

**ENERGY TRANSITION, GENERATIONAL
JUSTICE AND CLIMATE CHANGE:
the role of fossil fuels and low carbon economy**

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vendas@letracapital.com.br
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Hirdan Katarina de Medeiros Costa
(*Coordinator*)

Authors:

Ana Carolina Correa da Costa Leister
Alexandre Betinardi Strapasson
Alexandre Sales Cabral Arlota
Aristeu Gomes Tininis
Claudia Regina Cançado Sgorlon Tininis
Denilson Ferreira
Diogo Martins Teixeira
Edmilson Moutinho dos Santos
Fernanda Munari Caputo Tomé
Fernanda Torres Volpon
Guilherme C. Pinho
Hirdan Katarina de Medeiros Costa
Isabela Morbach Machado e Silva
Israel Lacerda de Araújo
Karina Ninni Ramos
Marilda Rosado de Sá Ribeiro
Paola Petry
Natália de Assis Brasil Weber
Regina Batista
Rodrigo Pereira Botão

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Multifaceted approach to energy transition towards decarbonization

Marilda Rosado de Sá Ribeiro¹

Fernanda Torres Volpon

Abstract: This chapter introduces a multifaceted energy transition approach seen as a decarbonization process encompassing fossil fuels' phasing out in favor of renewable energy sources. The main aim is to analyze energy transition's capacity to reduce greenhouse gas emissions (GHG) and to mitigate climate change effects. It also highlights the economic and social aspects featuring energy transition as a transformation affecting modern society and future generations. Accordingly, renewable energy plays central role in the energy sector due to its positive impacts, mainly on the environment. Energy transition is a heterogeneous process that makes such a transition unique in each country. Consequently, energy transition requires more concrete and specific legal framework to allow the effective expansion of renewable sources as global energy revolution mechanism.

Keywords: energy transition; renewable energy; greenhouse gases; climate change.

1. Introduction

Energy has become an essential element to all activities performed by modern society². According to the European Union, as addressed in the Green Paper named “Towards a

¹ Special thanks to Bernardo Steinitz. Bachelor of Laws from PUC-Rio. Corporate lawyer at Barbosa, Raimundo, Gontijo e Câmara Advogados, for his contribution to the English version of this manuscript.

² “Energy is the lifeblood of any economy”. ROEBEN, Volker. *Towards a European Energy Union: European Energy Strategy in International Law*. Cambridge: Cambridge University Press, 2018, p. 1. “Energy is a fundamental element of human society and history”. FATOUROS, Arghyrios A. *An international legal framework for energy*. Leiden: Brill-Nijhoff, Collected Courses of the Hague Academy of International Law, vol. 332, p. 363-446, 2008, p. 368.

European Strategy for the Security of Energy Supply” (2000)³, energy demand increased as consequence of a ‘service-oriented’ economy that results in an ‘energy-intensive economy’.

Systematic fossil fuel consumption has marked the global economy, which witnesses global geopolitical crises⁴ related to fossil fuel exploration, production, and transport. Therefore, the energy industry has been often regulated by nationalist policies and ruled by the domestic law of States. Thus, it is possible observing lack of academic debate on the legal aspects of, conflicts and future developments in the energy sector in International Law⁵.

History has shown that several international events had transnational effects on the energy sector. Accordingly, energy security and dependence are the main concerns of global energy governance. Countries lacking natural resources⁶ are exposed to uncertainties and oscillations of the international energy market, and this is the reason why they undertake the position of leaders in the energy transition.

In addition to the aforementioned aspects, States shall not disregard the possible future depletion of fossil fuels⁷, as well as

³ EUROPEAN UNION LAW. COM (2000) 769 final. *Libro Verde: Hacia una estrategia europea de seguridad del abastecimiento energético*. Available at <<https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=celex:52000DC0769>>. Access on September 21, 2020. p. 15.

⁴ MANZANO, Jordi Jaria i; CHALIFOUR, Nathalie; KOTZE, Luis J. Energy Governance: a key challenge in the era of globalization. In: MANZANO, Jordi Jaria i; CHALIFOUR, Nathalie; KOTZE, Luis J. *Energy, Governance and Sustainability*. Cheltenham: Edward Elgar Publishing, p. 1-7, 2016, p. 1.

⁵ “Until [...] recent times, energy was very much seen as a national issue that required little, if not any, international legal intervention”. BRADBROOK, Adrian. Energy Law as an Academic Discipline. Oxfordshire: *Journal of Energy & Natural Resources Law*, p.193-217, 1996, p. 203. With respect to such an aspect, “Historically, energy supply and consumption, and the possible exception of oil exploitation, were seen by nations as matters of solely domestic concern”. WAWRYK, Alexandra. International Energy Law: An Emerging Academic Discipline. In: BABIE, Paul; LEADBETER, Paul (Eds.). *Law as Change: Engaging with the Life and Scholarship of Adrian Bradbrook*. University of Adelaide Press, p. 223-256, 2014, p. 228.

⁶ It is important highlighting that “energy resource endowments and availability are not evenly distributed across the world, and it creates or exacerbates inequalities and poverty”. BRUCE, Stuart. Energy Governance and Institutions (International). In: LEAL FILHO, Walter *et al.* (eds.). *Affordable and Clean Energy*. Encyclopedia of the UN Sustainable Development Goals. Cham: Springer Nature Switzerland, p. 1-16, 2020, p. 2.

⁷ FATOUROS, Arghyrios A. *An international legal framework for energy*. Leiden:

the negative effects of GHG emissions on the environment and on climate change effects. Thus, energy transition is a necessary process that has multifaceted impacts and contributes to fight climate change, boost economic development, and broaden the access to energy services⁸.

