RENEWABLE ENERGY INVESTMENT IN TURKEY: BETWEEN ASPIRATION AND ENDURANCE

Turkey is endowed with some of the richest and most diverse renewable energy resources in the world. These resources are well-suited to help address some of the country's most compelling energy security, sustainability, and fiscal challenges, but a stable economic and policy environment is necessary. The challenging financial conditions of 2018, combined with a still-evolving policy framework for renewable energy, calls into question whether the country's explosive renewable energy growth will continue over the coming years. Through a combination of prudent economic management, calibration of policy mechanisms to grow both large-scale and small-scale renewables, and an open orientation towards trade and investment, Turkey can still provide a compelling model for clean energy growth as it searches for success stories ahead of the Republic's centennial in 2023.

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Turkey has been, for much if not all of its history, a country of liminality, straddling cultures and continents, balancing modernity with traditionalism. It should come as no surprise, then, that its status in the architecture of international climate change governance, and indeed its status in the global energy transition, is similarly ambivalent. And yet, despite this ambivalence, the sheer logic of renewable energy investment in Turkey continues to push in a positive direction, despite a number of headwinds both foreseeable and unforeseeable.

The climate imperative for Turkish renewables development remains ambiguous at best. Turkey participated in the December 2015 Paris climate conference, submitting a target of reducing its greenhouse gas (GHG) emissions by 21 percent below business as usual in 2030.[1] Despite the Paris Agreement's elimination of the anachronistic distinctions made between developed and developing countries, Turkey was able to negotiate a special status, exempting it from any obligations to provide climate finance to poorer nations.[2] It went on to sign the Paris Agreement in April of 2016.

However, Ankara has left the Agreement unratified, arguing that at the time of the Paris Agreement, France had promised it access to international climate funds to assist with meeting its Paris commitments and that the prospective withdrawal of the United States from the Paris Agreement threatened the provision of such funds.[3] It left the November 2017 UN climate conference early, reportedly unsatisfied with the pace of progress over funding the Green Climate Fund from which it hopes to draw.[4] Moreover, Turkish climate negotiators have recently led an increasingly vocal group of countries that argue all nationally determined contributions (climate commitments) should be voluntary in every way, including being exempted from any formal quantification exercises to measure their significance.[5]

Luckily, however, the logic of capitalizing on Turkey's renewable energy potential does not rely exclusively, nor even primarily, upon fulfilling the country's voluntary

[1] Climate Action Tracker, "Turkey: Pledges and Targets," 2018, https://climateactiontracker.org/countries/turkey/pledges-and-targets/

[2] Michael Schneider, "A Tangled Case – Turkey's Status under the UNFCCC and the Paris Agreement," *International Center for Climate Governance*, No. 53 (July 2017), http://www.iccgov.org/wp-content/uploads/2017/07/53_A-Tangled-Case-%E2%80%93-Turkey%E2%80%99s-Status-under-the-UNFCCC-and-the-Paris-Agreement.pdf

[3] Stefan Wagstyl, "Turkey Push for Climate Funds Adds to Concerns about Paris Accord," *Financial Times*, 9 July 2017, https://www.ft.com/content/bbef9a42-64c0-11e7-8526-7b38dcaef614

[4] "İklim Konferansında Türkiye Rest çekti," [Turkey gives ultimatum in the environment conference] *Habertürk,*, 19 November 2017, https://www.haberturk.com/iklim-konferansinda-talepler-kabul-edilmeyince-turk-heyeti-rest-cekti-1719729

[5] Simon Evans and Jocelyn Timperley, "Bonn Climate Talks: Key Outcomes from the May 2018 UN Climate Conference," *Carbon Brief,* 11 May 2018, https://www.carbonbrief.org/bonn-climate-talks-key-outcomes-from-the-may-2018-un-climate-conference

climate commitments. Indeed, the logic for further development of renewables is rooted firmly in a robust and diversified renewable resource base, acute energy security concerns, and an increasingly supportive renewable energy policy framework. Despite these tailwinds, the country faces a number of challenges in fully capitalizing upon its renewable energy potential, including proper implementation of the policy framework, balancing a desire for domestic value chains against prohibitive domestic content requirements, and challenges related to the recent financial crisis and currency weakness.

