Turkey at a Crossroads:

Invest in the Old Energy Economy or the New?

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Executive Summary

Turkey is at a crossroads, deciding whether to invest in the old energy economy or the new.

The choice is stark: one path leads to a coal-fired past while the other points toward a brighter future rooted in renewables.

Whichever direction Turkish policymakers choose will have momentum on its side. National consensus clearly favors better energy security and greater diversification in how the country fuels its electricity grid. On these two points there is no debate.

How Turkey will achieve these goals is uncertain, however, as policymakers weigh whether to push the country toward construction of a new lignite-fired fleet of generators or to take part in a global energy sector transformation fueled by renewables.

Worldwide, solar- and wind-powered resources combined with gains in energy efficiency continue to establish viable—indeed superior—alternatives to coal-powered electricity generation. Renewables are more economically sustainable, less financially risky, and better for the environment and public health.

Renewables have market forces on their side. As investment in coal-fired generation is waning, investment in solar, wind and energy-efficient technologies is rising. The world is on the verge of an exponential—rather than linear—growth rate for new technologies, a trend that support expansion of solar-supported battery systems especially and to which capital flows are adjusting accordingly.

Renewables provide more than just an energy solution to any given economy. Their development drives innovation that is likely to spill over to into other sectors, raising the potential for skill-based development and providing vast employment opportunities.

In the meantime, as renewables gain market share, the myth of coal has dwindled. Coal is no longer seen—as it once rightly was—as the tool for broader economic development. Coal-fired generation in the new energy economy is proving increasingly unviable for the overleveraged and high-priced risks it carries, which include both political risk and market risk. More important, coal is losing market share because it is no longer cost competitive.

This energy transformation is occurring fastest in developing economies. China and India are at the limits of their coal-fired generation because of the unacceptable levels of air pollution it creates, and the growth of renewables in both China and India—and in several other emerging economies—is exceeding government expectations. This uptake of renewable energy is driven by the convergence of demand for capacity that can alleviate energy poverty, the desire for national energy security and the push for diversification. It is supported by a growing flow of investor capital.

Turkey is at risk of missing this boat.

This reports details, in particular, the dangers to the Turkish economy in making the Turkish electricity sector more reliant on lignite:

- A rapid, subsidized lignite-fueled power plant build-out would put upward pressure on currently low electricity prices. The subsidies for lignite-fuel power plants in a new electricity law currently under consideration, by IEEFA's estimates, would initially cost US$1.1 billion each year. This cost, if passed through to consumers, would raise the market price of

electricity by 19%. The annual cost of the subsidies could be as high as $US2 billion and could raise electricity market prices by as much as 29%.

- The subsidy scheme in the new electricity law would undercut recent progress in liberalizing Turkish energy markets.
- The rapid addition of new lignite-fired power plants would lock in the costs of these plants at a time of slow or declining growth in the demand for power and damage. It would create excess generating capacity whose costs would have to be paid by consumers and businesses whether or not that capacity is needed.
- By trying to improve its energy security by increasing its dependence on coal, Turkey would be fighting a losing battle against the larger energy transformation occurring globally and in other important emerging economies.
- The potential for defaults and stranded assets would undermine the Turkish banking sector.

Our research finds also that Turkey, among the sunniest countries in Europe, is not investing seriously enough in its renewable-energy potential. The examples of China, India, and several other emerging economies illustrate how competition and investor interest are converging to create robust renewable-energy markets. Turkey is lagging especially in solar-energy investment. The paltry 0.3 GW of installed solar capacity in Turkey pales in comparison, for example, to Spain's 7 GW and Germany's 40 GW.

Turkey has the potential to be more economically competitive if it adapts faster to the global energy transformation.

