ed.), 'Special issue on renewable energy disputes', *Oil, Gas & Energy Law*, 3 (2015).

[28] Once generated from energy sources, electricity has to be transmitted through high-voltage networks to major demand centres and distributed to the final consumers. Electricity trading is thus dependent on the interconnectivity of physical infrastructure and the availability of transmission capacity. W. Patterson, *Transforming Electricity* (London: Earthscan, 1999).

larger regions. To achieve its objectives, the book is divided into four parts, which, taken together, can provide the reader with a comprehensive understanding of the issues at stake in the field of electricity and the lessons that can be drawn from an analysis of the state of play in the current international trade and investment regimes. The four parts correspond to the following four thematic areas:

(i) the technical and economic foundations of a global grid;
(ii) regional experiences with cross-border electricity trade;
(iii) the specific interconnectivity issues posed by electricity transportation and their implications for international trade and investment law in working towards inter-regional trade in electricity;
(iv) the regulatory challenges raised in the trade and investment fields by the quest for a level playing field in the promotion of RE electricity.

Part I of the volume takes stock of the technical advances that have been made in electrical engineering and cross-border electricity trade, and identifies the current challenges posed by the expansion of inter-regional electricity grids. It also examines the economic and geopolitical determinants of international trade in electricity and addresses electricity governance issues. Chatzivasileiadis and Ernst build on the analysis of recent technical improvements in electricity network development to conceptualise the idea of a global grid as a means to efficiently integrate renewables into the grid while ensuring reliability and security of supply. They show that long-distance interconnections can be both technically feasible and economically competitive, in addition to being environmentally desirable. They identify the main market operation and regulatory challenges posed by cross-border electricity trade and underscore the need for further research to find appropriate solutions to market-coupling obstacles when interconnecting larger regions in the longer term. In the same vein, Houmøller elaborates on the possible practical solutions to the political problems raised by market coupling over vast areas, focusing on the role and tasks to be attributed to regulators. He draws on the European example to argue that a single spot exchange can ensure a reliable and cost-efficient day-ahead congestion management system, again in the spirit of facilitating the shift to renewables in the electricity sector. Robinson complements the technical stock-taking of cross-border electricity trade with an analysis of the economic and geopolitical drivers of trade in electricity. He points out that, irrespective of technical feasibility, sound economics, political stability and shared values are necessary preconditions to overcome the costs and

limits of building interconnectors and trading electricity, especially when generated from RE sources. He argues that any reform process aimed at fostering RE electricity trade must be based on political stability and a shared long-term vision for the peoples of the different countries involved. Defilla maps the global intergovernmental and non-governmental organisations that play a role in the electricity industry. Based on an analysis of the most pressing regulatory challenges posed by the technological improvements occurring in the sector, he examines various options for good governance for the future global electricity grid. He contends that the Energy Charter Treaty (ECT), as a unique multilateral and legally binding framework dealing exclusively with energy issues, could play a key role in this respect, provided that renewables receive sufficient priority and that a specific instrument (a treaty or a protocol) for electricity can be developed.

Part II provides an in-depth analysis of the experiences of the most important regions of the world in promoting electricity trade integration, and RE electricity in particular. Le Page starts by describing the EU experience. He recollects the fundamental steps in the creation of the internal energy market, from the early 1990s to the adoption of the Third Energy Package in 2009. He gives an account of the set of policies pursued in parallel by the EU and its Member States to set out the path towards decarbonisation, with a particular focus on the power generation industry. In his opinion, greater coherence between the EU energy and climate frameworks is the only way to limit distortions to the internal energy market to a minimum while still ensuring a level playing field for investment in RE production and the achievement of RE targets in a cost-efficient manner. Sioshansi discusses the North American experience (United States and Canada). He notes that, to date, green electricity generation and trade has mainly been encouraged at the level of individual states, provinces, cities and communities (as well as a growing number of corporations), rather than at the federal level. Accordingly, he suggests that policy-makers focused on encouraging RE electricity trade must remain cognisant of such bottom-up developments in the region and revisit their approaches with a consideration of the challenges posed by decentralised RE electricity produced by so-called 'prosumers'. Jusoh describes the Asian experience, focusing on the Member States of the Association of Southeast Asian Nations (ASEAN). After giving an account of the state of play in RE electricity trade in ASEAN Member States, he underscores the many challenges they face in ensuring that green electricity trade in the region meets the objectives of the ASEAN

Community 2015, from rural electrification to technology development and innovation in the field, from raw material supply to trade facilitation. He urges ASEAN Member States to make a concerted effort to stimulate a new policy approach for the promotion of RE electricity which tackles issues incidental to energy transformation, such as sustainable development. Kambanda focuses on the African experience. He notes that, with the exception of the SAPP, African power pools are still in their developmental stages, and electricity trade is mostly based on bilateral agreements. He contends that regional electricity trade in Africa remains limited because of a lack of physical infrastructure (due in part to lack of access to capital), poor planning, lack of maintenance and poor performance of the power utilities. Based on the continent's huge hydro, solar and geothermal potential, however, he suggests that African countries should establish RE targets, combined with additional incentives for attracting RE investments, in order to overcome these challenges. Lembo and Eleoterio conclude Part II by describing the Latin American experience. They observe that current electricity cooperation and integration projects in the Americas are focused on the development of regional grid interconnections that are supported by bilateral and regional agreements. While acknowledging the efforts of Latin American countries to foster RE electricity trade, they argue that the lack of a common regulatory framework remains a major obstacle to all electricity integration projects in the region. Accordingly, they advocate for new rules to provide coherence to cross-border electricity trade in Latin America.

Part III looks at the main interconnectivity issues raised by the peculiarities of electricity transportation and trade via fixed grids, and their implications for the trade and investment legal framework. Selivanova explores relevant international trade rules disciplining the conditions for access to fixed electricity infrastructure, namely the rules on transit in Article V of the General Agreement on Tariffs and Trade (GATT) and the General Agreement on Trade in Services (GATS) disciplines related to energy services. She finds that Article V does not address, among others, the issue of construction of new transit capacity – for which, she contends, an effective investment framework is needed. She notes that GATS rules do not currently address the anti-competitive practices that are common among incumbents controlling different segments upstream and downstream along the energy value chain. She proposes that additional commitments be negotiated either in an annex to GATS on Energy Services or in a Reference Paper to address competition issues and problems of third-party access to fixed infrastructure. Gudas moves