However, the decarbonization process faces challenges due to its intrinsic heterogeneity. Each country has its unique energy matrix and particularities that affect the lawmaking process. Therefore, it is necessary adopting concrete global measures and requiring international cooperation from actors participating in the international energy context.

2. The genesis of global energy transition

History has shown several changes in the main energy sources and such changes have caused transnational disputes and price oscillations in the international energy market⁹. After the “coal fueled” industrial revolution, oil emerged as the primary energy source for modern activities¹⁰ are presenting economic power among States.

Brill-Nijhoff, Collected Courses of the Hague Academy of International Law, vol. 332, p. 363-446, 2008, p. 370.

⁸ STAFFELBACH, Bruno. Foreword. In: MATHIAS, Klaus; HUBER, Bruce R. (Eds.). *Energy Law and Economics*. Cham: Springer International Publishing AG, vol. 5, p. 59-76, 2018, p. vi.

⁹ “Cuando el carbón mostró su sorprendente poder energético, la biomasa perdió su hegemonía energética de más de tres siglos protagonizando una transformación sin precedentes, dando lugar a la I y II Revolución Industrial”. Henry Jiménez Guanipa classifies the fossil fuel phasing out process for renewable energy as the fourth energy transition, which is preceded by the following transition processes (i) human and animal strength replacement, in addition to other wind and biomass energy (by coal) sources; (ii) coal replacement by oil, which is consolidated as the most important energy resource; and (iii) the author states that there would be another transition after the 1970s crisis, but this time it would focus on natural gas participation in the energy market. GUANIPA, Henry Jiménez. La cuarta transición energética y el camino hacia la descarbonización: el caso de Alemania. In: GUANIPA, Henry Jiménez; LEAL, Marisol Luna. (Coord.). *Crisis climática, transición energética y derechos humanos: Protección del medio ambiente, derechos humanos y transición energética*. 1. ed. Bogotá: Ediciones Ántropos Ltda., Tomo II, p. 247-279, 2020, p. 250-252.

¹⁰ RIBEIRO, Marilda Rosado de Sá. *Direito do Petróleo*. 3. ed. Rio de Janeiro: Renovar, 2014, p. 1.

The 1970s¹¹ oil crisis triggered a reaction led by consumer countries as a response to oil producers' power exercised in the global market. States deprived of oil reserves were mainly concerned with energy dependence, potential geopolitical and economic crises, and a possible energy shortage.

The oil crisis consequences upon consumer countries' economies¹² led to the creation of the International Energy Agency (IEA) in 1974 by the Organization for Economic Cooperation and Development (OECD)¹³. The International Energy Agency (IEA) was established to implement a fast and coordinated response to future disruptions in the international energy supply¹⁴.

Consequently, international energy cooperation in the 20th century focused on energy security and nuclear energy¹⁵ evolving to a new global energy governance scope over the years. Fossil fuel energy consumption impact on the environment and on human health, as well as concerns with sustainable development were in the mainstream of energy transition debates.

¹¹ "These [energy security] concerns were brought to world attention by the Arab oil embargo in 1973 and the subsequent oil price increases in 1979 and 1981. Although the only direct legal consequence flowing from the Organisation of Petroleum Exporting Countries' (OPEC) strangle hold on petroleum exports was the agreement to create a strategic petroleum reserve, to guard against future world export problems, the OPEC ascendancy in the 1970s was responsible for highlighting energy security concerns worldwide and caused many countries to rethink their energy strategies". LYSTER, Rosemary; BRADBROOK, Adrian. Energy, international environmental law and sustainable development, In: LYSTER, Rosemary; BRADBROOK, Adrian. *Energy Law and the Environment*. Cambridge: Cambridge University Press, p. 34-77, 2006, p. 35.

¹² HEUBAUM, Harald. Global Energy Governance. In: WEISS, Thomas G.; WILKINSON, Rorden. *International Organization and Global Governance*. 2. ed. New York: Routledge, p. 681-693, 2018, p. 684.

¹³ In order to accede IEA, it is necessary to previously become member of the OECD and also comply with other requirements imposed by the agency, for example, having a crude oil reserve and / or reserves equivalent to 90 days of import based on the previous year in order to contribute to future energy shortage responses. INTERNATIONAL ENERGY AGENCY. *IEA Membership*. Available at <<https://www.iea.org/countries/members/>>. Access on 20 July 2020.

¹⁴ LEAL-ARCAS, Rafael; MINAS, Stephen. Mapping the International and European Governance of Renewable Energy. *Yearbook of European Law*, vol. 35, n. 1, p. 621-666, 2016, p. 637.

¹⁵ ROEHRKASTEN, Sybille. *Global Governance on Renewable Energy: Contrasting the Ideas of the German and the Brazilian Governments*. Springer, 2015, p. 74.

Therefore, other issues were incorporated to the modern global energy governance¹⁶ agenda in addition to energy security¹⁷, namely: (i) climate change mitigation; and (ii) access to energy services¹⁸. The process to replace fossil fuel consumption by the use of renewable energy¹⁹ sources within this new scenario, became the very genesis of energy transition²⁰. Renewable sources represent the opportunity to produce electricity by having minimal impact on the environment.

¹⁶ Cécile Kérébel proposes the following global energy governance definition: ‘the architecture of institutions and processes - formal and informal, public and private - that contribute to the definition of collective rules and to structure world relationships on energy’. KÉRÉBEL, Cécile. Qu’est-ce que la gouvernance globale de l’énergie? Les termes du débat. In: KÉRÉBEL, Cécile; KEPPLER, Jan Horst. *La Gouvernance mondiale de l’énergie: gouvernance européenne et géopolitique de l’énergie*. Paris: L’Institut français des relations internationales, tome 5, p. 15-36, 2009.