> *"The sheer logic of renewable energy investment in Turkey continues to push in a positive direction, despite a number of headwinds both foreseeable and unforeseeable."*

Turkey displays the highest average energy demand growth of all OECD countries over the past 15 years, and its domestic energy production meets only around one-quarter of its total energy use. The country's energy import costs are also rising amid rising oil prices, increasing 37 percent in 2017 to more than 37 billion dollars, or nearly 16 percent of its total import value.[6] And, while there is some debate over Turkey's own estimates—comprising the "business as usual" scenario in its climate commitments—that its energy demand will double from 2016 to 2026, it is clear that it is on pace for continued energy demand growth, so much so that the country's long-stated ambitions of becoming a major natural gas trading hub have been stymied by its own domestic use of most new pipeline capacity into the country.[7] Over the past decade, Turkey has turned into one of the most attractive energy investment destinations globally, with a variety of different energy technologies and opportunities in play. Over the next five years, aggregate energy sector investment needs are expected to be around 110 billion dollars, double the pace of the previous decade.[8]

In light of these dynamics, Turkish policymakers are pursuing a variety of strategies to meet rising demand, reduce import dependence, and bolster the country's energy security. Alongside coal, natural gas, and some nuclear investment, renewables are playing a large role in this strategy. The country is blessed with an abundant

[6] Ebru Sengul, "Turkey's Energy Import Bill up by 37% in 2017," *AA Energy*, 1 February 2018, https://www.aa.com.tr/en/energy/finance/turkeys-energy-import-bill-up-by-37-in-2017/18644

[7] Emre Tunçalp, "Turkey's Natural Gas Strategy: Balancing Geopolitical Goals and Market Realities," *Turkish Policy Quarterly,* Vol. 14, No. 3 (Fall 2015), pp. 67-79, http://turkishpolicy.com/files/articlepdf/turkeys-natural-gas-strategy-balancing-geopolitical-goals-market-realities_en_9097.pdf

[8] "Energy and Renewables - Invest in Turkey," http://www.invest.gov.tr/en-US/sectors/Pages/Energy.aspx.

renewable energy resource base, one that is broad and diversified across solar, wind, geothermal, and hydro resources in a way that few other countries enjoy.[9] With only the wind turbine technology available to the mass market today, let alone future improvements, Turkey has 150 GW of viable, installable wind power capacity.[10]

History of the Renewable Energy Framework

A 2009 Electricity Energy Market and Supply Security Strategy Paper set forth a clear mandate for the government to take steps to increase the share of renewable energy in the power sector, which was soon followed by Turkey's first major national renewable energy targets, established in its 2010–2014 Strategic Plan. These included a goal of having renewables account for 30 percent of total electricity production by 2023 (an important year marking the centennial of the Republic of Turkey), and only included specific technology deployment targets for wind and hydroelectricity, both of which were foreseen as comprising the lion's share of the country's renewable growth to 2023.[11]

The 2015–2019 Strategic Plan held the 30 percent target constant, but added short-term, mid-term, and long-term targets for individual energy technologies, and this time included solar, geothermal, and biomass among them.[12]

The 2015–2019 Strategic Plan also implicitly recognized impediments to faster progress toward the target, in particular, grid interconnection issues for wind farms, as well as the relative dearth of large-scale renewable projects being developed, and included several new policies meant to accelerate renewable project development. Most significant was the issuance of new Renewable Energy Resource Area (YEKA) regulations by the Ministry of Energy's Renewable Energy General Directorate. The YEKA framework seeks to catalyze the development of the country's significant renewable energy potential by streamlining and permitting tender processes, opening up new land for project development, and generally enabling large-scale renewable development. In practice, it represents a "winner-takes-all" auction system.

In August 2018, Turkey revised upwards its renewable target to 50 percent of all electricity production by 2023, following upon data from the country's Energy

[9] Sybille Roehrkasten, Sonja Thielges, and Rainer Quitzow, eds. "Sustainable Energy in the G20," IASS Study, December 2016,
https://www.iass-potsdam.de/sites/default/files/files/iass_study_dec2016_en_sustainableenergyg20_0.pdf

[10] Tanay Sıdkı Uyar, "Barriers and Opportunities for Transformation of Conventional Energy System of Turkey to 100 % Renewable Community Power," in *Springer Proceedings in Energy*, 2017, p. 112.

