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An Unclear Future for Iranian Energy Transition in Light of the Re-imposition of Sanctions

by M. Hazrati and Z. Malakoutikhah

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An Unclear Future for Iranian Energy Transition in Light of the Re-imposition of Sanctions

Mohammad Hazrati and Zeynab Malakoutikhah***

Abstract

Moving toward energy transition for an oil and gas rich country such as Iran could be a great advancement for the global energy transition and greenhouse gas (GHG) emissions reduction. Despite the international and national commitments of Iran to reduce GHG emissions and increase the share of renewables in its energy mix, the re-imposition of sanctions following the withdrawal of the US from the Joint Comprehensive Plan of Action (JCPOA), have hindered the successful achievement of such targets. This paper examines the main impediments derived from these sanctions, as a lack of foreign investment, a lack of technology transfers and consequently, the shift in Iran's policy away from renewable energy. As energy transition toward renewables falls into the category of a global public good through its decarbonising the energy sector, the US's sanctions on Iran will not only affect Iran, but also the global population as a whole. This paper is original since the situation is examined from an Iranian perspective and uses official documents, statements, and laws, obtained from both Persian and English sources.

Introduction

Over the past century, while the growth of fossil fuels has caused widespread access to modern forms of energy and subsequently considerable human progress, it has also brought serious environmental impacts and climate change.[1] As a result, there have been national and international efforts to transition from fossil fuels to renewables and to change fundamentally the current global system which is dominated by fossil fuels. An energy transition to renewables would bring at least two important benefits: first, a reduction in greenhouse gas (GHG) emissions, and second, improvements to energy security.[2] Any move toward a transition to cleaner and renewable energy for an oil and gas rich country, such as Iran, could significantly advance a global energy transition. Iran has the second and fourth largest global gas and oil resources respectively, and its energy sector is responsible for 77% of its GHG emissions.[3]

In addition to Iran's vast oil and gas resources, it also has enormous geographical opportunities

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[1] John Watson, 'Twenty-First Century Energy: Opportunities and Responsibilities' in *Energy Transitions: Past and Future* (World Economic Forum, 2013) <http://www3.weforum.org/docs/WEF_EN_EnergyVision_Report_2013.pdf> (accessed 29 August 2018).

[2] See: Raphael J. Heffron et al., 'A Treatise for Energy Law' (2018) 11(1) *Journal of World Energy Law and Business* 45; and Hugh Dyer and Maria J. Trombetta, *International Handbook of Energy Security* (Edward Elgar, 2013).

[3] Michal Nachmany et al., 'The 2015 Global Climate Legislation Study: A Review of Climate Change Legislation in 99 Countries' (LSE, July 2015) <http://www.lse.ac.uk/GranthamInstitute/publication/2015-climate-legislation-study/> (accessed 3 September 2018).

to develop renewable energy, in particular wind and solar energy.[4] Despite this huge potential to develop renewables, their share of the country's total electricity generation capacity is less than 1%.[5] Iran has national and international obligations to reduce its GHG emissions and develop renewable energy. The most recent commitments are—having signed the Paris Agreement—to reduce GHGs (both conditionally and unconditionally) by 12% by 2030[6] and, according to the Sixth Five-Year National Development Plan (FYNDP) (2016–2021) to increase the share of renewable energy to at least 5% of overall power generation by 2021.[7]

Environmental problems, and in particular that of climate change, are problems of global public goods. Public goods are goods in the public domain and available for all to consume, and thus have the potential to affect all people.[8] When this concept is used at the global level, it means that goods are 'public' not only for the population of a particular country but also for the entire world. The concept of a global public good has three criteria: first, it covers more than one group of countries; second, its benefit must reach a broad spectrum of the global population; and third, humanity as a whole should be its beneficiary.[9] The risk of global climate change cuts across borders, so that an energy transition away from fossil fuels and towards renewable energy is a concern for all countries. Energy transition toward renewables falls into the category of global public good through its decarbonising the energy sector.

However, the severe economic and financial sanctions on Iran over the last several decades have resulted in the failure of Iran's previous commitments to reduce GHGs and to increase its reliance on renewable energy. Following the lifting of sanctions through the Joint Comprehensive Plan of Action (JCPOA)[10] in 2016, Iran was preparing to make a policy and take the actions required for energy transition. The re-imposition of sanctions by the withdrawal of the US in 2018 has made the future of energy transition unclear. As climate change mitigation is considered a global public good, the US's sanctions and consequently Iran's failure to reduce GHGs and achieve energy transition are clearly against the global public good. The failure caused by these sanctions affects not only Iran, but also the whole population of the world.

This paper will examine the potential impacts of the US's re-imposition of sanctions on Iran's energy transition, and in particular, on renewable energy sector. These sanctions have negatively influenced investment, technology transfer and Iran's policies regarding developing

[4] Mohammad Askari et al., 'Comparing the Generation of Electricity from Renewable and Non-Renewable Energy Sources in Iran and the World: Now and Future' (2015) 12 (6) *World Journal of Engineering* 630.
[5] EIA, 'Country Analysis Brief: Iran' (EIA, 2018), <https://www.eia.gov/beta/international/analysis_includes/countries_long/Iran/iran.pdf> (accessed 7 October 2018).
[6] Iran's Department of Environment, *Intended Nationally Determined Contribution*, (November 2015) < https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/Iran/1/INDC%20Iran%20Final%20Text.pdf> (accessed 3 August 2018).
[7] The Iranian Parliament, The Six FYNDP (2016–2021), art.50.
[8] Inge Kaul et al, 'Why do Global Public Goods Matter Today?' in Inge Kaul, *Providing Global Public Goods: Managing Globalisation* (OUP, 2003) 3.
[9] Inge Kaul et al, 'Defining Global Public Goods' in Inge Kaul, Isabelle Grunberg and Marc A. Stern, *Global Public Goods: International Cooperation in the 21st Century* (OUP, 1999) 10–12.
[10] The JCPOA has concluded between China, France, Germany, Russia, the UK, the US (P5+1) and Iran in 2015. It ensures that Iran's nuclear program will be peaceful. As a result, all UN Security Council sanctions as well as multilateral and national sanctions related to Iran's nuclear programme, including steps on access in areas of trade, technology, finance, and energy will be lifted. See: JCPOA, (Vienna, 14 July 2015) < https://www.state.gov/documents/organization/245317.pdf> (accessed 12 September 2018).

renewable energy. To this end, the article is divided into three sections. In the first section, global energy transition's efforts and Iran's obligations for developing renewable energy are discussed to demonstrate the current trend for energy transition, and Iran's position in this process. The second section addresses the importance and the potential opportunity of Iran to move toward energy transition. The third section examines the barriers that have been made by the US's economic and financial sanctions on Iran, which have impeded Iran to carry out its obligations to reduce GHGs through developing renewable energy.

Global Energy Transition and Iran's Obligations

The current global energy system is completely dominated by fossil fuels, which together constituted more than 85% of the total primary energy consumption in 2017, of which the principal energy sources were oil (34%), coal (28%), gas (23%), hydro-electricity (7%), nuclear (4%) and other (non-hydro) renewables (4%), respectively.[11] Energy production and use are currently responsible for around two-thirds of global GHGs,[12] and are the primary reason for global warming. [13] It is internationally accepted that anthropogenic GHGs, especially CO_2, are a cause of climate change, which in turn has detrimental impacts on humanity and the environment.[14] For instance, the concentration of CO_2 in the atmosphere has increased by more than 45% between 1750 (the beginning of the industrial era) and 2016.[15] If the current trend increases, particularly as a result of the increase in the global population[16] and the rise in incomes in emerging countries,[17] climate change and its associated environmental challenges will accelerate dramatically.

The United Nations Framework Convention on Climate Change

Although the United Nations Framework Convention on Climate Change (UNFCCC, 1994) was the first international treaty to acknowledge and address human-driven climate change, and provided a structure for the international consideration of climate change, it did not contain detailed obligations for achieving particular climate change-related goals.[18] The ultimate aim of the UNFCCC was to "stabilize GHG concentration at a level that would prevent dangerous

[11] Oil (4621.9 mtoe), coal (3731.5 mtoe), natural gas (3156.0 mtoe), hydro-electricity (918.6 mtoe), nuclear (596.4 mtoe), and other renewables (486.8 mtoe). See: BP, 'BP Statistical Review of World Energy' (BP, June 2018), <https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/statistical-review/bp-stats-review-2018-full-report.pdf> (accessed 20 June 2018).