Renewable resources like wind and solar can be added in smaller increments, allowing for greater flexibility in responding to changes in demand forecasts, without burdening consumers with additional excess capacity when projected loads do not materialize. Renewables can make Turkey's electricity-market pricing more competitive. More investment in renewables would lead to higher productivity and more value-added growth—making the Turkish economy overall more competitive—and would help the country escapes its current middle-income trap. Greater investment in renewables would also help Turkey avoided the damage to the environment, public health, and public finance that would result from a dash to coal and lignite.

By increasing renewables' share of power generation and by limiting investments in fossil-fuel-fired electricity, Turkey would also be guarding against likely financial defaults and the risk of expensive investments in coal and lignite plants becoming stranded-assets. A renewable resource policy also would avoid weakening the balance sheets of households, companies, banks and the public sector. Diversifying its energy mix by adding larger amounts of renewable resources would also enable Turkey to attract a bigger share of international institutional capital, which is flowing today in growing amounts to developing economies that have significant and serious plans for adding renewables.

Trying to achieve energy security through lignite subsidies, by contrast, is an economically unviable and financially insecure alternative to investing in renewables.

Renewable energy, with its technological advantages, deflationary cost structure, environmental benefits, and increasing pool of financing opportunities is a better way to put Turkey on a sustainable path to becoming a more competitive economy.

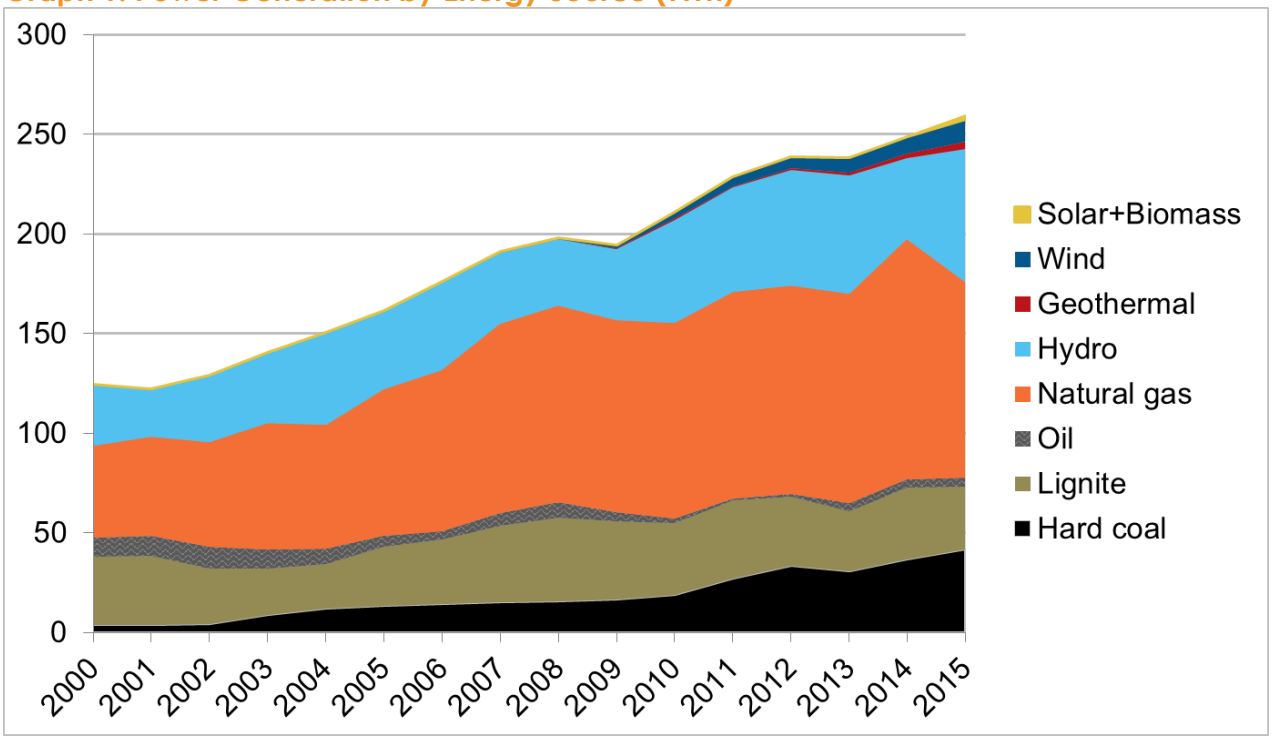
A. Introduction

Turkey is a middle-to-high income country, globally speaking, and is on an upward trajectory in terms of economic growth. Its energy demands have grown too.