[11] International Energy Agency, "Strategic Plan 2010," 27 October 2015, https://www.iea.org/policiesandmeasures/pams/turkey/name-24960-en.php

[12] International Energy Agency, "Strategy Plan 2015-2019," 1 December 2015, https://www.iea.org/policiesandmeasures/pams/turkey/name-148506-en.php

Markets Regulatory Authority (EMRA) showing that Turkey had already exceeded 30 percent renewable generation by mid 2018.[13] While hydro is the largest clean energy resource in the country's power mix, accounting for around 20 percent, in the month of August 2018 all non-hydro renewables accounted for roughly another 15 percent.[14] The government also announced that it intends to offer 10 GW of solar and 10 GW of wind tenders over the next decade, suggesting a continued pace of 1 GW of each per year under the YEKA system.

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The same month, as part of a broader economic "100-day action plan" unveiled by President Recep Tayyip Erdoğan amid the summer 2018 Turkish financial crisis, new tenders for three gigawatts (GW) of solar capacity representing just under five billion dollars in value were announced.[15] It remains unclear whether this three GW of solar capacity is additional to, or part of, the existing solar tender program planned over the next decade.

Rooftop Solar Opportunities

Installed solar capacity in Turkey was at just under 3.5 GW at the end of 2017, from only 40 MW in 2014.[16] The majority of this represents unlicensed projects under one megawatt that qualify for a feed-in-tariff, and which have been primarily sited near-by commercial and industrial customers for self-consumption.[17] Unlicensed projects notably do not have a local-content requirement, but have also been excluded from accessing a more generous feed-in-tariff (19.6 cents per kWh versus 13.3 cents per kWh) afforded to projects with a certain quotient of domestic content.[18] To date, unlicensed projects also must access the grid through a connection agreement that is

[13] "Turkish Authorities Aim to Boost Renewable Power Generation to 50 Percent by 2023," *Daily Sabah*, 24 August 2018, https://www.dailysabah.com/energy/2018/08/25/turkish-authorities-aim-to-boost-renewable-power-generation-to-50-percent-by-2023

[14] "Electricity Generation in Turkey," *Turkey's Energy Atlas*, http://en.enerjiatlasi.com/electricity-generation/turkey/.

[15] "Erdogan Announces Turkey's 100-Day Energy Plan," *Anadolu Agency Energy,* 6 October 2018, https://www.aa.com.tr/en/energy/nuclear/erdogan-announces-turkeys-100-day-energy-plan/21122

[16] World Bank, "Turkey: Rooftop Solar Market Assessment," February 2018, http://documents.worldbank.org/curated/en/532211519629608085/pdf/TR-Rooftop-Solar-Output-P162236.pdf

[17] "Turkey's Solar Growth Continues despite Challenging Requirements on Recent Tender'," *PV Europe,* 26 January 2017, https://www.pveurope.eu/News/Markets-Money/Turkey-s-solar-growth-continues-despite-challenging-requirements-on-recent-tender

[18] World Bank, "Turkey: Rooftop Solar Market Assessment."

signed between the project developer and the relevant network operator.[19]

While the unlicensed model has succeeded in stimulating investment in ground-based projects just under one MW, the growth of these projects has slowed since the government made the relevant regulations more stringent in March 2016. Furthermore, the entire unlicensed framework was perceived as providing insufficient incentives and regulatory streamlining in order to promote smaller rooftop solar systems. While the Turkish Solar Energy Association is forecasting total solar capacity to grow to 14 GW in 2023, the country is very unlikely to hit that target without significantly greater rooftop solar deployment.

New regulations were offered by the Energy Market Regulatory Authority in January 2018 to make it easier for the development of household scale (10 kW or less) rooftop solar in Turkey, including a net-metering style provision that would allow such facilities to sell back excess electricity to the grid at 13.3 cents per kWh. This was shortly followed by an amendment to tax statutes, also exempting the excess electricity sales of these small-scale solar facilities from income taxes.[20] These are welcome sources of support for a rooftop solar sector that has thus far underperformed its potential, particularly compared to other large solar markets such as China, Germany, and the United States. However, in order for this potential to be fully harnessed, further policy reforms, such as the removal of import taxes on imported solar PV modules used for rooftop projects and the establishment of a dedicated rooftop solar project credit facility through Turkey's commercial banking system, could be considered. These and other recommendations are succinctly captured in a recent report by the World Bank.[21]

Large Scale Solar and Wind Projects

The government is counting on large-scale solar and wind mega-projects to play a more equitable role, alongside unlicensed projects, in achieving the country's ambitious renewable targets.