[12] Darren McCauley, *Energy Justice: Re-Balancing the Trilemma of Security, Poverty and Climate Change, Journal of Energy Resource and Social Science* (Palgrave Macmillan, 2018) 27; and IEA, 'Perspectives for the Energy Transition: Investment Needs for a Low-Carbon Energy System' (IEA, 2017), <https://www.iea.org/publications/insights/insightpublications/PerspectivesfortheEnergyTransition.pdf> (accessed 29 August 2018).

[13] Ishita Haldar, *Global Warming: The Causes and Consequences* (Mind Melodies, 2011) 12.

[14] Inter-governmental Panel on Climate Change (IPCC), 'Global Warming of 1.5 °C' (2018) < https://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf> (accessed 20 August 2018); and *The Urgenda Foundation v. Kingdom of Netherland*, District Court of the Hague, Case No.200.178.245, 17 April 2017.

[15] Corinne L. Quere et al., 'Global Carbon Budget 2017' (2018) 10(1) *Earth System Science Data* 405-407.

[16] The global population will reach more than 9 billion in 2040, or more than 11 billion in 2100. See: UN, 'World Population Projected to Reach 9.8 billion in 2050 and 11.2 billion in 2100' (United Nations, 2017), <https://www.un.org/development/desa/en/news/population/world-population-prospects-2017.html> (accessed 2 August 2018).

[17] BP 'Advancing the Energy Transition' (BP), <https://www.bp.com/content/dam/bp/en/corporate/pdf/sustainability-report/group-reports/bp-advancing-the-energy-transition.pdf> (accessed 31 August 2018); IEA, 'World Energy Outlook 2017' (IEA, 2017), <https://www.iea.org/weo2017/> (accessed 31 August 2018).

[18] Richard K. Lattanzio, 'International Climate Change Financing: The Green Climate Fund (GCF)' (US Congressional Research Service, 2011).

interference with the climate system".[19] Iran ratified the UNFCCC in 1996.[20] Based on the categorisation of countries by the UNFCCC, Iran was included among the non-Annex I parties, which are vulnerable to the potential economic impact of climate change response measures due to relying heavily on income from fossil fuel production and commerce.[21] The special needs of these countries for investment, technology transfer, and insurance are recognised by the Convention.[22] Iran's National Communications (NCs) to the UNFCCC were submitted in 2003, 2011 and 2018.[23] These NCs explained the measures taken by Iran and its plans for the future; in order to reduce emissions, the priority for the energy sector is to promote energy efficiency as well as the wider utilisation of natural gas and renewable energy resources.[24] Based on the latest submitted NC, Iran aims to increase the share of renewable energy in its total fuel mix, including an increase in national consumption by 1000MV annually, an increase in biogas power plants in landfill centres by 20MV, and an increase in the capacity of incinerators to produce electricity and heat by 10MV.[25]

The Kyoto Protocol

The Kyoto Protocol was adopted in 1997 and entered into force in 2005. Based on the principle of 'common but differentiated responsibilities', the Kyoto recognised the developed countries as a current responsible for high levels of GHG emissions with more responsibility in the future.[26] The second set of obligations for Iran stem from the acceptance of the Kyoto Protocol in 2005.[27] The Kyoto Protocol commits its parties by setting internationally binding emission reduction targets,[28] and aimed to facilitate the implementation of the UNFCCC. It helped establish emission reduction commitments from 37 countries.[29] Although it recognised that developed countries were mainly responsible for GHGs, it encouraged developing countries to formulate national projects, which were funded by the developed countries, to improve local emission factors.[30] The three mechanisms for meeting the targets provided by the Kyoto Protocol included International Emissions Trading, Joint Implementation, and the Clean Development Mechanism (CDM). Amongst these mechanism, the CDM is the only mechanism in which non-Annex I countries, including Iran, can participate in mitigating the climate change.[31] The aim of the CDM is to help developing countries achieve sustainable development by promoting environmental investment from developed countries;[32] the most common

[19] UN General Assembly, A/RES/48/189, United Nations Framework Convention on Climate Change (UNFCCC), 20 January 1994; art 2.
[20] Ibid; and UN Treaty Collection, <https://treaties.un.org/Pages/ViewDetailsIII.aspx?src=IND&mtdsg_no=XXVII-7&chapter=27&Temp=mtdsg3&clang=_en> (accessed 13 January 2019).
[21] UNFCCC, 'Parties and Observers', <https://unfccc.int/parties-observers>.
[22] Ibid.
[23] UNFCCC, First National Communication, 31 March 2003; Second National Communication, 23 November 2011; and Third National Communication, 11 August 2018.
[24] UNFCCC, Third National Communication, 11 August 2018, 87.
[25] Ibid.
[26] UN Climate Change, 'What is the Kyoto Protocol', < https://unfccc.int/process-and-meetings/the-kyoto-protocol/what-is-the-kyoto-protocol/what-is-the-kyoto-protocol> (accessed 15 January 2019).
[27] UN Treaty Collection, < https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-a&chapter=27&clang=_en> (accessed 15 January 2019).
[28] Kyoto Protocol to the United Nations Framework Convention on Climate Change (Kyoto Protocol), UN Doc FCCC/CP/1997/7/Add.1, 10 December 1997.
[29] Kateryna Holzer, *Carbon-Related Border Adjustment and WTO Law* (Edward Elgar, 2014) 12.
[30] Reza Alizadeh et al., 'Iranian Energy and Climate Policies Adaptation to the Kyoto Protocol' (2015) 9(3) *International Journal of Environmental Research* 854.
[31] Kyoto Protocol (1997), (n 28), art 12.
[32] The CDM's projects include end-use energy efficiency improvement, supply-side energy efficiency improvement, renewable energy, fuel switching, agriculture, industrial process, sinks projects. See: UNFCCC,

investment is in renewable energy.[33] By the same token, Iran established the Designated National Authority in order to assist the potential CDM projects. In Iran, there have been 31 CDM projects, most of which have been related to fuel switching in the existing plants, switching from single-cycle to combined-cycle generation, and renewable energy projects including landfill gas energy, wind farms and hydropower plants.[34]

The Paris Agreement

In the latest and maybe most crucial international effort to combat climate change, on 12 December 2015, the conference of the parties to the UNFCCC adopted the Paris Agreement.[35] In order to respond to the risks of climate change, the Agreement has three objectives: first, to keep the global temperature rise in this century well below 2 degrees Celsius above pre-industrial levels, and pursue efforts to limit the temperature increase to 1.5 degrees Celsius above pre-industrial levels; second, to make finances available to fund low-carbon and climate-resilient development; and third, to increase the ability of countries to adapt to the adverse impacts of climate change.[36] By July 2018, 180 countries representing 88.75% of global emissions had ratified the Agreement.[37] The Paris Agreement requests each country to outline and communicate their post-2020 climate actions, known as Intended Nationally Determined Contributions (INDCs). Parties must pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions.[38]

The central goal of the Paris Agreement, to limit the rise in average global temperature, is achievable through a substantial and rapid reduction in the use of fossil fuels, an increased share of renewables, and the promotion of energy efficiency: an approach known as 'energy transition'.[39] Renewable energy and energy efficiency can deliver the majority (over 90%) of

'Introduction to the CDM', <https://unfccc.int/files/cooperation_and_support/capacity_building/application/pdf/unepcdmintro.pdf> (accessed 10 October 2018).

[33] Reza Alizadeh et al., 'CDM in Iran: Does it Need a Revival?' (2016) 10 *International Journal of Global Warming* 202.

[34] UNFCCC, 'CDM Validation Projects' <http://cdm.unfccc.int/Projects/Validation/index.html > (accessed 8 October 2018).

[35] United Nations Climate Change (UNCH), 'What is the Paris Agreement' <https://unfccc.int/process-and-meetings/the-paris-agreement/what-is-the-paris-agreement> (accessed 29 August 2018).