¹⁷ Energy security is understood as meeting the energy needs of humanity to maintain the minimum standard of living in the developed world by promoting development and stimulating transnational quality of life, either in undeveloped and developing countries. LEAL-ARCAS, Rafael; FILIS, Andrew; ABU GOSH, Ehab S. *International Energy Governance: Selected Legal Issues*. Cheltenham: Edward Elgar, 2014, p. 7. Belén del Río adds that 1973 was the key year for the energy security in global energy governance topic. DEL RÍO, Belén. La gobernanza global de la energía (*global energy governance*). *Anuario Español de Derecho Internacional*, vol. 32, p. 439-473, 2016, p. 449.

¹⁸ Aleh Cherp, Jessica Jewell and Andreas Goldthau pointed out three main global energy governance scopes: (i) energy security, (ii) access to energy services, and (iii) climate change. CHERP, Aleh, JEWELL, Jessica, GOLDTHAU, Andreas. Governing Global Energy: Systems, Transitions, Complexity. *Global Policy*, vol. 2, issue 1, p. 75-88, 2011, p. 77.

¹⁹ The main characteristic of renewable sources lies on their regeneration capacity. Energy itself is not renewable, but some of its sources are, such as sun, wind and water. According to the International Renewable Energy Agency Statute, the “term ‘renewable energy’ means all energy forms sustainably produced from renewable sources, including, inter alia: 1. bioenergy; 2. geothermal energy; 3. hydropower; 4. ocean energy, including inter alia tidal, and the wave and ocean thermal energy; 5. solar energy; and 6. wind energy”. INTERNATIONAL RENEWABLE ENERGY AGENCY. *Statute of IRENA, 2009*. Available at <https://www.irena.org/-/media/Files/IRENA/Agency/About-IRENA/Statute/IRENA_FC_Statute_signed_in_Bonn_26_01_2009_incl_declaration_on_further_authentic_versions.pdf?la=en&hash=635C494208DD405EA8CD2BDB04414FCD40F55F1>. Access on September 22, 2020. Rafael Leal-Arcas and Stephen Minas claim that renewable energy is the product of sustainable energy sources, excluding fossil fuels (oil, natural gas and coal) and uranium. LEAL-ARCAS, Rafael; MINAS, Stephen. Mapping the International and European Governance of Renewable Energy. *Yearbook of European Law*, vol. 35, n. 1, p. 621-666, 2016, p. 621.

²⁰ MERSINIA, Ioanna; PENTTINEN, Sirja-Leena. Examining Different Aspects of the Energy Transition. In: MERSINIA, Ioanna; PENTTINEN, Sirja-Leena. *Energy Transitions: Regulatory and Policy Trends*. Cambridge: Intersentia, vol. 5, p. 1-8, 2018, p. 1.

Unlike what has happened in other times in history, we are facing a different transformation process in the energy sector, whose new primary energy source does not rely on its own economic advantage or abundance. The low carbon transition is mainly based on environmental and human health protection pillars²¹.

The transition to renewable sources gathers several positive aspects by improving (i) access to modern energy services, (ii) promoting energy supply security, (iii) reducing GHG emissions and (iv) reducing fossil fuel dependence²². These aspects also contribute to change the global energy governance paradigm.

It is interesting noticing that energy transition is a complex multifaceted process encompassing economic, social and geopolitical structures. Its complexity is compared to major infrastructure projects during the reconstruction period after World War II²³. This process is called “*Energiewende*”²⁴ in Germany and it has been in the mainstream of the country’s academic and political debates since the 1980s²⁵. The gradual fossil fuel

²¹ “*La cuarta transición está movida por la reacción a los daños causados por la quema de recursos fósiles y por los efectos de las emisiones de gases de efecto invernadero (GEI) sobre el medio ambiente y el clima* . GUANIPA, Henry Jiménez. La cuarta transición energética y el camino hacia la descarbonización: el caso de Alemania. In: GUANIPA, Henry Jiménez; LEAL, Marisol Luna. (Coord.). *Crisis climática, transición energética y derechos humanos: Protección del medio ambiente, derechos humanos y transición energética*. 1. ed. Bogotá: Ediciones Ántropos Ltda., Tomo II, p. 247-279, 2020, p. 252.

²² FATOUROS, Arghyrios A. *An international legal framework for energy*. Leiden: Brill-Nijhoff, Collected Courses of the Hague Academy of International Law, vol. 332, p. 363-446, 2008, p. 405.

²³ BOSSELMANN, Klaus. Germany’s ‘Energiewende’: what can environmental law scholarship learn from it?. In: MANZANO, Jordi Jaria i; CHALIFOUR, Nathalie; KOTZE, Luis J. *Energy, Governance and Sustainability*. Cheltenham: Edward Elgar Publishing, p. 11-29, 2016, p. 12.

²⁴ The terminology of ‘Energiewende’ was incorporated to the international vocabulary and it signals what can be seen as transition from the fossil fuel era to the era of renewable sources and sustainability. “The combination of nuclear power phasing out, saving energy and shifting to renewable energy became known as the energy transition or Energiewende”. BOSSELMANN, Klaus. Germany’s ‘Energiewende’: what can environmental law scholarship learn from it? In: MANZANO, Jordi Jaria i; CHALIFOUR, Nathalie; KOTZE, Luis J. *Energy, Governance and Sustainability*. Cheltenham: Edward Elgar Publishing, p. 11-29, 2016, p. 12.