Per capita income levels have gone from US$3,000 to almost $10,000 level over the past 15 years, a time in which Turkish electricity-sector installed capacity has doubled. Electricity-sector growth has been driven by economic growth, but has occurred also because Turkey has liberalized its electricity market, changing from a state-owned monopoly system to a more competitive and cost-efficient structure.

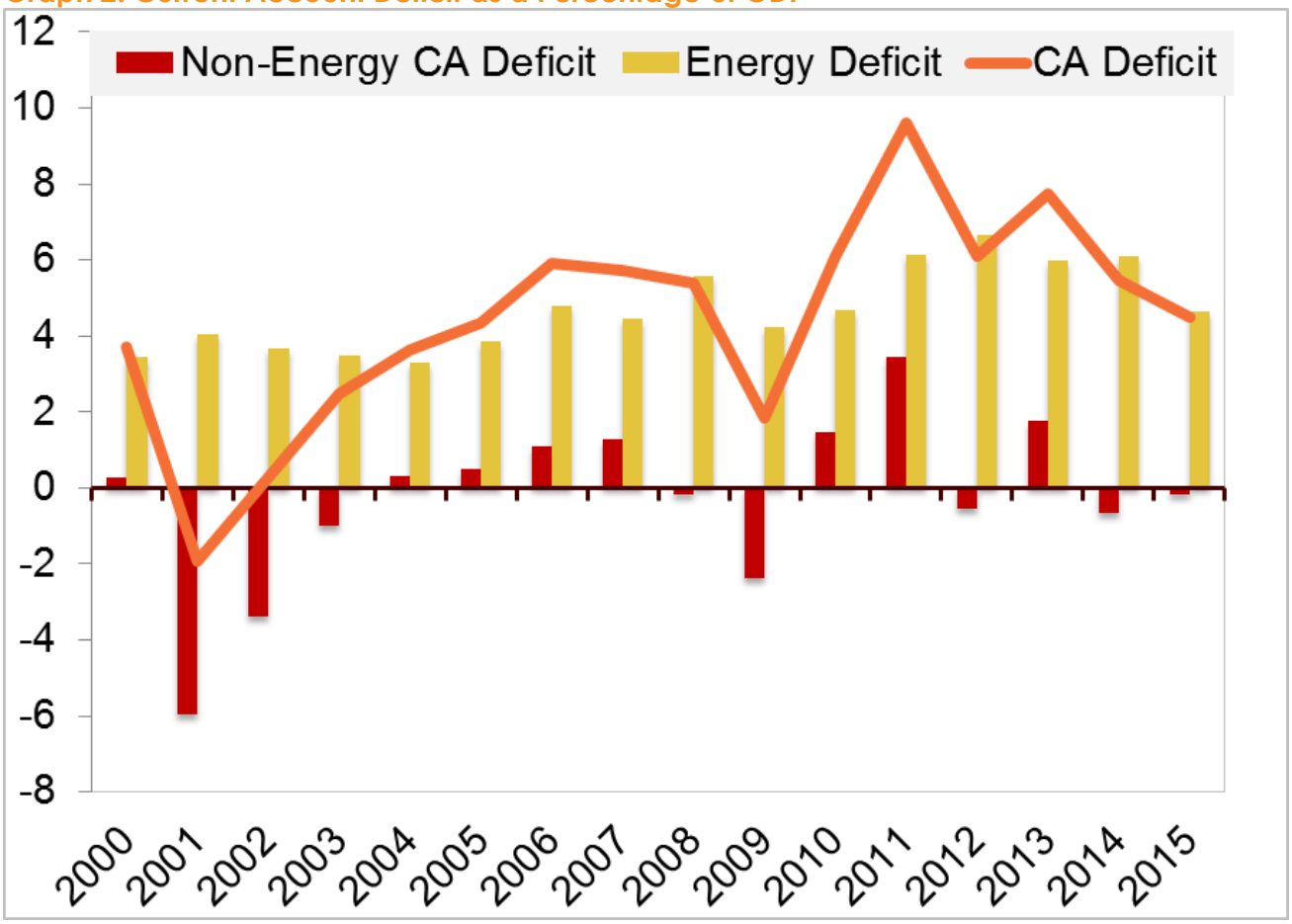
Meantime, the power-generation mix in Turkey has shifted as the country has come to rely more and more on imported natural gas. In 2000, natural gas accounted for 37% of power-generation; that ratio had increased to 48% by the end of 2014 (graph 1).