Tenders were successfully held for both solar and offshore wind under the YEKA system in 2017. The wind tender, worth around one billion dollars, was particularly impressive, with a consortium of Siemens Gamesa Renewable Energy and two Turkish firms—Kalyon Enerji and Türkerler Holding—winning against seven other bidders to develop 1,000 MW of onshore wind across multiple sites at a tariff of

[19] "Turkey's Renewable Energy Market and Investment Opportunities," *Invest in Turkey,* April 2018, http://www.invest.gov.tr/en-US/infocenter/publications/Documents/RENEWABLES.ENERGY.INDUSTRY.pdf

[20] "Turkey's Renewable Energy Market and Investment Opportunities," April 2018.

[21] World Bank, "Turkey: Rooftop Solar Market Assessment."

3.48 cents per kilowatt-hour (kWh). This was significantly below the global average cost of six cents per kWh for onshore wind in 2017 as reported by the International Renewable Energy Agency (IRENA).[22] A separate solar tender, worth 1.4 billion dollars, was won by Hanwha Q Cells of South Korea in partnership with Kalyon Enerji, and will involve the construction of a 1 GW project in central Turkey at a tariff of 6.99 cents per kWh.[23] This, too, represents attractive pricing considering that the global average levelized cost of utility-scale solar observed by IRENA was 10 cents per kWh in 2017.[24]

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2017 was thus a pivotal year not only in proving out that there would be significant interest in the new YEKA system for tendering pre-identified territory for large-scale renewable projects, but also that the energy costs realized through the auction system would be competitive against both coal and nuclear, other resources backed by the government as solutions to energy security concerns. A major lignite coal tender for a project in Çayırhan in 2017 produced an agreed electricity cost of 6.04 cents per kWh, only narrowly less expensive than the solar project and far costlier than the wind project. And the Akkuyu nuclear plant, the first unit of which is scheduled to be delivered in 2023, has a locked-in electricity price of 12.5 cents per kWh for 70 percent of its production, with the remainder being sold on the spot market.[25]

Early in 2018, the second wave of renewable energy tenders under the YEKA system was announced, one for solar and another for offshore wind. Candidate regions for the 1 GW solar tender include Hatay along the southern coast, Niğde in Central Anatolia and Şanlıurfa in southeast Turkey, while candidate regions for the 1 GW

[22] International Renewable Energy Agency (IRENA), "Renewable Power Generation Costs in 2017," 2018, Abu Dhabi, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Jan/IRENA_2017_Power_Costs_2018.pdf

[23] Hanwha Q. Cells, "Kalyon Enerji Consortium Awarded the Tender to Construct Region's Largest 1 GW Solar Power Plant in Turkey," *PR Newswire: News Distribution, Targeting and Monitoring*, 23 March 2017, https://www.prnewswire.com/news-releases/hanwha-q-cells-kalyon-enerji-consortium-awarded-the-tender-to-construct-regions-largest-1-gw-solar-power-plant-in-turkey-300428308.html

[24] International Renewable Energy Agency (IRENA), "Renewable Power Generation Costs in 2017," 2018, Abu Dhabi, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Jan/IRENA_2017_Power_Costs_2018.pdf

[25] World Nuclear Association, "Nuclear Power in Turkey," http://www.world-nuclear.org/information-library/country-profiles/countries-t-z/turkey.aspx

offshore wind tender include Saros, Kıyıköy and Gallipoli in northwest Turkey.[26]

For future tenders to be successful, the government will need to ensure sufficient interest, participation, and competition. This will not necessarily be easy, as the scale and "winner-take-all" risk of the tenders, significant domestic content requirements, and some degree of regulatory unpredictability all contribute to limiting interest among developers. To the degree that the government can loosen some domestic content requirements, promote further ease of grid interconnection, and provide long-term certainty on feed-in-tariffs, this will help to ensure continued interest in the licensed YEKA project tenders for years to come.