[36] The Paris Agreement (2015), UN Doc FCCC/CP/2015/L.9, 12 December 2015, art 2 (a) to (c).

[37] UN Treaty Collection, 'Paris Agreement', <https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&clang=_en> (accessed 30 August 2018). On 1 June 2017, US President Donald Trump announced his intent to withdraw the United States from the Paris Agreement, but Article 28 of the Paris Agreement only permits a Party to withdraw by giving written notification to the Secretary-General of the United Nations, which may only be provided "after three years from the date on which [the Paris Agreement] entered into force for a Party." Withdrawal then takes effect upon expiry of one year from the date of receipt. The Paris Agreement entered into force for the US on 4 Nov 2016. Hence, the earliest the US could give written notice is three years later (4 Nov 2019) and the earliest the US could leave the Paris Agreement is 4 Nov 2020. Until this time the US will remain a Party to the Agreement and is obliged under international law not to frustrate or obstruct its implementation. 'Paris Agreement Ratification Tracker' (Climate Analytics, July 2018), <http://climateanalytics.org/briefings/ratification-tracker.html> (accessed 30 August 2018).

[38] UNFCCC, 'Nationally Determined Contributions', <https://unfccc.int/process/the-paris-agreement/nationally-determined-contributions/ndc-registry#eq-2> (accessed 30 August 2018).

[39] World Energy Council, 'Global Energy Transition: A Comparative Analysis of Key Countries and Implications for the International Energy Debate' (World Energy Council, 2014), <https://www.atkearney.com/documents/10192/5293225/Global+Energy+Transitions.pdf/220e6818-3a0a-4baa-af32-8bfbb64f4a6b> (accessed 7 October 2018); and Lee Hannah, *Climate Change Biology* (2nd edn, Academic Press, 2015) 379.

required carbon reductions at the necessary pace.[40] In 2016, renewables were the world's fastest-growing energy source, and it is estimated that they will maintain this position up until 2040, and provide about 26% of the global energy mix in 2040 (based on IEA new policy scenario).[41] Despite this progress in renewables, to achieve the Paris Agreement targets, faster re-allocation of capital flows in the energy sector in favour of renewables and low-carbon energy technologies is essential.[42]

Iran signed the Paris Agreement in 2016 but it has not ratified it yet because of the objection by the Guardian Council.[43] The Guardian Council argued that as the INDC is an international obligation, so that it must be enacted by the Parliament,[44] while the INDC was submitted to the UNFCCC without the Parliament's approval.[45] Further, the Agreement has domestic opponents who argue that Iran, by ratifying it, would expose itself to significant expenses and that it might also have adverse effects on the national interest.[46] In response, the government of Iran has emphasised that its commitment to reduce GHG emissions through conditional and unconditional mitigation actions is non-binding.[47] The unconditional mitigation action is to reduce GHGs by 4% by 2030, compared to the Business As Usual (BAU) scenario. This level will be achieved through the development of combined-cycle power plants, renewable energy and nuclear power, the reduction of gas flare emissions, increasing energy efficiency, substituting high-carbon fuels with natural gas, and strategic planning for utilizing low-carbon fuels.[48] The conditional mitigation action is an additional reduction of up to 8% of GHGs against the BAU scenario (total 12%) provided the removal of sanctions and the non-imposition of any restriction or sanctions in the future.[49]

Iran's Internal Obligations

In addition to the international obligations, Iran has also internal obligations to reduce GHGs and develop its renewable energy sources, which are in line with its international commitments. These obligations have been addressed in regulations and national plans, including the Fifth Five-Year National Development Plan (FYNDP) (2010–2015),[50] and the Six FYNDP (2016–2021).[51] However, due to the sanctions imposed in the last few decades, not only were the targets in the above documents not achieved, but energy intensity and GHG emissions have

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[40] International Renewable Energy Agency (IRENA), 'Global Energy Transition: A Road Map to 2050' (IRENA, 2018), <http://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Apr/IRENA_Global_Energy_Transformation_2018_summary_EN.pdf?la=en&hash=2335A542EF74D7171D8EC6F547C77395BDAF1CEE> (accessed 31 August 2018); and Antonio Romano, 'Renewable investments: The impact of green policies in developing and developed countries' (2017) 68(1) *Renewable and Sustainable Energy Review* 738–747.

[41] IEA, 'World Energy Outlook 2016' (IEA, 2016) < https://www.iea.org/publications/freepublications/publication/WorldEnergyOutlook2016ExecutiveSummaryEnglish.pdf> (accessed 13 January 2019).

[42] IEA, (n 12).

[43] The Iranian Constitution, art. 4: 'All civic, penal, financial, economic, administrative, cultural, military, political, and other laws and regulations must be based on Islamic criteria. This principle governs all the articles of the constitution, and other laws and regulations. The determination of such compatibility is left to the Foqaha of the Guardian Council

[44] Guardian Council, 'نظر شورای نگهبان در مورد موافقت نامه پاریس'The Guardian Council's Opinion' (December 2016).

[45] Ibid.

[46] Maryam Qarehgozlo, 'Is Iran Pulling out Paris Agreement?' (*Tehran Times*, 20 May 2018), <https://www.tehrantimes.com/news/423741/Is-Iran-pulling-out-of-Paris-Agreement> (accessed 12 July 2018).

[47] INDC, (n 6).

[48] Ibid.

[49] Ibid.

[50] The Parliament, The Fifth FYNDP (2010-2015).

[51] The Six FYNDP (2016-2021), (n 7).

actually increased.[52] For instance, based on the Fifth FYNDP, Iran had a target to reduce energy intensity by 30% and generate 5,000 MW from renewable energies by 2015,[53] but because of the financial and technological shortages stemming from the sanctions, these targets were not achieved.[54] Further, according to the Sixth FYNDP, the government is obliged to increase the share of renewable energy resources to at least 5% of the total power generation mix by 2021.[55]

Despite the international and national commitments of Iran to reduce GHG emissions and increase the share of renewables in its energy mix, as experiences have demonstrated, sanctions hinder the successful achievement of such targets which are examined in the next sections in detail.

The Importance of Energy Transition in Iran

Iran is known as an oil and gas rich country with huge amount of production (oil: 217.62 Mtoe, and gas: 169.07 Mote in 2016) and consumption (oil: 79.18Mtoe and gas: 166.45 Mtoe in 2016).[56] The amount of oil and gas in Iran could last for 86.5 years and 148 years, respectively, if production were to continue at the rate of 2017.[57] These huge levels of oil consumption and production have had negative environmental and climate change implications.[58] In 2016, Iran was the seventh largest CO_2 producer, producing about 656 MT.[59] In terms of environmental challenges, air pollution is the most critical energy-related challenge for Iran; four of the ten most polluted cities in the world are in Iran.[60] The most hazardous of the air pollutants are products of fossil fuels.[61] It is estimated that, in 2013, more than 19,500 deaths in Iran were attributable to air pollution.[62] The economic cost of air pollution was estimated at 2.2% of Iran's GDP, or 13 billion USD per year.[63]