Graph 1: Power Generation by Energy Source (TWh)



Source: TEIAS

Graph 2: Current Account Deficit as a Percentage of GDP

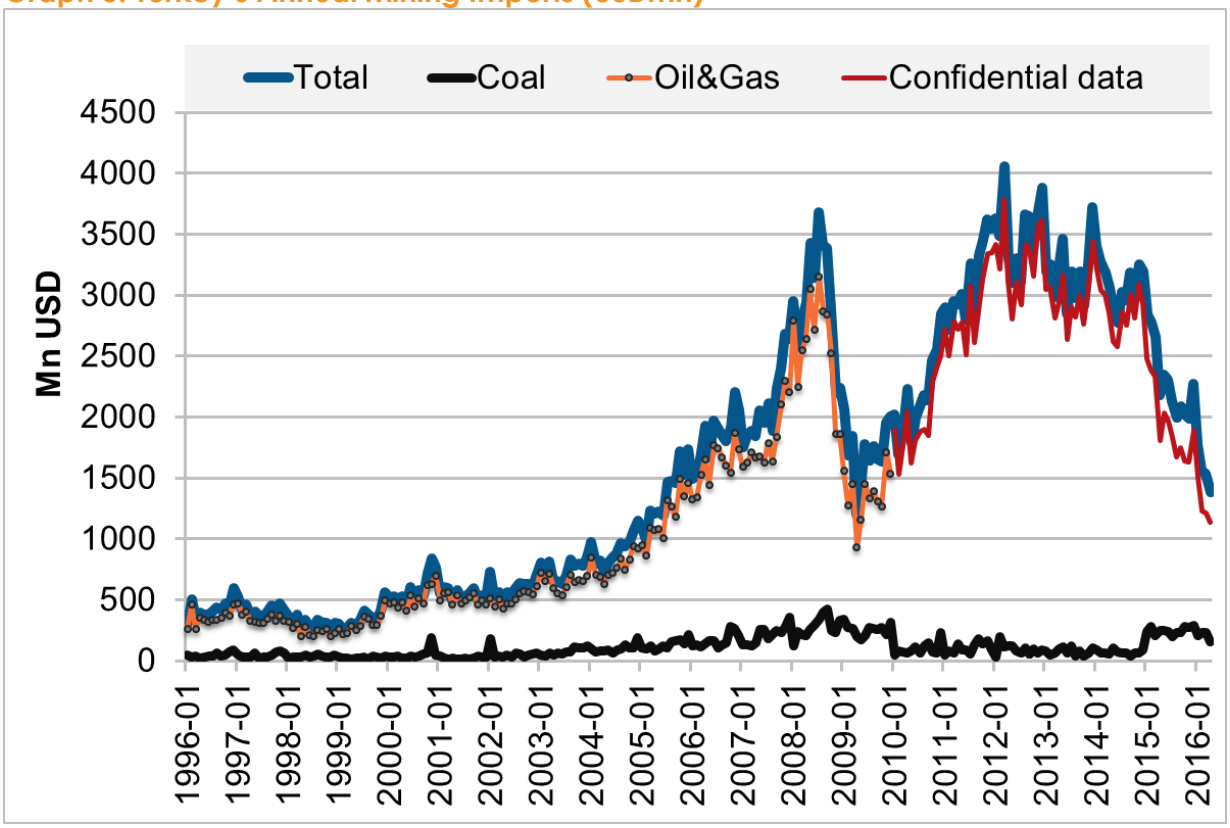


Source: Central Bank of Turkey and Turkstat

Turkey's electricity energy deficit—that is, the proportion of imported fuel required to run its grid—reached 6% of GDP by 2014 (graph 2), and oil and natural gas accounted for more than 90% of that deficit (graph 3). While its heavy dependence on natural gas has increased the vulnerability of the Turkish