Geothermal Energy Opportunities

Geothermal also represents a promising and underexploited resource base for Turkey, though it has a long history, with the first geothermal electricity production coming from the Kızıldere field starting in 1974.[27] The country has over 1,000 geothermal springs, with around 80 percent of them concentrated in Western Anatolia. The vast majority—90 percent—of these sites are suitable for direct thermal applications, while around 10 percent are potentially suitable for electricity generation.[28] The government has long played an active role in the development of its geothermal sector, and resource administration was divided between the federal government, which led on research projects and those for power generation, and provincial governments, which led on geothermal for heating and direct use.[29]

Since the introduction of a feed-in-tariff and more explicit renewable energy policy framework, however, Turkey has grown its installed geothermal capacity significantly. Over the past decade alone, geothermal has grown from only 30 MW in 2008 to currently ranking fourth in the world, at 1.2 GW total.[30] Notably, the country's previous target of 1 GW of geothermal by 2023 has already been exceeded.

Can Turkey's geothermal sector continue its rapid expansion? Policymakers certainly hope so. The former General Manager of the General Directorate of Renewable

[26] Nuran Erkul, "Turkey Names Candidate Areas for 2nd Renewable Tenders," *Anadolu Agency Energy*, 26 March 2018, https://www.aa.com.tr/en/energy/solar/turkey-names-candidate-areas-for-2nd-renewable-tenders/19385

[27] Ali Kindap et al., "Privatization of Kizildere Geothermal Power Plant and New Approaches for Field and Plant," 2010, https://www.geothermal-energy.org/pdf/IGAstandard/WGC/2010/0708.pdf

[28] "Republic of Turkey Ministry of Energy and Natural Resources - Geothermal," http://www.enerji.gov.tr/en-US/Pages/Geothermal

[29] Sanyal et al., "Comparative Analysis of Approaches to Geothermal Resource Risk Mitigation," World Bank (italik), 2016, http://documents.worldbank.org/curated/en/621131468180534369/pdf/105172-ESM-P144569-PUBLIC-FINAL-ESMAP-GeoRiskMitigation-KS024-16-web.pdf

[30] "Global Geothermal Capacity Reaches 14,369 MW – Top 10 Geothermal Countries, Oct 2018," *Think GeoEnergy - Geothermal Energy News*, http://www.thinkgeoenergy.com/global-geothermal-capacity-reaches-14369-mw-top-10-geothermal-countries-oct-2018/

Energy announced at a conference in April 2018 that the government would set a new 2030 geothermal target of 4 GW, and would also take additional steps to promote further development of geothermal direct thermal applications, as well as diversification of geothermal electricity production beyond Western Anatolia.[31]

> *"Geothermal represents a promising and underexploited resource base for Turkey."*

In order to hit or even exceed these targets, however, Turkey will need to attract additional private entities and capital into a sector that has traditionally been dominated by public investment. Much of the challenge pertains to the particular risk profile of geothermal, which differs significantly from other renewable resources such as solar or wind. The uncertainty associated with prospective geothermal resources cannot be resolved without the expenditure of significant up-front capital in order to drill exploratory wells, often two or more in order to accurately assess the ultimate yield of a site. In this sense, it can be considered more similar to oil and gas, and yet the modeling capabilities that exist in oil and gas are far more mature and developed than those for a smaller and more immature sector such as geothermal.

Until 2013, all but one of the geothermal projects developed in Turkey were developed on sites that had already been de-risked and proven suitable by the government and subsequently put out for tender.[32] Over time, however, the inventory of such de-risked sites will be exhausted and new approaches will be needed. The geothermal plant at Gümüşköy commissioned in 2013 was the first instance of a private firm, BM Holding, taking on significant financial risk to explore and develop a previously-unproven geothermal site, incurring early stage costs that accounted for one-quarter of the project's 50 million dollars total.[33] The European Bank for Exploration and Development (EBRD) played a key role in financing early-stage exploration through a domestic Turkish lender. Going forward, new approaches such as geothermal resource risk insurance, a pioneering "risk sharing mechanism" backed by the World Bank, and enhanced geothermal technologies—perhaps driven in part by collaborations with US research projects—will be critical to ensuring the