²⁵ According to Jonas Kaiser *et al*, the term ‘Energiewende’ was adopted in 1980 after the research pursued by “*Öko-Institut Wuppertal*”, according to which, “it was originally coined by the German Institute for Applied Ecology (“*Öko-Institut Wuppertal*”) in 1980. This topic found its way into the political debate at the late 2002, when the Social Democrats and the Greens formed a governmental coalition. The term lost

and nuclear energy replacement by the use of renewable energy sources is not only an environmental concern in the German market, it also regards the population's safety against potential nuclear accidents²⁶.

Energy transition in Brazil is linked to the climate change, oil price volatility and energy production decentralization contexts. The Brazilian energy matrix, mainly the power sector, already conceives the prevalence of renewable energy sources due to hydroelectricity representation in the energy matrix. This scenario has, somehow, contributed to the underdevelopment of other energy sources, such as wind and solar power. This panorama can be subjected to change in the near future, since new government incentives to explore other energy sources have been constantly updated.

Therefore, energy transition is a multiform and heterogeneous process that evolves differently in each country; moreover, it is influenced by several aspects, such as (i) technological development; (ii) budgetary issues, and (iii) regulatory improvements. Thus, it is necessary analyzing this transition based on environmental, economic, and social perspectives.

3. Mitigation of climate change effects

Environmental impacts caused by the energy industry²⁷ has shown that energy and environment are intrinsically related to

its political grip in the following years, and required a window of opportunities in 2011, which was opened by the Fukushima disaster, since it brought the issue back to the top of the public and political agenda". KAISER, Jonas; RHOMBERG, Markus; MAIREDER, Axel; SCHLOGL, Stephan. *Energiewende's Lone Warriors: A Hyperlink Network Analysis of the German Energy Transition Discourse*. *Media and Communication*, vol. 4, Issue 4, p. 18-29, 2016, p. 20.

²⁶ "a reaction to the Fukushima nuclear accident, a phase out should eliminate the dangers of these technologies". MATHIS, Klaus; HUBER, Bruce R. *Energy Law and Economics*. Cham: Springer International Publ., 2018, p. ix.

²⁷ "Energy and the environment are physically linked in the natural fuel cycle. From exploration and extraction through processing and transportation and then to distribution, consumption, and disposal of the natural re- sources that are used to produce energy, environmental consequences follow . HEFFRON, Raphael J.; RØNNE, Anita; TOMAIN, Joseph P.; BRADBROOK, Adrian; TALUS, Kim. A treatise for energy law. Oxford: *Journal of World Energy Law & Business*, vol. 11, issue 1, mar. p. 34-48, 2018, p. 44.

each other. The United Nations Conference on Environment and Development (Rio 92)²⁸ acknowledged the undeniable connection between those two issues. The likely energy inclusion in Agenda 21 was discussed in this conference, but it was later excluded from it.

United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and the Kyoto Protocol adoption in 1997 were a major contribution to energy transition advancements, mainly when it comes to measures intended to promote renewable energy source using to reduce GHG emissions.

Based on Article 2(1)(a)(iv) of the Kyoto Protocol, the Parties agreed to “implement and/or further elaborate policies and measures” to improve “research on, as well as the promotion, development and increased use of, new and renewable forms of energy”²⁹. The obligations set by UNFCCC and the Kyoto Protocol increased States’ awareness about the need of reducing GHG emissions, as well as their perception that promoting the use of renewable energy has relevant impact on climate change mitigation.

From the 2000s onwards, the importance of increasing renewable sources’ participation in the global energy matrix was reaffirmed on several occasions³⁰. In 2015, the Paris Agreement recognized the need of creating “sustainable patterns of

²⁸ ORGANIZAÇÃO DAS NAÇÕES UNIDAS. *Conferências de meio ambiente e desenvolvimento sustentável: um miniguia da ONU*, 2017. Available at <<https://nacoesunidas.org/conferencias-de-meio-ambiente-e-desenvolvimento-sustentavel-miniguia-da-onu/>>. Access on July 31, 2020.

²⁹ UNFCCC. *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. Available at <<https://unfccc.int/resource/docs/convkp/kpeng.html>>. Access on September 22, 2020. See also WILDER, Martijn; DRAKE, Lauren. International Law and the Renewable Energy Sector. In: CARLARNE, Cinnamon P.; GRAY, Kevin R.; TARASOFSKY, Richard. *The Oxford Handbook of International Climate Change Law*. Oxford: Oxford University Press, p. 357-390, 2016, p. 364.

³⁰ It is important highlighting among the international declarations and agendas: (i) “Sustainable Energy for All” program created by the United Nations Organization, in 2012; (ii) declaration of the “Decade of Sustainable Energy for All between 2012 and 2024; and (iii) The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015. REDGWELL, Catherine. International Regulation of Energy Activities. In: ROGGENKAMP, Martha; REDGWELL, Catherine; RØNNE, Anita; DEL GUAYO, Iñigo del. *Energy Law in Europe: National, EU and International Regulation*. 3. ed. Oxford: Oxford University Press, p. 13-136, 2016, p. 16.

consumption and production” as mechanism to fight climate change³¹.

Commitments undertaken in environmental multilateral agreements have contributed to redirect energy policies that were previously focused on fossil fuels. States reshaped their energy strategies concerning fuel types consumed in their territory and started a transformation process towards environmental protection.

It should be noticed that carbonized energy matrix has transboundary effects. Therefore, they should be considered a transnational legal subject³². GHG emissions account for air pollution³³, whereas energy production activities such as oil exploration, production and transport increase the incidence of international environmental disasters³⁴, whose impacts go beyond national boundaries. Another essential aspect is related to progressive energy consumption increase in the years to come. This increased consumption is partially explained by population growth, which will have direct effect on the environment³⁵.

The European Commission estimates that electricity generation accounts for at least 75% of GHG emissions³⁶.