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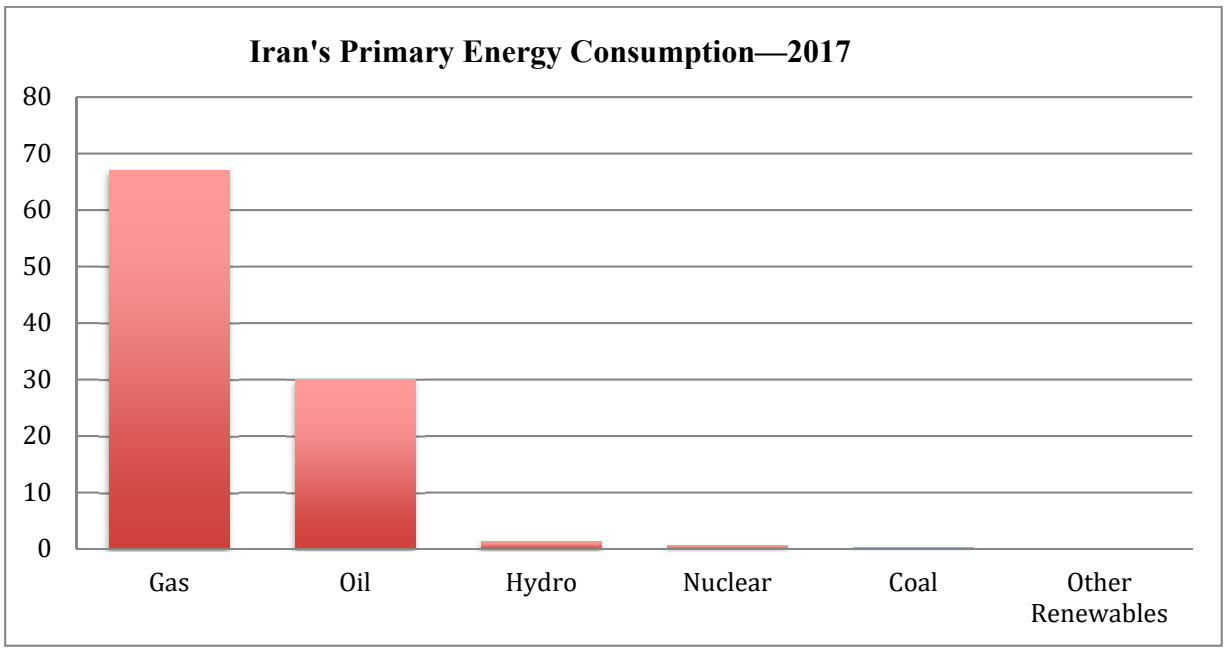
[52] INDC, (n 6).
[53] The Fifth FYNDP (2010–2015), (n 50) art. 139.
[54] Ministry of Energy, Renewable Energy, and Energy Efficiency Organisation (SATBA), 'Your World First: Renewable Energy in Iran' (SATBA, 2016) <http://www.satba.gov.ir/suna_content/media/image/2017/02/5196_orig.pdf?t=636219021775330000> (accessed 4 February 2018).
[55] The Six FYDP (2016–2021), (n 7).
[56] This amount of production and consumption put Iran as the 6th and 12th largest crude oil producer and consumer, and 3rd and 4th natural gas producer and consumer respectively. IEA, 'IEA Energy Atlas' (IEA, 2016) < http://energyatlas.iea.org/#!/tellmap/-1165808390/1> (accessed 25 January 2019).
[57] In 2017, Iran produced around 3,867 million barrels of oil per day (mmb/d), and 238,003 million cubic metres (m/cm) of gas. See: BP, 'Oil Reserves' (BP, 2018), <https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/oil/oil-reserves.html> (accessed 21 June 2018).
[58] Mohammad J. Amiri and Saeid S. Eslamian, 'Investigation of Climate Change in Iran' (2010) 3(4), *Journal of Environmental Science and Technology 208-216.*
[59] Global Carbon Atlas, 'CO_2 Emissions by Country', <http://www.globalcarbonatlas.org/en/CO2-emissions> (accessed 5 February 2018).
[60] United Nations Environment Programme (UNEP), 'Air Quality Policies: Iran' (UNEP, 2015), <https://wedocs.unep.org/bitstream/handle/20.500.11822/17218/Iran.pdf?sequence=1&isAllowed> (accessed 5 February 2018).
[61] Petroleum, petrochemicals, fertilizers, caustic soda, energy, power and cement are the main industries contributing to this air pollution. In 2016, Iran was the world's third largest flaring country. Flaring gas wastes a valuable energy resource that could be used to support economic growth. It also contributes to climate change by releasing millions of tons of CO_2 into the atmosphere.
[62] World Bank, 'Iran Economic Monitor: Toward Reintegration' (World Bank Group, 2016), <http://documents.worldbank.org/curated/en/741891483046725613/Iran-economic-monitor-towards-reintegration> (accessed 5 February 2018).
[63] Ibid.

In 2017, Iran's total primary energy consumption was about 275.4 million tonnes of oil equivalent (Mtoe),[64] which placed the country as the world's tenth largest energy consumer[65] and, in terms of energy consumption per head of population, it is estimated that Iran is 80% above the average of the Middle East.[66] This high level of energy consumption is mainly attributed to high levels of energy and fuel subsidies for both consumers and businesses.[67] In 2017, Iran paid the largest amount of energy subsidies (for electricity, coal, gas and oil).[68] Of its total primary energy consumption in 2017[69] (Figure 1), natural gas was the leading type of energy used, at around 67%, followed by oil at around 31%, hydro-electricity at about 1.3%, nuclear at 0.58%, coal at 0.39% and other renewables at 0.036%.[70]

Figure 1: Iran's Primary Energy Consumption—2017



Source: BP Statistical Review of World Energy.

Regarding the power sector, Iran's nominal capacity to generate electricity reached about 77,000 megawatts (MW) in 2017,[71] over 62,000 MW of which are accounted for by thermal power plants, including steam-powered power plants (15,829MW), gas-powered stations

[64] BP, 'BP Statistical Review of World Energy' (BP, June 2017), <http://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/statistical-review-2017/bp-statistical-review-of-world-energy-2017-natural-gas.pdf> (accessed 8 September 2018).
[65] 'Total Energy Consumption: Slight Recovery in Energy Consumption in 2016' (Global Energy Statistical Year Book, 2017), <https://yearbook.enerdata.net/total-energy/world-consumption-statistics.html> (accessed 4 February 2018).
[66] SATBA, (n 54).
[67] Ibid.
[68] IEA, 'Energy Subsidies by Countries' (IEA, 2017), <https://www.iea.org/weo/energysubsidies/> (accessed 4 February 2018).
[69] Primary energy comprises commercially-traded fuels, including modern renewables used to generate electricity. BP, (n 64).
[70] Ibid.
[71] 'Statistical Summary of Iran's Electricity Industry in 1395', (Electric Power Industry Statistics), <http://amar.tavanir.org.ir/pages/vaziat/kholase-kol.php> (accessed 3 February 2018).

(27,258 MW), and combined-cycle plants (19,470 MW).[72] The rest comes from hydropower plants (12,000 MW), distributed generation station (1,500 MW), Bushehr nuclear plant (the only nuclear power plant in the south of Iran) (1,000 MW), and other renewables (less than 500 MW).[73] In 2016, Iran generated almost 276 billion kilowatt hours (kWh) of electricity, of which more than 90% were from fossil fuel sources, including 70% gas and 23% oil.[74]

Iran's geographic position is suitable for different forms of renewable energy. The southern provinces are suitable for solar and wind energy. Iran is located on the world's 'Solar Belt', experiencing high amounts of solar radiation and an average of 300 sunny days per year.[75] 1.7 million hectare (ha) of Iranian land receives more than 270 watts per square metre (W/m^2), and 28 million ha—which is equivalent to 17.5% of the country's total area—receives somewhere between 250 and 270 W/m^2.[76] In addition, Iran has the potential to produce 1.4 gigawatts (GW) of wind power, since 2.1 million ha of Iran's land has an average annual wind speed of 8 metres per second (m/s).[77] Nevertheless, the share of renewable energy, excluding hydro-power, of the country's overall electricity generation is less than 1%.[78] This is mainly because of cheap resources of fossil fuels, the lack of infrastructure, investment and technology.[79]

The country's huge reliance on the production and consumption of fossil fuels and its climate change and environmental implications necessitate an energy transition away from fossil fuels. Furthermore, an overreliance on only one or two sources of energy has made the country vulnerable to any variation in production, investment, export and the price of the sources, and has generally reduced its energy security.[80] To improve its energy security, the country must diversify its energy types; based on the geographic position of Iran, the development of different forms of renewable energy is the best and most readily applicable alternative. However, developing renewables depends on three main factors: foreign investment, technology transfers and government policy. Almost all of these have been adversely affected by the re-imposition of the economic and financial sanctions on Iran by the US, following the withdrawal of the US from the JCPOA in May 2018.