electricity market to volatility in global energy prices, the geographical concentration of gas imports has also brought risk (graph 4): More than 70% of gas imported into Turkey comes from Russia and Iran, making "the use of natural gas as a tool of regional and global political conflict" a topic of growing concern.[1]

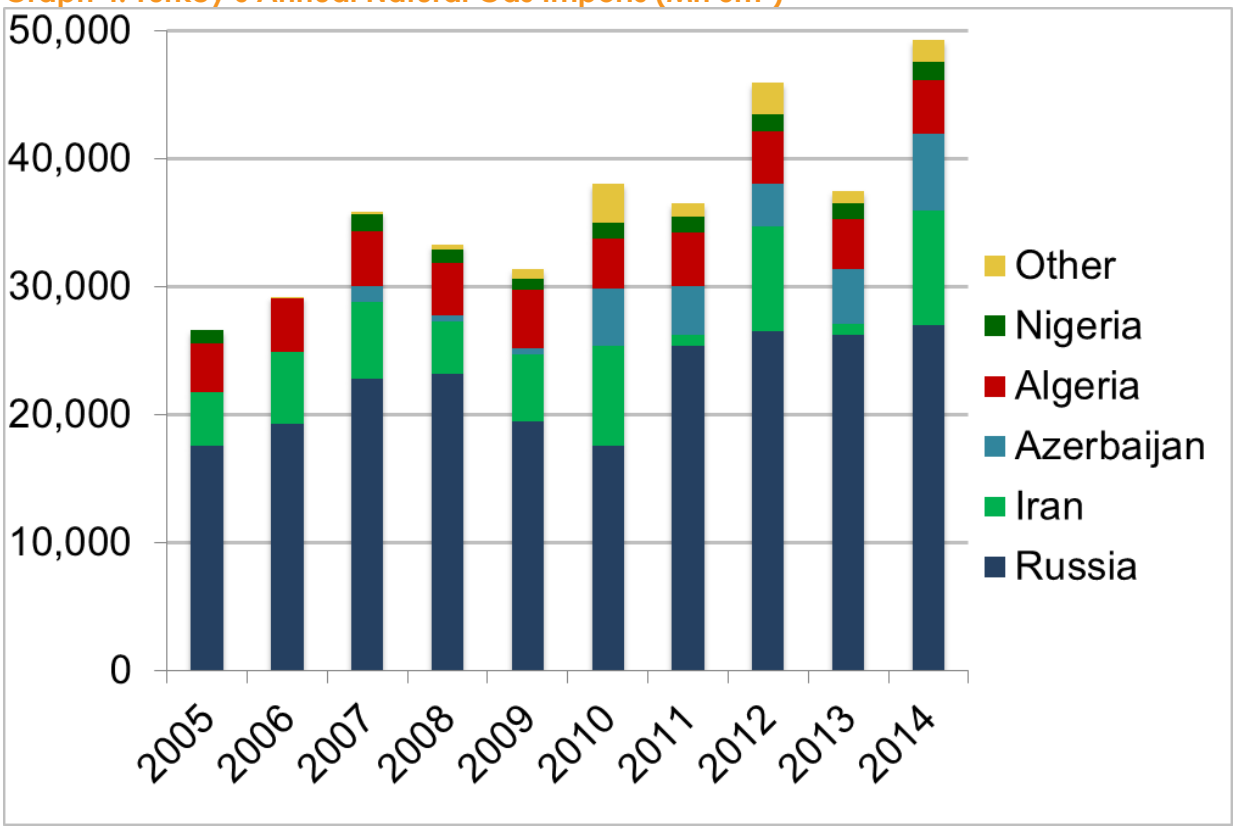
[1] Bourgeot R., 'Russia-Turkey: A Relationship Shaped by Energy', March 2013, IFRI and Ataç A., 'How Important is Russian Gas for Turkey?', November 2015, TEPAV