[31] "Turkey Remains Bullish on Geothermal Development Setting New Target of 4,000 MW by 2030," *Think GeoEnergy - Geothermal Energy News*," http://www.thinkgeoenergy.com/turkey-remains-bullish-on-geothermal-development-setting-new-target-of-4000-mw-by-2030/

[32] Padraig Oliver and Martin Stadelmann, "Public Finance and Private Exploration in Geothermal: Gümüşköy Case Study, Turkey," 2015, p. 33, https://climatepolicyinitiative.org/wp-content/uploads/2015/03/SGG-Report_Public-Finance-and-Private-Exploration-in-Geothermal_Gumuskoy-Turkey1.pdf

[33] Oliver and Stadelmann (2015).

continued growth of geothermal in Turkey.[34]

Maintaining Growth amid Challenging Conditions

Despite Turkey's prolific renewable resource base and the propitious wave of renewable investment in recent years, the country's renewable sector faces a number of challenges as it evolves to become a fundamental pillar of the economy and the backbone of a more constructive climate policy orientation.

Turkey's steep domestic content requirements ambitions, aimed at lofty ambitions at developing an indigenous renewable manufacturing capacity, present one such challenge. Turkey is considered to have the strictest local content requirements for renewables of any country in the world, first applied to the government's initial solar tender under the YEKA system, along with a prohibitive 50 percent tariff on solar panel imports in July 2016.[35] This initial foray was seen as successful, however, with the winning Kalyon-Hanwha consortium building an integrated solar manufacturing facility in an industrial park outside of Ankara to support its one GW solar project.[36] The facility has a capacity of 500 MW of ingot and wafer production, 650 MW of solar cells, and 800 MW of solar panels, set to begin production in late 2018, and with room to scale further.[37]

The Turkish government is now attempting to achieve the same indigenization of manufacturing and supply chains in the wind sector, where successful bids require a local content requirement of at least around 60 percent for onshore wind and slightly less for offshore wind projects.[38] Although there is already a Turkish industrial base capable of constructing at least some towers, blades, foundations, and other components for wind power in the country, further work will be needed to establish a robust manufacturing platform capable of both exports to the broader region as well as further R&D to advance wind energy productivity.[39]

The ultimate costs and benefits of the domestic content effort are still uncertain, with Turkey facing a particularly uphill battle in the solar sector. China currently has

[34] "Türkiye Jeotermal Risk Paylaşım Mekanizması," [Turkey's Geothermal Risk Sharing Mechanism] http://rpmjeotur-kiye.com/en/homepage/

[35] "Turkey Seeking Renewables Industry With Make-It-Here Rules," *Bloomberg,* 22 November 2016, https://www.bloomberg.com/news/articles/2016-11-22/turkey-seeking-renewable-energy-industry-with-make-it-here-rules

[36] "Turkey Launches First Solar Cell Integrated Factory," *Hürriyet Daily News*, http://www.hurriyetdailynews.com/turkey-launches-first-solar-cell-integrated-factory-124575

[37] "Kalyon-Hanwha PV Factory to Start Production by End-2018 - Report," *Renewablesnow.com*, https://www.chinadialogue.net/article/show/single/en/10775-China-s-solar-industry-is-at-a-crossroads/

[38] "Local Content a Key to Turkish Offshore Wind Tender," *Offshore Wild Journal,* 20 June 2018, https://www.owjonline.com/news/view,local-content-a-key-to-upcoming-turkish-offshore-wind-tender_52205.htm

[39] Offshore Wild Journal (2018).

market share of between 55 percent to 72 percent of the global value chain, from polycrystalline silicon to final solar module assembly.[40] With 2018 poised to be the first year in history in which the global solar market contracts at a time when China's own solar manufacturing continues to ramp up, the local content requirements may ultimately lead to higher solar development costs, and thus higher electricity prices for consumers, than would otherwise be the case with a more free-market approach. However, Turkey maintains a competitive and diversified manufacturing economy, as well as an educated workforce, and so it may be willing to pay such costs in order to find an appropriate, strategic niche in the global solar value chain. Persistent weakness in the Turkish lira also enhances the competitiveness of local Turkish equipment, labor, and processes, a point that paradoxically leads well into the next major challenge facing Turkish renewables investment.