The Impact of Sanctions on Iran's Transition to Renewables

The history of the US imposing sanctions on Iran can be traced back several decades for a wide range of issues, such as supporting National Liberation Movements, which some of them are internationally designated as terrorists, abusing human rights and Iran's potential access to weapon of mass destructions.[81] The US has imposed sanctions on Iran since the event of

[72] 'Iran Thermal Power Plants Capacity at 62,000 MW', (*Financial Tribune*, 26 September 2017), <https://financialtribune.com/articles/energy/73106/iran-thermal-power-plants-capacity-at-62000-mw> (accessed 12 January 2019).
[73] Ibid.
[74] EIA, (n 5).
[75] SATBA, (n 54).
[76] Pooya Azadi et al., 'The Outlook for Natural Gas, Electricity, and Renewable Energy in Iran' (Stanford Iran 2040 Project, Working Paper 3, 2017) <https://iranian-studies.stanford.edu/sites/g/files/sbiybj6191/f/publications/the_outlook_for_natural_gas_electricity_and_renewable_energy_in_iran_2.pdf> (accessed 26 August 2018).
[77] Ibid.
[78] EIA, (n 5).
[79] Mohsen Hemmati, 'A Sustainable Transition to Renewable Energy Resources in Oil Producing Countries: A Case Study of Iran' (Master Thesis, University of Lund 2017).
[80] Heffron et al., (n 2), 45.
[81] Daniel L. Byman, 'Iran, Terrorism, and Weapon of Mass Destruction' (2008) 31(3) *Studies in Conflict & Terrorism* 172; Gawdat Bahgat, 'Iran, the United States, and the War on Terrorism' (2003) 26 (2) *Studies in*

hostage taking in Tehran in 1979.[82] Unlike the US, which chose the policy of containment, the European states had no intention of abandoning all links with Iran, so that have embraced the policy of engagement with Iran.[83] The 'secondary' sanctions by the US had begun with the D'Amato bill (1995), the Iran and Libya Sanction Acts (1996) which had its name changed to the Iran Sanction Acts (2006) and its amendment (2010).[84] Following the resumption of Iran's nuclear programme in 2007, the EU changed its policy and imposed sanctions on Iran's nuclear and ballistic missile programmes, froze the assets of the Central Bank of Iran, imposed an oil embargo, stopped all trade in gold, metals and diamonds, and went on to ban insurance for shipping in 2012.[85] The secondary sanctions by the US before 2010 were not effective enough due to a lack of support from the EU, but when the EU joined the US in imposing sanctions against Iran, the secondary sanctions have adversely affected Iran's sectors, including energy sector. The main secondary sanctions were imposed on the Iranian energy sector, due to Iran's huge oil and gas reserves, and its revenue and GDP dependency on these sources. These secondary sanctions, which aimed to prevent international companies accessing the US market if they did business with Iran,[86] applied through different Acts and Executive Orders (EOs).[87]

Iran and the P5+1 countries, including China, France, Russia, the United Kingdom, and the United States, plus Germany reached an agreement—the Joint Comprehensive Plan of Action (JCPOA)—on 14 July 2015, and the United Nations Security Council (UNSC) issued Resolution 2231 (2015) which terminated all provisions relating to nuclear proliferation.[88] The EU also lifted all financial and economic sanctions relating to the Iranian nuclear programme, including banking and insurance measures,[89] oil, gas and petrochemical sectors, shipping,

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Conflict and & Terrorism 93, Gawdat Bahgat, 'Iran and Terrorism: The Transatlantic Responses' (1999) 22 (2) *Studies in Conflict & Terrorism* 141; and Gray Sick, 'Iran: Confronting Terrorism' (2003) 26 *Washington Quarterly* 83.

[82] Zeynab Malakoutikhah, 'Iran: Sponsoring or Combating Terrorism' (2018) *Studies in Conflict and Terrorism*, DOI: 10.1080/1057610X.2018.1506560; and David P. Houghton, 'Explaining the Origins of the Iran Hostage Crisis: A Cognitive Perspective', (2006) 18(2) *Terrorism and Political Violence* 259 – 279.

[83] See: Richard Nephew, *The Art of Sanctions: A View from the Field* (New York, Columbia University Press, 2018).

[84] Megan McCurdy, 'Unilateral Sanctions with a Twist: The Iran and Libya Sanctions Act of 1996' (1997) 13(2) *American University International Law Review* 398-437.

[85] The EU Sanctions on Iran: Council Common Position 2007/140/CFSP, Council Decision 2010/413/CFSP, 2011/235/CFSP, 2012/35/CFSP, 2012/152/CFSP, and 2012/635/CFSP.

[86] 'Sanctions against Iran: A Guide to Target, Terms and Timetables; Addendum to Decoding the Iran Nuclear Deal', (Belfer Centre for Science and International Affairs, Harvard Kennedy School, 2015), <http://belfercenter.ksg.harvard.edu/files/Iran%20Sanctions.pdf> (accessed 11 July 2016).

[87] The US Sanction; Executive Order No. 12170, 12205and 12211 (1979_1980), State Sponsor of Terror Designation (January 1984), Executive Order No. 12613 (1987), Iran-Iraq Arms Non-Proliferation Act (October 1992), Executive Order No. 12938 (1994), Executive Order No. 12957 and 12959 (1995), Iran and Libya Sanction Act of 1996, Pub.L. 104-172, 110 Stat. 1541, codified as amended at title 50 U.S.C. ch. 35 § 1701 et seq., Executive Order No. 13059 (1997), Iran Non-proliferation Act of 2000, Pub.L. 106-178, 114 Stat. 38, codified as amended at title 50 U.S.C. ch. 35 § 1701, Executive Order NO. 13224 (2001), Executive Order No. 13382 (2005), Iran Freedom Support Act of 2006, Pub.L. 109-293, 120 Stat. 1344, Executive Order No. 13438 (2007), Comprehensive Iran Sanctions Accountability and Divestment Act of 2010, Pub.L. 111–195, 124 Stat. 1312, Executive Order No. 13553 (2010), Executive Order No. 13572 (2011), Executive Order No. 13590 (2011), Section.311 Money Laundering designation, USA PATRIOT ACT of 2011, Pub.L. 107-56, 115Stat. 272, Section 1245, National Defence Authorisation Act for Fiscal Year 2012 of 2011, Pub.L. 112-18, 125Stat. 1298, Executive Order No. 13599 (012), Executive Order No. 13606 (2012), Executive Order No. 13608 (2012), Executive Order No. 13622 (2012), Iran Threat Reduction and Syria Human Rights Act of 2012, Pub.L 112-158, 126Stat. 1214, Executive Order NO. 13628 (2012), Iran Freedom and Counter-Proliferation Act of 2012, Subtitle D Pub.L. 112-239, 126Stat, Executive Order No. 13645 (2013)

[88] UNSC, Res 2231 (2015), S/RES/2231 (2015), 7488th meeting 20 July 2015.

[89] See: Annexes VIII and IX to Regulation (EU) No. 267/2012.

shipbuilding and transport sectors, gold, other precious metals, banknotes and coinage, metals, software and the de-listing of persons, entities and bodies.[90] The US ceased 'secondary' sanctions and terminated the Executive Orders[91] from the Implementation Day of the JCPOA, on January 16, 2016, onwards.[92] However, on 8 May 2018, President Trump decided to cease US participation in the JCPOA and to re-impose sanctions because he considered the JCPOA as a failed agreement to deal with the threat of Iran.[93] Although the effects of sanctioning a regime can be discussed in an array of aspects, this section focuses on the effects of sanctions on the development of renewable energy in Iran.