³¹ BRASIL. Decreto Nº 9.073, de 5 de junho de 2017. Promulga o Acordo de Paris sob a Convenção-Quadro das Nações Unidas sobre Mudança do Clima, celebrado em Paris, em 12 de dezembro de 2015, e firmado em Nova Iorque, em 22 de abril de 2016. *Diário Oficial [da] República Federativa do Brasil*, Brasília, 05 jun. 2017.

³² RIBEIRO, Marilda Rosado de Sá. *Direito do Petróleo*. 3. ed. Rio de Janeiro: Renovar, 2014, p. 35.

³³ INTERNATIONAL ENERGY AGENCY. *World Energy Outlook 2018*. Available at <<https://www.iea.org/weo2018/>>. Access on August 1, 2020, p. 47.

³⁴ “Other major international environmental impacts associated in whole or in part with energy use and production include acid rain, climate change and the dumping of radioactive wastes. To a lesser extent one can also add the depletion of the ozone layer and desertification. As a result of these developments, energy is now very much a part of international environmental law”. LYSTER, Rosemary; BRADBROOK, Adrian. Energy, international environmental law and sustainable development, In: LYSTER, Rosemary; BRADBROOK, Adrian. *Energy Law and the Environment*. Cambridge: Cambridge University Press, p. 34-77, 2006, p. 36.

³⁵ FATOUROS, Arghyios A. *An international legal framework for energy*. Leiden: Brill-Nijhoff, Collected Courses of the Hague Academy of International Law, vol. 332, p. 363-446, 2008, p. 404.

³⁶ COMISSÃO EUROPEIA. *COM(2018) 773 final*. Un planeta limpio para todos. La visión estratégica europea a largo plazo de una economía próspera, moderna, competitiva y climáticamente neutra. Available at <<https://eur-lex.europa.eu/legal-content/ES/TXT/PDF/?uri=CELEX:52018DC0773&from=EN>>. Access on July 31, 2020. p. 7.

Consequently, renewable energy now plays main role in the energy transition process, but its production often means applying methods and instruments focusing on the use of natural resources such as wind, water, the sun, waves and even the planet's internal energy. Electricity production from renewable sources has almost null and reversible contamination impact³⁷. For this reason, it became an ally in the fight against climate change and to mitigate damages to human health.

In addition to environmental benefits, there are other fundamentals contributing to the incorporation of new energy policies to support renewable energy. Fossil fuel dependence reduction contributes to energy security and new projects in the energy industry boost the economy and attract private investments.

Renewable energy also helps broadening the access to modern energy services. It is important bear in mind the possibility of implementing solar and wind energy projects in more remote communities that do not have access to the electricity grid and the distribution of unfeasible services in the past. This is the reason why energy transition has economic and social potential, as well as brings along environmental benefits.

4. Economic and social aspects of the energy transition

The process to phase out fossil fuels by replacing them by energy sources broadly available in nature also accounts for an economic and social rationale that justifies investments in energy transition³⁸. This change has impact on energy price, as well as increases domestic supply security as States reduce their exposure to market fluctuations and to effects of potential oil crises.

³⁷ RUIZ OLMO, Irene. *El régimen retributivo de la electricidad fotovoltaica*. 2018. 567 f. Tese (Programa de Doctorado) – Departamento de Derecho Administrativo, Universidad de Sevilla, España, p. 39.

³⁸ VOLPON, Fernanda. El papel de las energías renovables en la transición energética global. In: GUANIPA, Henry Jiménez; LEAL, Marisol Luna. (Coord.). *Crisis climática, transición energética y derechos humanos*: Protección del medio ambiente, derechos humanos y transición energética. Bogotá: Ediciones Ántropos Ltda., Tomo II, 1a ed., p. 323-355, 2020, p. 341-345.

On the one hand, the cost to generate power from renewable sources, mainly from solar and wind sources, remains high, higher than that generated by electricity production from fossil fuels.³⁹ This outlook results from choices made for past energy policies, such as the case of the current infrastructure, which allows the easy electricity dispatch from thermoelectric plants and the historically implemented subsidies to the energy production using fossil fuels.

On the other hand, investments in new projects focused on using renewable sources contribute to reduce fossil fuel consumption and to economic development, if ones takes into consideration the necessary capital to put these new projects in place. Therefore, the complexity of this process requires the implementation of large infrastructure undertakings similar to those recorded in the post-World War II reconstruction period⁴⁰.

Another relevant aspect refers to achieving universal access to modern energy services⁴¹, which is a necessary step towards poverty eradication and the reduction of social inequalities⁴². In

³⁹ HESELHAUS, Sebastian. Energy Transition Law and Economics. In: MATHIS, Klaus; HUBER, Bruce R. (Ed.) *Energy Law and Economics*. Cham: Springer International Publishing, Economic Analysis of Law in European Legal Scholarship, vol. 5, p. 19 - 41, 2018, p. 20.

⁴⁰ BOSSELMANN, Klaus. Germany's 'Energiewende': what can environmental law scholarship learn from it?. In: MANZANO, Jordi Jaria i; CHALIFOUR, Nathalie; KOTZE, Luis J. *Energy, Governance and Sustainability*. Cheltenham: Edward Elgar Publishing, p. 11-29, 2016, p. 12.