Graph 3: Turkey's Annual Mining Imports (USDmn)



Source: Turkstat (Oil and gas imports were classified as confidential data after 2010)

Graph 4: Turkey's Annual Natural Gas Imports (Mn Sm³)



Source: Energy Market Regulatory Authority (EMRA)

Given Turkey's heavy dependence on natural gas and its growing demand for energy, the government has acknowledged the need for establishing a national policy for "reaching a competitive energy system that exploits domestic and renewable energy resources to the extent possible, envisaging the use of nuclear technology in electricity generation, supporting reduction of energy intensity of the economy, minimizing waste and environmental effects of energy, strengthening the country's strategic position in international energy trade.'[2] These targets specifically include decreasing energy intensity[3] by 20%, increasing the share of renewables to 30%, commissioning two nuclear plants as well as decreasing the natural gas portion of electricity generation to 30% over the next decade.[4]

Turkey has made progress toward some of these objectives. The Turkish power generation market has been markedly liberalized with less state ownership of power generation and distribution.[5] Establishment of an organized market for electricity trade allows for competitive pricing across an increasing share of the market. As a result, electricity prices in Turkey fell to historical lows in 2015 and the first months of 2016. Renewable energy has gone from zero share of the market in 2009 to 7.8% in 2015.

These trends suggest an opportunity that is slipping away, however. The government is currently planning to replace natural-gas-powered generation with electricity fired by domestically produced lignite. Under current government proposals, electricity generated from domestically produce lignite is targeted to increase from 31 TWh at the end of 2015 to 57 TWh by the end of 2018.[6] All told, the government has announced 71 new projects for coal-fired power plants, most of which would be run on Turkish lignite. It has also recently enacted an Electricity Law amendment that establishes a new annual tender pricing system and grid-dispatch priorities that favor electricity generated by lignite-fueled power plants.[7]

It is not too late to take a path that is more economically, financially and environmentally sustainable. A wise national energy strategy would increase generation from renewable resources, liberalize energy markets further and invest more in energy efficiency. Such strategies would improve Turkey's economic output and competitiveness. Increasing Turkey's reliance on lignite, on the other hand, would hobble economic growth and make Turkey less competitive with economies that are switching to more cost-efficient, financially viable and economically productive renewable energy sources.

The current emphasis on coal, and on the expansion of lignite-fired power production, poses economic and financial risks that, taken individually and cumulatively, threaten Turkey's progress. Significant increases in coal use—lignite or otherwise—would impose higher costs on

[2] The 10th Development Plan 2014-2018, p.103, Ministry of Development

[3] Energy intensity is a measure of the energy efficiency of a nation's economy. It is calculated as units of energy per unit of gross domestic product. The lower the energy intensity the better, as it means the country is using energy more efficiently to produce economic output.

[4] 'Turkey's Changing Power Markets', November 2014, BNEF

[5] The privatization model being pursued by the government, currently based on bilateral agreements, is serving to increase the number of companies active in the sector— both in terms of whole and retail electricity sales. Such agreements are made between suppliers and eligible consumers that have sufficiently high demand to buy from the wholesale market from 'Turkey's Changing Energy Markets,' November 2014, BNEF.