Investment and Technology Transfer

Energy transition processes are, by and large, capital intensive and thus require huge amounts of initial investment and technology, especially in developing countries.[94] The particular dependence of developing countries, such as Iran, on financial assistance and technology transfer from developed countries to achieve GHG emission reduction through energy transition has been recognised in different conventions based on the 'common but differentiated responsibilities' principle,[95] and has been explicitly mentioned by Iranian officials.[96]

In Iran, the total annual investments needed to achieve unconditional and conditional GHG mitigation are about $17.5 and $52.5 billion respectively.[97] In particular, to achieve 5000 MW of renewable power generation capacity, which is Iran's target by 2021, Iran needs investment worth about $13 billion.[98] In addition, it needs advanced technologies in different sectors, and to facilitate the use of renewable and alternative energy resources (like nuclear power), as well as biofuels, biogas, waste-to-energy production, and carbon capture and storage (CCS).[99]

Following the lifting of sanctions through the JCPOA, Iran increased its oil exports, regained access to foreign exchange reserve funds, was reintegrated into the international financial system, and attracted foreign investment in key sectors.[100] Based on official Iranian announcements following the lifting of sanctions in 2016, foreign investors, in particular European companies, submitted investment proposals worth $3.6 billion concerning the

[90] JCPOA (2015), (n 10), No. 19, 20 and 26.
[91] Ibid, No. 18, 19, and 21.
[92] The U.S. Department of the Treasury, 'Guidance Relating to the Lifting of Certain U.S. Sanctions Pursuant to the Joint Comprehensive Place of Action on Implementation Day', (The U.S. Department of the Treasury and the U.S. Department of State, Guidance Document, 2016), <https://www.treasury.gov/resource-center/sanctions/Programs/Documents/implement_guide_jcpoa.pdf> (accessed 12 July 2018).
[93] The U.S. Department of the Treasury, 'Iran Sanctions' (Resource Centre, May 2018), <https://www.treasury.gov/resource-center/sanctions/Programs/Pages/iran.aspx> (accessed 1 July 2018).
[94] See: Charles W. Donovan, 'Introduction to Renewable Energy Finance' in Charles W. Donovan (ed.) *Renewable Energy Finance: Powering the Future* (London: Imperial College Press, 2015) 9.
[95] UNFCCC (1994), (n 19), arts 4 (8) & (9); and Hooman Peimani, 'Financial Barriers to the Development of Renewable and Green Energy Projects in Asia' (ADB Institute, August 2018), <https://www.adb.org/sites/default/files/publication/445156/adbi-wp862.pdf> (accessed 14 September 2018).
[96] Iranian Labour News Agency (ILNA), 'کارنامه وزارت نیرو پس از لغو تحریم The Outcome of the Energy Ministry after Lifting Sanctions', (January 2017) <https://www.ilna.ir> (accessed 17 September 2018); and Mohammad Zarnegar, 'Renewable Energy Utilisation in Iran' (2018) 40(7) *Energy Sources* 769.
[97] INDC, (n 6).
[98] Tsvetana Paraskova, 'Foreign Investors Offer $3.6 B to Develop Iran Renewables' (*Oilprice.com*, 20 August 2017), <https://oilprice.com/Latest-Energy-News/World-News/Foreign-Investors-Offer-36B-To-Develop-Iran-Renewables.html> (accessed 23 June 2018).
[99] INDC, (n 6)
[100] Kennet Katzman, 'Iran Sanctions' (US Congressional Research Service, September 2018).

development of renewable energy projects by October 2017.[101] However, due to the return of secondary sanctions on foreign firms that do business with Iran, many foreign companies interested in investing in renewable energy have decided to leave Iran.[102] For instance, the UK-based venture firm Quercus announced its halting of the construction of a solar power plant ($570 million) because of the US's sanctions. This project would have been the world's sixth largest solar plant, with a 600 MW capacity.[103] In another case, Norway Saga Energy, which signed a $2.9 billion deal in October 2017 to build a solar power plant in Iran, ceased all activities and left the Iranian market.[104]

In addition to the secondary sanctions and foreign companies' fear of being fined by the US and losing the US market, the financial restrictions resulting from financial sanctions are another reason for leaving Iran's renewable energy market. Iran is a primary target of the US's financial sanctions regime and the US makes an effort to prevent Iran from using the international financial system, through convincing banks in different countries to cease handling Iran's financial transactions.[105] The financial sanctions imposed on Iran are concentrated on the flow of funds and other forms of value to and from Iran, as well as corporations, individuals and other entities. These sanctions prohibit financial transactions and make the export and import of goods and services difficult.[106] The main financial sanctions, as they relate to this article, can be divided into three categories. The first category bans direct access to the US financial system, which means that US dollars cannot be directly transferred to Iranian banks.[107] The second category bans indirect access (U-turn transactions) to the US financial system. The ban on U-turn transaction means sanctioning non-Iranian foreign banks that are handling transactions on behalf of Iranian banks.[108] The third category includes sanctions on foreign banks conducting transactions with sanctioned Iranian entities, including opening new correspondent or payable-through accounts for any foreign banks doing business with Iran's energy sectors.[109]

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[101] Watson Farley and Williams, 'An Update on Renewable Energy on Iran', (Watson Farley and Williams, April 2018), <http://www.wfw.com/wp-content/uploads/2018/04/WFWBriefing-Renewable-Energy-Iran-Update.pdf> (accessed 16 August 2018).

[102] Lefteris Karagiannopoulos, 'Exclusive: UK's Quercus Pulls Plug on $570 Million Iran Solar Plant as Sanctions Bite' (*Reuters*, 14 Aug 2018) <https://www.reuters.com/article/us-iran-sanctions-quercus-exclusive/exclusive-britains-quercus-pulls-plug-on-570-million-iranian-solar-plant-idUSKBN1KZ0ZR?feedType=RSS&feedName=environmentNews> (accessed 14 August 2018).

[103] Ibid.

[104] Omid S. Kalehsar, 'Iran's Renewable Energy Outlook Dims after US Withdrawal from the Nuclear Deal', (*Atlantic Council*, 16 July 2018) <http://www.atlanticcouncil.org/blogs/iransource/iran-s-renewable-energy-outlook-dims-after-us-withdrawal-from-the-nuclear-deal-2> (accessed 20 July 2018).

[105] The Comprehensive Iran Sanctions, Accountability and Divestment Act of 2010 (CISADA); the US Patriot Act's Money Laundering Designation of 2011; the National Defence Authorization Act of 2012 (NDAA); the Iran Threat Reduction and Syria Human Rights Act of 2012; the National Defence Authorisation Act of 2013.

[106] Barry E. Carter and Ryan M. Farha, 'Overview and Operation of US Financial Sanctions, Including the Example of Iran' (2013) 44(3) *Georgetown Journal of International Law* 904.

[107] US Congressional Research Service, 'Iran Sanctions', (January 2019) <https://fas.org/sgp/crs/mideast/RS20871.pdf> accessed 20 January 2019.

[108] Ibid.

[109] CISADA, Section 104; IFCA, Section 1244(d). See: Jonathan Brewer, 'UN Financial Sanctions on Iran' (2016) 161 (4) *RUSI Journal*, 22-26; Megan McCurdy, 'Unilateral Sanctions With a Twist: The Iran and Libya Sanctions Act of 1996' (1997) 13(2) *American University International Law Review* 398-437; Sanction Against Iran: A Guide to Target, Terms and Timetabled; Addendum to Decoding the IRAN Nuclear Deal', (Belfer Center for Science and International Affairs, Harvard Kennedy School 2015) < http://belfercenter.ksg.harvard.edu/files/Iran%20Sanctions.pdf> (accessed 15 January 2019).

In addition to the previously mentioned sanctions, under the US Patriot Act 2001, Iran has been identified as 'a major money laundering country'.[110] By the same token, in 2017, Iran was ranked as the highest risk country in terms of money laundering by the Basel Institute on Governance.[111] Furthermore, the Financial Action Task Force (FATF)[112] as an inter-governmental body with the objective to set standards for anti-money laundering and counter-terrorism financing, recognised Iran as a high-risk and non-cooperative jurisdiction.[113] The main reason for being the high-risk country is deficiencies in anti-money laundering and counter-terrorism financing measures.[114] From 2009 to 2016, the FATF called on its members and other jurisdictions to apply effective counter-measures with regard to Iran.[115] The counter-measures consist of a range of different activities, from enhanced due diligence to the limitation or prohibition of financial transactions with Iran. From June 2016 to the present date (February 2019), the FATF has suspended counter-measures in order to monitor Iran's progress in implementing the anti-money laundering and counter-terrorism financing measures.[116] Although the FATF's recommendations are not binding, in practice, positioning Iran as a non-cooperative country creates difficulties with transactions.