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The recent economic volatility in the Turkish economy, and the associated solvency challenges of Turkish utilities, has also presented significant challenges for renewable development. A recent report by Boston Consulting Group and TÜSİAD, the Turkish "Electricity Producers Association," found that the Turkish electricity sector has accumulated $95 billion of investments over the past 15 years, supported by $51 billion of outstanding debt.[41]

The more than 50 percent decline in the Turkish lira from mid-2017 to mid-2018, driven initially by a mounting current account deficit and further intensified by foreign currency denominated debt defaults and skepticism over the credibility of monetary policy, has exacerbated the burden of debt facing the power sector. Utilities and power sector firms are unable to compensate with concomitant electricity price increases due to price ceilings and regulatory barriers, complicating their ability to service dollar-denominated debt amid increasingly unfavorable exchange rates.

Turkish power prices in dollar terms have declined from over 80 dollars per megawatt-hour in 2010 to less than 45 dollars in mid-2018, forcing renegotiation of

[40] Liu Bin, "China's Solar Industry Is at a Crossroads," China Dialogue (italik), 13 August 2018, https://www.chinadialogue.net/article/show/single/en/10775-China-s-solar-industry-is-at-a-crossroads

[41] "Once Darling of Foreign Investors, Turkey's Power Market Struggles," *Reuters*, 10 September 2018, https://www.reuters.com/article/us-turkey-currency-energy/once-darling-of-foreign-investors-turkeys-power-market-struggles-idUSKCN1LQ1S3

debt on the part of many power producers.[42] The same BCG/TÜSİAD report indicates that generators need to, in aggregate, produce nearly seven billion dollars annually in cash flow to repay an annual amount of 4.3 billion dollars in principal and 2.6 billion dollars in interest for the sector's outstanding debt inventory.[43] The government has stepped in with a temporary support scheme that involves state-owned transmission company, Türkiye Elektrik İletim A.Ş. (TEİAŞ), making payments to gas and coal plants that meet certain operational criteria and which are experiencing losses on their electricity sales. Up to 1.4 billion Lira in payments are possible for 2018.[44]

Amid these challenging financial conditions, a number of large power sector-involved conglomerates have sought to divest certain stakes, including in renewables-oriented subsidiaries, which in turn have tightened the environment for renewable finance over 2018. Fitch Ratings lowered its outlook for Turkish solar and wind capacity amid challenging financial conditions, while simultaneously recognizing that continued weakness in the lira will further prioritize domestic energy production (such as that provided by renewables) over foreign currency-denominated oil and gas imports.[45]

Concluding Remarks

Turkey has no shortage of renewable energy potential, nor is it short of compelling reasons to make the further development of this potential a central pillar of the country's energy strategy. The limitations to renewable energy investment and growth in Turkey have had far more to do with the macroeconomic environment and regulatory design in the country. This should prove reassuring over the long-term but which should also serve to focus attention on what must be done over the short term to ensure an attractive investment environment. If the country can stabilize its currency and financial markets into 2019, provide policy certainty and stability with regard to renewable energy incentive mechanisms, and successfully restructure electricity sector debt to ensure continued solvency of the sector, the future is bright for renewables in Turkey. Indeed, there is no reason why the country cannot serve as a model for others in the region, and use its renewables success to leverage further gains in terms of energy security, economic development, and climate action in the

[42] "Turkey Faces Ticking Bomb With Energy Loans of $51 Billion," *Bloomgberg,* 11 July 2018, https://www.bloomberg.com/news/articles/2018-07-11/turkey-faces-ticking-time-bomb-with-energy-loans-of-51-billion

[43] Bloomberg (2018).

[44] Bloomberg (2018).

[45] "Turkey Currency Crisis To Cement Focus On Renewables And Coal Power," *Fitch Solutions,* 31 August 2018, http://www.fitchsolutions.com/corporates/energy-natural-resources/turkey-currency-crisis-cement-focus-renewables-and-coal-power-31-08-2018

process. To get there, however, quiet, consistent hard work will have to take priority over flashy announcements and targets. In doing so, Turkey will showcase to the world that it is a serious player, and one to be learned from, in the global energy transition.