⁴¹ Based on the definition proposed by the International Energy Agency in the Access to Energy report issued in 2017, access to energy services includes (i) household access to a minimum level of electricity; (ii) household access to safer and more sustainable fuels, cooking and heating stoves than traditional biomass stoves; (iii) access level to enable productive economic activities; as well as (iv) access to public services. INTERNATIONAL ENERGY AGENCY. *Energy Access Outlook 2017*. Available at <<https://webstore.iea.org/download/direct/274>>. Access on August 3, 2020. The World Bank defines access to energy services as the ability of the final consumer to use services that require energy appliances or adequate energy supply - citing - a non-exhaustive role, such as electricity, kitchen services, air circulation, refrigeration, cell phone charging, heating, communication, entertainment, computing, among others. WORLD BANK GROUP. *Beyond Connections: Energy Access Redefined*. Available at <<https://openknowledge.worldbank.org/bitstream/handle/10986/24368/Beyond0connect0d000technical0report.pdf>>. Access on August 1, 2020.

⁴² INTERNATIONAL ENERGY AGENCY. *Energy Access Outlook 2017*. Available at <https://webstore.iea.org/download/direct/274?fileName=WEO2017Special-Report_EnergyAccessOutlook.pdf>. Access on August 2, 2020, p. 11. The World Bank also provides a definition: "Today, more than one billion people live without

2015, the United Nations highlighted the relevance of achieving “universal access to affordable, reliable and modern energy services”⁴³ by 2030 as a target of the Sustainable Development Goal 7 (SDG 7), which is part of the 2030 Agenda for Sustainable Development adopted by all United Nations Member States, in 2015.

A large fraction of the world population is marginal to basic energy services, such as electricity and clean cooking facilities. In 2016, IEA pointed out that 1.1 billion people lacked access to electricity in their daily activities⁴⁴ and that 2.8 billion people were devoid of clean cooking facilities, which forced them to use biomass, kerosene or coal for power generation⁴⁵.

The universalization of modern energy services is directly related to the use of renewable energy sources, since it allows broader electricity service distribution. Thus, micro and mini electric power generation projects with photovoltaic plates

electricity, which is only a slight improvement since 2012. Another 3 billion cook or heat their homes with polluting fuels like wood or other biomass, resulting in indoor and outdoor air pollution that causes about 4.3 million deaths each year. At this rate, the world will only reach 92% electrification by 2030, leaving many in the dark and unable to seize economic and social opportunities that can help them lead better lives”. WORLD BANK GROUP. *Energy & Mining*. Available at <<http://www.worldbank.org/en/topic/energy>>. Access on August 2, 2020. Segundo os dados da *Renewable Energy Policy Network*, o número de pessoas sem acesso à eletricidade seria 1,06 bilhão. RENEWABLE ENERGY POLICY NETWORK. *Renewables 2018: Global Status Report*. Available at <<http://www.ren21.net/gsr-2018/>>. Access on August 2, 2020. p. 24.

⁴³ UNITED NATIONS. *Sustainable Development Goals*. Available at <<https://www.un.org/sustainabledevelopment/energy/>>. Access on July 30, 2020. See also RIBEIRO, Marilda Rosado de Sá; VOLPON, Fernanda Torres. Global Energy Governance within BRICS players: cooperation and adoption of efficient measures to achieve progress. In: CASELLA, Paulo Borba; BUENO, Elen de Paula; CARVALHO, Evandro Menezes de; KÜNZLI, Willi Sebastian. (Coords.). *International Legal Aspects of BRICS*. Belo Horizonte, Brazil: Editora D’Plácido, v. 1, p. 39-68, 2019, p. 59.

⁴⁴ INTERNATIONAL ENERGY AGENCY. *World Energy Outlook 2018*. Available at <<https://www.iea.org/weo2018/>>. Access on August 1, 2020.p. 98.

⁴⁵ “Developing Asia is home to around 65% of the global population without access, with 1.7 billion people lacking clean cooking facilities. Five times more people lack clean cooking access than electricity in this region. However, the latest data shows promising signs, with 525 million people gaining access since 2011, compared with only 250 million between 2000 and 2011. In India and China, access rates have reached 47% and 70% respectively”. INTERNATIONAL ENERGY AGENCY. *World Energy Outlook 2018*. Available at <<https://www.iea.org/weo2018/>>. Access on August 1, 2020. p. 98.

have been gaining special prominence, as they involve greater consumers' participation in solar energy using.

Consumers in Germany actively participate in energy transition through investments in self-consumption electricity production, which represents one third of the country's installed capacity⁴⁶. Distributed generation stands out in Brazil for its growth and relevance in the energy consumption market.

Renewable energy is in the very core of energy transition and transformation aiming at a cleaner energy matrix. This paradigm shift not only contributes to fight climate change, but also expands the access to modern energy services.

5. The role played by renewable energy in the global energy transition process

The main focus of the international energy agenda at late 20th century was energy supply and nuclear energy security⁴⁷, but renewable energy leads the clean energy transition, nowadays. Renewable sources provides a tripartite of positive impacts, namely: environmental protection, energy security and sustainable-development promotion⁴⁸.

The first international conference about the exploration of renewable energy sources took place in 1961 in Rome; it is known as the Conference on New and Renewable Sources of Energy⁴⁹. This conference focused on the use of sources capable of reducing

⁴⁶ GUANIPA, Henry Jiménez. La cuarta transición energética y el camino hacia la descarbonización: el caso de Alemania. In: GUANIPA, Henry Jiménez; LEAL, Marisol Luna. (Coord.). *Crisis climática, transición energética y derechos humanos: Protección del medio ambiente, derechos humanos y transición energética*. 1. ed. Bogotá: Ediciones Ántropos Ltda., Tomo II, p. 247-279, 2020, p. 272.

⁴⁷ ROEHRKASTEN, Sybille. *Global Governance on Renewable Energy: Contrasting the Ideas of the German and the Brazilian Governments*. Springer, 2015, p. 74.