The EU has declared its commitment to the JCPOA regardless of the withdrawal of the US, it is in the process to protect European companies and banks from potential effects of US sanctions,[117] and to establish a Special Purpose Vehicle (SPV) to facilitate payments related to Iran's exports and imports.[118] The EU's efforts have not been effective so far, as the strict regulations impose on banks; if banks have a relationship with Iran, they might violate sanctions against Iran and consequently encounter fines and penalties.[119] As an example, HSBC in 2012, Deutsche Bank in 2013, BNP Paribas in 2014, and Crédit Agricole in 2015, were fined due to breaching of sanctions against Iran.[120]

However, there is still potential for smaller international banks and companies, which do not have the benefit of accessing the US market, to handle transactions and also invest in renewable

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[110] United States of America: Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism Act of 2001 (US Patriot Act 2001), 26 October 2001, Section 311.

[111] Basel Institute on Governance, 'Basel AML Index Report 2017', <https://index.baselgovernance.org/sites/index/documents/Basel_AML_Index_Report_2017.pdf> (accessed 15 August 2018).

[112] See: FATF Official Website, <http://www.fatf-gafi.org/home/> (accessed 25 September 2018).

[113] FATF, 'High-Risk and Other Monitored Jurisdictions' <http://www.fatf-gafi.org/countries/#high-risk> (accessed 19 January 2019).

[114] FATF, 'Public Statement- October 2018', (19 October 2018, Paris), <http://www.fatf-gafi.org/publications/high-riskandnon-cooperativejurisdictions/documents/public-statement-october-2018.html> (accessed 20 January 2019).

[115] FATF, 'FATF Statement' (26 June 2009, Paris), <http://www.fatf-gafi.org/publications/high-riskandnon-cooperativejurisdictions/documents/fatfstatementconcerningiranuzbekistanturkmenistanpakistanandsaotomeandprincipe-26february2009.html> (accessed 14 August 2018).

[116] Ibid.

[117] EU External Action Services, 'Statement from the Joint Commission of the JCPOA' (July 2018) < https://eeas.europa.eu/headquarters/headquarters-homepage/48076/statement-joint-commission-joint-comprehensive-plan-action_en > (accessed 10 September 2018).

[118] EU Task Force Iran, 'Implementation of the Joint Comprehensive Plan of Action: Joint Ministerial Statement' (September 2018) https://eeas.europa.eu/headquarters/headquarters-homepage/51036/implementation-joint-comprehensive-plan-action-joint-ministerial-statement_en> (accessed 30 September 2018).

[119] IMF, 'The Withdrawal of Correspondent Banking Relationships: A Case for Policy Action' (IMF 2016) <www.imf.org/external/pubs/ft/sdn/2016/sdn1606.pdf> (accessed 7 January 2019).

[120] 'Fines for Banks that Breached US. OFAC Sanctions' (Reuters, 2018) < https://www.refinitiv.com/content/dam/gl/en/documents/infographics/fines-for-banks-that-breached-us-sanctions-infographic.pdf> (accessed 20 January 2019).

energy projects in Iran. As an example, the German renewable energy company Durian GmbH, which is developing a 100 MW project, has decided not to cease its activities although the progress is slow, and it might faces problems regarding transactional security.[121]

As a result of the above-mentioned financial sanctions and restrictions, foreign companies and banks are reluctant to invest in and/or to finance projects inside of Iran due to the problems with financial transactions, impediments from the US market, and the probable fines imposed on them by breaching the US sanctions.

Iranian Renewable Energy Policy

When issues of national survival of a country are at stake, abstract priorities tend to be set aside,[122] and consequently the policy will shift to keep national survival. In addition to the adverse effects of sanctions on investment and technology transfer, the sanctions negatively influence the policies of renewable energies on three different levels: by making ineffective the policy mechanisms designed to accelerate renewable energy sector, by forcing the Paris Agreement targets to be discarded, and by marginalising energy transition through a greater focus on petroleum production, export and consumption. These three levels are discussed in detail as follows.

Although the extent to which the re-imposition of sanctions might impact the economy is difficult to predict due to uncertainties around the various aspects, based on the current data, the two main immediate implications so far have been a fall in the value of the Rial (Iranian currency) against foreign currencies,[123] and a soaring inflation rate.[124] Iran's implementation of a feed-in tariff mechanism in the context of a guaranteed Power Purchase Agreement (PPA) with a 20-year term[125] has been the country's main policy for attracting private sector investment to its renewable energy sector.[126] PPA is a long-term agreement to buy power from a company that produces it. PPA allows the government to host a power system with no upfront costs.[127] In exchange, it agrees to purchase electricity from the system owner at a pre-determined rate over a 20 or 30-year term.[128] However, in the case of Iran the PPA is provided with the specified tariffs, during years of contract, the tariffs will be adjusted in accordance with coefficient.[129] Yet because of the deterioration of the macro-economic situation due to sanctions, the policy lost its attractiveness.

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[121] Marian Willuhn, '5 GW of Renewable Plans Hang in the Balance Following Re-enaction of Iranian Sanction', (*PV Magazine*, 10 Aug 2018), <https://www.pv-magazine.com/2018/08/10/5-gw-of-renewable-plans-hang-in-the-balance-following-reenaction-of-iranian-sanctions/> (accessed 24 September 2018).
[122] Nephew, (n 83), 80.
[123] The Guardian, 'Iranian Rial Hits All-Time Low as Citizens Scramble for US Dollars', (The Guardian, 11 April 2018), <https://www.theguardian.com/world/2018/apr/11/iranian-rial-all-time-low-us-dollars-tehran> (accessed 25 September 2018).
[124] The Central Bank, 'نرخ تورم و شاخص بهای کالاها و خدمات مصرفی (Inflation Rate and Consumer Price Index)' , <https://www.cbi.ir/Inflation/Inflation_FA.aspx> (accessed 25 September 2018).
[125] The Amendment of the Energy Consumption Pattern Act, and its Executive By-law, (2016), art 61.
[126] Mehdi Barimani, 'Cost-Benefit Analysis of Renewable Power Under Full Subsidy Targeting Law Enforcement Conditions in Iran' (2016) 6 (1) *International Journal of Energy Economics and Policy* 106.
[127] Erick Woodroof, *Green Facilities Handbook: Simple and Profitable Strategies for* Managers (CRS Press, 2009, London) 145.
[128] Ibid.
[129] Tariffs for all power plants except wind farms, will be multiplied by 0.7, starting from the first day of the second 10 years till the end of the contract. Tariffs for the wind farms with the capacity factor of 40% and above in the first 10 years, will be multiplied by 0.4, starting from the first day of the second 10 years till the end of the

The currency of payment under the PPA is the Iranian Rial, which has been losing its value against foreign currencies.[130] The collapse of Iranian Rial has caused the costs of producing energy from the renewable technologies raised by three times, while the rate of purchase by the government has not changed correspond with this cost increase.[131] Although PPA provides a method to mitigate the risk of inflation and exchange rate fluctuations, but it applies at the beginning of the year of operation with regard to inflation, and one year before operation with regard to exchange rate fluctuation.[132] It means inflation and exchange rate fluctuation from the date of signature of the PPA to the date of actual operation are not covered.[133] The lack of access to foreign currencies resulting from the various sanctions and restrictions, has let to Iran's inability to reform its policy and pay in any currencies except Rial.[134] This could discourage both foreign and Iranian investors who have the option of investing in another country with a stronger currency.[135]In addition, there are two exchange rate systems in Iran, an official exchange rate that is set by the Central Bank of Iran on a daily basis and used for state transitions, and a free market rate,[136] which the difference between two these exchange rates is so considerable. This raises the question of alignment between the rate applied for the adjustment of the power purchase price and the rate pursuant to which profits can be converted into foreign currency and repatriated by the foreign investor.[137] By December 2018 there have been more than 320 projects under the PPA with a capacity of 4, 204 MW,[138] but many of which have been stopped working because of the exchange rate fluctuation.[139]

Furthermore, renewable projects require large capital costs per unit of actual power capacity, which is estimated to be about between $3,700 to $5,900/$kW_a$, compared to gas-fired plants with about $1,000/$kW_a$.[140] This has created a further barrier to the Iranian government providing capital for the renewable projects, mainly as a result of public funds scarcity.[141] Within this context of economic instability, many investors might also be concerned about the financial capabilities of the relevant Iranian institutions to meet their financial obligations to pay the minimum tariff rates announced.[142] Thus, sanctions may cause the feed-in tariff policy to become ineffective and unattractive in the renewable energy sector through depreciation of

contract. Power plants with capacity factor of 20% will be multiplied by 1 and for the range between 20% and 40% in a proper coefficient.