[6] Demircan Z., 'What Energy mix for Turkey in 2030', Ministry of Energy and Natural Resources http://www.ewea.org/events/workshops/wp-content/uploads/2013/03/EWEA-TUREB-Workshop-27-3-2013-Zafer-Demircan.pdf and 'Energy Production Program Based on Domestic Sources' and 'Developing Energy Efficiency Program' Action Programs, Ministry of Energy and Natural Resources http://odop.kalkinma.gov.tr/dokumanlar/14Enerji_Verimliliginin_Gelistirilmesi_Programi.pdf

[7] The amendment to the Electricity Law (02/1081) was proposed to the Parliament on April 25, 2016 and approved by the Parliament on June 4. Accordingly, Turkish Electricity Trading and Contracting Company is holding annual electricity buy-out tenders from lignite plants. The winners will provide electricity to TETAS at pre-determined prices, bypassing the daily electricity market. Details of the tender mechanism are to be announced by a decree by the Cabinet of Ministers.

consumers and taxpayers. It would also require the country to reverse liberalization of its power markets, putting owners of existing plants and funders of new ones at risk.

This paper contrasts major trends in the global energy transformation with Turkey's direction and explains how Turkey could benefit from diversifying its energy mix away from fossil fuels and into more wind and solar resources.

Table 1: Turkey's Electricity Generation and Installed Capacity (As of December 2015)

	Generation		Installed Capacity	
	TWh	% Share	GW	% Share
Hard coal	41.7	16%	6.5	9%
Lignite	31.2	12%	8.7	12%
Natural Gas & Oil	101.4	39%	27.0	37%
Hydro	66.9	26%	25.9	35%
Renewables	18.6	7%	5.7	8%
Total	259.7	100%	73.8	100%

Source: TEIAS

B. International Energy Markets

Diversification Is Becoming the Norm

Developed and developing economies alike are diversifying their energy sources to include significantly bigger proportions of renewables. This global move away from coal is toward new technologies, toward new job-producing industries, and toward a political consensus that restores public confidence in energy policy.

Most countries that are heavily dependent today on coal-fired electricity are reducing that dependence: In the U.S., the biggest economy in the world, there are no plans for new coal-fired plants and indeed the country's emphasis is on retiring many of its existing coal-fired generators,[8] which are failing financially because they can no longer compete.[9] Across Europe, which collectively makes up the second-largest economy, countries that include the United Kingdom, Austria, and Portugal are in the midst of coal-fired phase-outs. Belgium has closed its last coal-fired power station.[10]

China, the third-largest economy in the world, announced a three-year moratorium on new coal mines at the end of 2015 and said it would curtail coal-fired production capacity in response to rising concerns about air pollution and because of industrial overcapacity.[11] China is of special note because it burns half of all coal consumed globally. As China moves to increase the presence of renewable energy, coal's share of power generation in China is

[8] http://www.eei.org/resourcesandmedia/industrydataanalysis/industryfinancialanalysis/finreview/Documents/FinancialReview_2015.pdf, p. 50-51

[9] IEEFA has researched and provided evidence in court proceedings related to the financial problems of new plants in the United States. See: ieefa.org: Edwardsport, Kemper and Prairie State.

[10] http://www.climatechangenews.com/2016/04/05/belgium-quits-coal-power-with-langerlo-plant-closure/

[11] 'China to Halt New Mine Approvals Amid Pollution Fight' December 2015, Bloomberg

expected to fall to 59% by 2020 from 69% at the end of 2015.

South Africa is an example of a developing economy that has historically been completely reliant on coal-fired electricity but is turning increasingly to solar, wind, hydropower and nuclear power in an acknowledgment of the reality that coal-fired electricity is too expensive and that the subsidies for supporting coal are turning out to be unsustainable.[12]

Coal, Once a Driver of Economic Development, Is Now an Impediment

Coal (including lignite), once a key driver of development in the U.S., China, India—and scores of other countries—is recognized today for the fundamental limits it now imposes and the wide of risks to which it exposes economies, governments, citizens and the environment.