⁴⁸ VOLPON, Fernanda Torres. Meio ambiente, Segurança Energética e Desenvolvimento Sustentável: A tríade de impactos positivos da energia renovável. In: RIBEIRO, Marilda Rosado de Sá (Org.); GRAÇA, Daniela Lorena León. *Meio ambiente, Perspectivas Jurídicas: Do nacional ao global*. Belo Horizonte: Arraes Editores, v. 1, 2018, p. 175-196, 2018, p. 188-193.

⁴⁹ UNITED NATIONS. General Assembly A/CONF.100/11. *Report of the United Nations conference on new and renewable sources of energy*, 1981. Available at <https://digitallibrary.un.org/record/25034/files/A_CONF-100_11-EN.pdf>. Access on August 3, 2020. p. 52.

supply uncertainty, as well as on and energy distribution in the future⁵⁰. The debate on renewable energy sources crossed boundaries and became the subject of other conferences on energy and sustainable development, over the years.

In 2011, the United Nations launched the “Sustainable Energy for All” program⁵¹, which was based on three pillars: (i) universal access to energy services; (ii) increase in the total energy efficiency rate; and (iii) enhancement on renewable energy participation in the global energy matrix.

However, renewable sources’ centrality in the energy transition debate was consolidated by the inclusion of target n. 2 of SDG 7 in Agenda 2030. Based on this document, States agreed about the need of “increase substantially the share of renewable energy in the global energy mix”⁵² in order to reach sustainable development by 2030.

Urging to increase renewable energy consumption, many countries inserted renewable energy sources participation quotas in their national energy matrix in their local laws as legal strategy to reduce GHG emissions⁵³. In 2016, the International Renewable Energy Agency reported that 150 countries had already inserted targets in their domestic legislation to increase the share of renewable sources in their energy matrix⁵⁴.

There is a normative pattern whose targets were disassociated from their effective implementation financing mechanisms to

⁵⁰ ROWLANDS, Ian H. Renewable energy and international politics. In: DAUVERGNE, Peter. *Handbook of Global Environmental Politics*. Cheltenham: Edward Elgar, p. 78-94, 2005, p. 80.

⁵¹ Sustainable Energy for All (SEforALL) is an international organization working with leaders in government, the private sector and civil society to drive further, faster action toward achievement of Sustainable Development Goal 7 (SDG7), which calls for universal access to sustainable energy by 2030, and the Paris Agreement, which calls for reducing greenhouse gas emissions to limit climate warming to below 2° Celsius . SUSTAINABLE ENERGY FOR ALL. *About*. Available at <<https://www.seforall.org/who-we-are>>. Access on August 2, 2020.

⁵² UNITED NATIONS. *Department of Economic and Social Affairs - Sustainable Development*. Available at <<https://sdgs.un.org/goals/goal7>>. Access on August 2, 2020.

⁵³ BERGMANN, Ariel; HANLEY, Nick; WRIGHT, Robert. Valuing the attributes of renewable energy investments, *Energy Policy*, n. 34, p. 1004-1014, 2006, p. 1004.

⁵⁴ INTERNATIONAL RENEWABLE ENERGY AGENCY. *Renewable Energy Targets*. Available at <<http://resourceirena.irena.org/gateway/dashboard/index.html>>. Access on August 2, 2020.

encourage a greater uptake of renewable energy sources across different countries. Therefore, several quotas have not yet been implemented – they remain below the States’ initial goals. The Scottish Government has established that 100% of the electricity to be consumed by 2020 should result from renewable sources.⁵⁵ This target was reduced by 50% and must be met by 2030⁵⁶.

Renewable source share increase in the national energy matrix is directly related to the attractiveness of financial mechanisms implemented by energy policies adopted by each State. Investors need to benefit from attractive tariffs or governmental subsidies in order to invest in renewable energy projects since the cost to produce electricity from renewable sources remains higher than that from fossil fuels.

The European Union framework is a successful example of regulatory approaches favorable to renewable energy. Its three directives, which were issued in 2001, 2009 and 2018, have led to energy policy heading towards the use of renewable energy sources for electricity production and in other sectors such as transport and buildings’ energy efficiency⁵⁷. This finding highlights the importance of well-structured regulatory framework contributions to renewable energy development and to energy transition progress.

In addition, international cooperation in the energy sector as comprehensive principle⁵⁸ contributes to information

⁵⁵ See also MARTINOT, Eric. Grid Integration of Renewable Energy: Flexibility, Innovation, and Experience. *Annual Review of Environment and Resources*, vol. 41, p. 223-251, 2016, p. 224.

⁵⁶ “By 2030 we aim to generate 50% of Scotland’s overall energy consumption from renewable sources, and by 2050 we aim to have decarbonised our energy system almost completely”. SCOTLAND GOVERNMENT. Scottish Government. *Renewable and Low Carbon Energy*. Available at <<https://www.gov.scot/policies/renewable-and-low-carbon-energy/>>. Access on August 2, 2020.

⁵⁷ “The key source of energy law and policy is national governments. Governments set the energy policy in their country and then introduce the legislation to meet those goals. Many Member States in the EU and states in the USA have to take into account federal law and policy but these states have a large amount of autonomy as to how they meet their energy needs”. HEFFRON, Raphael J.; TALUS, Kim. The development of energy law in the 21st century a paradigm shift? Oxford: *Journal of World Energy Law & Business*, vol. 9, issue 3, p. 189-202, 2016, p. 194.

⁵⁸ The concept of international cooperation turns out to be ‘the true concert of shared wills and capacities, in detriment of unilateral action, whose major objective is enshrined in the realization of the common good’. RIBEIRO, Marilda Rosado de Sá; ALMEIDA, Bruno Rodrigues de. O Princípio Abrangente da Cooperação

sharing advancements and improves regulatory procedures and technological development. Hence, other countries can develop their own energy policies based on the successful European practice of adopting a regulatory framework to effectively promote projects based on renewable source using. Energy transition progress requires multiple-dimension efforts to encourage various initiatives within different areas.