[130] Watson Farley and Williams, (n 101).

[131] SATBA, 'شرکت های دارای قرارداد خرید تضمینی (The Companies under the PPA)', < http://www.satba.gov.ir/suna_content/media/image/2018/12/7244_orig.pdf> accessed 22 January 2019.

[132] Watson Farley and Williams, (n 101).

[133] Ibid.

[134] The PPA provides a formula for the adjustment of Iranian Rial-denominated tariffs to mitigate the risk of inflation and exchange rate fluctuations. However, inflation and exchange rate fluctuations from the date of signature of the PPA to the date of actual operation are not fully covered. See: SATBA, (n 54).

[135] See: Joel Krupa, and Rahmatallah Poudineh, 'Financing Renewable Electricity in the Resource-Rich Countries of the Middle East and North Africa: A Review' (Oxford Institute for Energy Studies, February 2017) 13.

[136] Financial Tribune, 'Iran Government Unifies Foreign Exchange Rate' (April 2018) < https://financialtribune.com/articles/economy-business-and-markets/84388/breaking-iran-government-unifies-foreign-exchange-rates> accessed 24 January 2018.

[137] Watson Farley and Williams, (n 101).

[138] A management board member of Iranian Wind Energy Association, without specifying, announced the news. See: SATBA, (n 131).

[139] ISNA, 'توقف پروژهای ساخت نیروگاه های تجدید پذیر (Stopping Renewable Energy Plants Projects)' https://www.isna.ir/news/97081407006/ > accessed 23 January 2019.

[140] Azadi et al, (n 76).

[141] Ibid.

[142] Ibid.

Iranian Rial, increasing the cost of construction and production and decreasing the public funds for investment.

The next key policy that is affected by sanctions is the commitment of Iran to the Paris Agreement. Based on Iran's INDC, conditional participation in mitigating GHG emissions, is subject to the removal of all economic, technological and financial sanctions, as well as the non-imposition of new restrictions or sanctions in the future.[143] So the re-imposition of sanctions by the US has already canceled the conditional contribution of Iran, which is 8% reduction. In addition, although the unconditional mitigation is not based on the removal of sanctions, the Iranian government has explicitly mentioned that, on the INDC document, only in the absence of any forms of restrictions and sanctions it could be facilitated and speeded up.[144]

The final policy change stemming from the sanctions involves a renewed focus on the production, export and consumption of oil, gas and petroleum products by Iran, and consequently, a retreat from or deceleration of the energy transition cycle, at least for the moment. The main target of sanctions is to reduce oil and gas exports (as the main country's income sources) to zero, according to a statement by the US National Security Advisor.[145] Regardless of whether or not the US can reduce Iran's oil exports to zero, what is clear is that Iran's oil exports start dropping,[146] even before the commencement date of the petroleum-related transactions sanctions, which was November 2018.[147]

It is estimated that Iran's crude oil and condensate exports in August 2018 dropped to 2.06 mb/d, compared to 3.09 mb/d at their peak in April 2018.[148] One might say that since this restriction will considerably reduce Iran's oil and gas exports and probably its production, it could result in unplanned but desirable circumstances for climate change mitigation; in addition, Iran would be forced to diversify its economy and reduce its dependency on oil and gas. However, Iran's record during the decades of international sanctions reveals that, despite the considerable reduction in its crude oil exports (by more than half in the years between 2011 and 2015), oil, gas and petroleum products still account for 80% of its export in 2018, their revenues are expect to fund half of the 2018–19 budget,[149] and over the last decade, Iran's GHG emissions have increased by 3%.[150] So it seems that energy transition requires long-term planning, financial resources, technologies and capacity, as well as a serious political will to implement it. It is an oversimplification to suppose that restrictions on Iran's oil exports would

[143] INDC, (n 6).
[144] Ibid.
[145] Patrick Wintour, 'US Ready to Drive Iranian Oil Exports to Zero, Says US National Security Adviser', (The Guardian, 22 August 2018).
[146] Paraskova, (n 98).
[147] The U.S. Department of the Treasury, 'Frequently Asked Questions Regarding the Re-Imposition of Sanctions Pursuant to the May 8, 2018 National Security Presidential Memorandum Relating to the Joint Comprehensive Plan of Action (JCPOA)' (The U.S. Department of the Treasury, 6 August 2018) <https://www.treasury.gov/resource-center/sanctions/Programs/Documents/jcpoa_winddown_faqs.pdf> (accessed 27 September 2018).
[148] Florence Tan, 'Iran Oil Export Set to Drop in August Ahead of US Sanctions: Data' (*Reuters*, 28 August 2018), <https://www.reuters.com/article/us-iran-crude/iran-oil-exports-set-to-drop-in-august-ahead-of-u-s-sanctions-data-idUSKCN1LD12M> (accessed 27 September 2018).
[149] 'Efforts to Preserve Economic Benefits of the Iran Nuclear Deal', (US Congressional Research Service, September 2018).
[150] 'Iran GHGs up 3% in decade' (*Financial Tribune*, 16 Nov 2017), <https://financialtribune.com/articles/environment/76232/iran-greenhouse-gas-emissions-up-3-in-decade> (25 September 2018).

accelerate energy transition, GHG emission reduction and a decrease in petroleum reliance. Conversely, it is foreseeable that although sanctions will severely affect Iran's oil exports, Iran will find some way to circumvent the sanctions as it has done over the past decades when international sanctions were imposed on Iran. If the methods for circumvent of sanctions were adopted, the focus would be on the petroleum rather than renewable energy because of its importance for the economy of the country. Since Iran's economic activity and government revenues depend to a large extent on oil revenues,[151] it seems logical to concentrate on selling this commodity rather than on renewable energy sector, which is in early stages. In addition, some of Iran's main oil and gas consumers—such as China and India, which are its first and second largest consumers, respectively—will probably keep buying petroleum and even investing in the oil and gas sector.[152] Furthermore, it is predicted that the consumption of these sources might remain unchanged as part of the Iranian primary energy mix; in 2017, more than 97% of Iran's primary energy consumption was based on fossil fuels,[153] and in 2016 more than 90% of its power generation was from oil and gas.[154] This is mainly because these resources are domestically abundant and cheap, and their infrastructures have already been well-developed, while the renewables are still in their infant stages.

Conclusion

Energy transition from fossil fuels toward renewables has been reinforced since the Paris Agreement (2015) through the creation of targets for reducing GHG emissions by 2040. It has been proven that to successfully achieve the targets of the Agreement, the contribution of all countries (including developed and developing countries) are needed. Further, the developed countries must shoulder more responsibility in order to support developing and vulnerable countries, based on the 'common but differentiated responsibility' principle. However, in the case of Iran which is known as an oil and gas rich country, with a high share of GHG emissions and low share of renewables in its energy mix, moving toward energy transition would be a considerable step for both the country and the international community. The re-imposition of sanctions on Iran following the US withdrawal from the JCPOA in 2018 has impeded this energy transition in Iran. These sanctions create restrictions and barriers in two main ways. The first of these involves the lack of investment and technology transfer due to the reluctance of and difficulties for many major renewables companies and banks to engage in the Iranian market. The second set of barriers involve the three different levels on which Iranian policy has been negatively influenced: by making the policy of feed-in tariffs ineffective, by allowing the country to overlook its Paris Agreement obligations, and by marginalising the energy transition policy and forcing it to refocus on the petroleum industry. As climate change mitigation is known to be a public good, the US's sanctions on Iran will not only affect Iran, but also the global population as a whole.

[151] The World Bank, 'Overview of Islamic Republic of Iran' <https://www.worldbank.org/en/country/iran/overview> accessed 23 January 2019.
[152] 'Who was buying Iranian oil and what happens next?' (*Oilprice.com*, 9 May 2018), <https://oilprice.com/Energy/Crude-Oil/Who-Was-Buying-Iranian-Oil-And-What-Happens-Next.html?> (25 September 2018).
[153] ibid; and BP, (n 64).
[154] EIA, (n 5).