Finally, although the energy transition process in Brazil exceeds the scope of the current study, it is important noticing the local movement to promote renewable energy in the Brazilian market⁵⁹. Accordingly, the Brazilian Energy Research Company, identified a change in the consumption pattern among its several studies within the energy sector; these change aimed at reducing GHG emissions.⁶⁰ Energy transition, for instance, was included in the National Energy Plan (PNE) scope for 2050⁶¹.

Furthermore, Senate Bill n. 712/2015⁶² proposed renewable source share increase in the internal energy supply by at least 60% (sixty percent), by 2040⁶³. This Bill was somehow consistent with Brazil's commitments to the Paris Agreement, after its

Internacional e a Governança dos Recursos Hídricos Transfronteiriços. In: RAMOS, Andre de Carvalho (Org.). *Direito Internacional Privado: Questões Controvertidas*. Belo Horizonte: Arraes Editores, p. 111-131, 2015, p. 114.

⁵⁹ RIBEIRO, Marilda Rosado de Sá; VOLPON, Fernanda Torres. Global Energy Governance within BRICS players: cooperation and adoption of efficient measures to achieve progress. In: CASELLA, Paulo Borba; BUENO, Elen de Paula; CARVALHO, Evandro Menezes de; KÜNZLI, Willi Sebastian. (Coords.). *International Legal Aspects of BRICS*. Belo Horizonte, Brazil: Editora D'Plácido, v. 1, p. 39-68, 2019, p. 57.

⁶⁰ EMPRESA DE PESQUISA ENERGÉTICA. EPE participa do Ciclo de Debates para Transição Energética. Apresentação diretor José Mauro Coelho sobre transição energética de 25 de abril de 2019. Available at <<http://www.epe.gov.br/pt/imprensa/noticias/epe-participa-do-ciclo-de-debates-para-transicao-energetica>>. Access on August 3, 2020.

⁶¹ EMPRESA DE PESQUISA ENERGÉTICA. *Plano Nacional de Energia*. Nota Técnica DEA 05/13 Termo Referência (TDR) para elaboração do PNE 2050. Available at <<http://epe.gov.br/pt/publicacoes-dados-abertos/publicacoes/Plano-Nacional-de-Energia-2050>>. Access on August 4, 2020. p. 14-15.

⁶² BRASIL. Lei nº 12.187 de 29 de dezembro de 2009. Institui a Política Nacional sobre Mudança do Clima – PNMC e dá outras providências. *Diário Oficial [da] República Federativa do Brasil*, Brasília, 30 dez. 2009.

⁶³ BRASIL. *Projeto de Lei do Senado nº 712, de 2015*. Available at <<https://www25.senado.leg.br/web/atividade/materias/-/materia/123890>>. Access on August 2, 2020.

ratification in 2016⁶⁴. This Agreement proposed to reduce 37% of GHG emissions recorded in 2005, by 2025, and this reduction should be close to 43%, by 2030⁶⁵.

Brazil operates in cooperation with different global energy governance organizations in the international energy scenario⁶⁶. In 2017, Brazil was established as 'Associated State' of the International Energy Agency, after more than one decade of partnership with this institution. In 2018, Brazil submitted its membership application to the International Renewable Energy Agency⁶⁷ as part of its international energy agenda. Therefore, in our opinion, in light of the international energy cooperation, Brazil is taking a path towards an energy transition process in compliance with global targets.

6. Conclusion

Fossil fuel consumption phasing out in favor of renewable energy sources was consolidated as the genesis of energy

⁶⁴ This project, however, was changed by the Infrastructure Services Commission in 2019, which considered the percentage unfeasible, recommending that the Ministry of Mines and Energy determine the target of renewable sources in the National Energy Plan (PNE). The 60% proposal was changed under the justification that it would be an 'unfeasible' goal, as 'it exceeds the country's technical and technological capacity to achieve this goal and may burden the internal energy supply'. For this reason, the rapporteur of the Commission for Infrastructure Services proposes that the target for the participation of renewable sources in the internal energy supply shall be established within the scope of the PNE, without determining, in law, a predetermined percentage. BRASIL. *Parecer da Comissão de Serviços de Infraestrutura, em decisão terminativa, sobre o Projeto de Lei do Senado nº 712 de 2015*. Available at <<https://legis.senado.leg.br/scleg-getter/documento?dm=7981020&ts=1583257075315&disposition=inline>>. Access on August 2, 2020.

⁶⁵ ITAMARATY. *Pretendida Contribuição Nacionalmente Determinada para Consecução do Objetivo da Convenção-Quadro das Nações Unidas sobre Mudança do Clima*. Available at <http://www.itamaraty.gov.br/images/ed_desenvsust/BRASIL-iNDC-portugues.pdf>. Access on August 14, 2020.

⁶⁶ VOLPON, Fernanda Torres. O Mosaico Regulatório da Governança Energética Global. In: RIBEIRO, Marilda Rosado de Sá. (Org.). VOLPON, Fernanda Torres (Colab.). *Governança Global*. Belo Horizonte: Arraes Editores, v. 1, p. 249-268, 2017, p. 257-259.

⁶⁷ INTERNATIONAL RENEWABLE ENERGY AGENCY. *IRENA Welcomes Brazil's Decision to Seek Membership of the Agency*. Available at <<http://www.irena.org/newsroom/pressreleases/2018/Feb/IRENA-Welcomes-Brazils-Decision-to-Seek-Membership-of-the-Agency>>. Access on July 20, 2020.