1. Financial risks that arise from coals failure to compete in terms of efficiency, its highly levelized costs, its need for annual (and sometimes expensive) operation and maintenance expenses and capital expenditures, and the need for costly investments to mitigate or eliminate its adverse public health and environmental impacts;
2. Economic risks that put whole regions and countries at danger of being unable to complete globally because their coal-based energy systems are inherently outdated;
3. Environmental risks that include air and water pollution, that aggravate global climate change, and that create social and economic upheaval.

The Economic-Development Rhetoric on Coal Has Changed

Traditional rhetoric around coal-fired power has argued that coal is the solution to energy poverty. This rhetoric is rooted mainly in the past: While today's developed economies, especially those of the U.S. and the European Union, were built on coal and oil, times have changed and fossil fuels do not offer the path forward they once did.

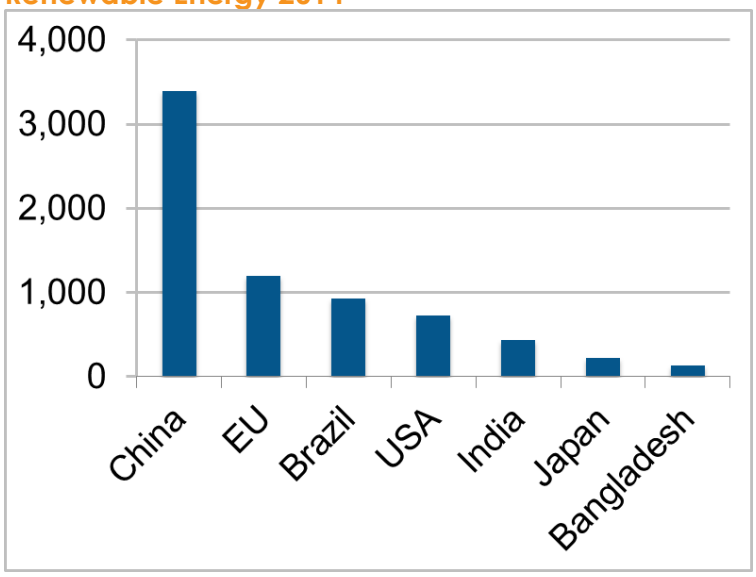
IEEFA research has shown how "coal, in its day, grew because economies could absorb the financial and environmental externalities.[13]" Coal worked, in other words, when societies and governments were willing and able to accept its consequences. Coal-fired generation in the world's new energy economy is proving unviable because it is overleveraged, high-priced, and harmful to the public health and the environment.

Systems that rely on subsidies for coal-based electricity are proving too costly simply because subsidies are no longer sustainable. India presents a case in point: The country's heavily subsidized DISCOMs—the utilities that distribute electricity—have collective debt of $USD 75-85 billion, a powerful example of how electricity price subsidies can go out of control.

[12] Sanzillo T., 'Energy Poverty Then and Now', March 2016, IEEFA
[13] Tom Sanzillo, 'Energy Poverty, Then and Now: How Coal Proponents Have It Wrong', March 2016, IEEFA

Solar and wind resources and energy-efficiency technologies, however, are increasingly being shown to be lower cost and lower risk alternatives for addressing energy poverty—and alternatives that are more financially and environmentally sustainable. The renewable-energy industry also brings access to innovation that can spill over into the broader economy, thereby offering a greater potential for job-skill development and more new jobs. Renewable-energy jobs totaled to 7.7 million in 2014, up 18 percent over 2013,[14] a trend that by all indications continues. Most of that growth is occurring in emerging economies (graph 5).

Graph 5: Estimated Direct and Indirect Jobs in Renewable Energy 2014



Source: Renewable Energy and Jobs, Annual Review 2015, IRENA

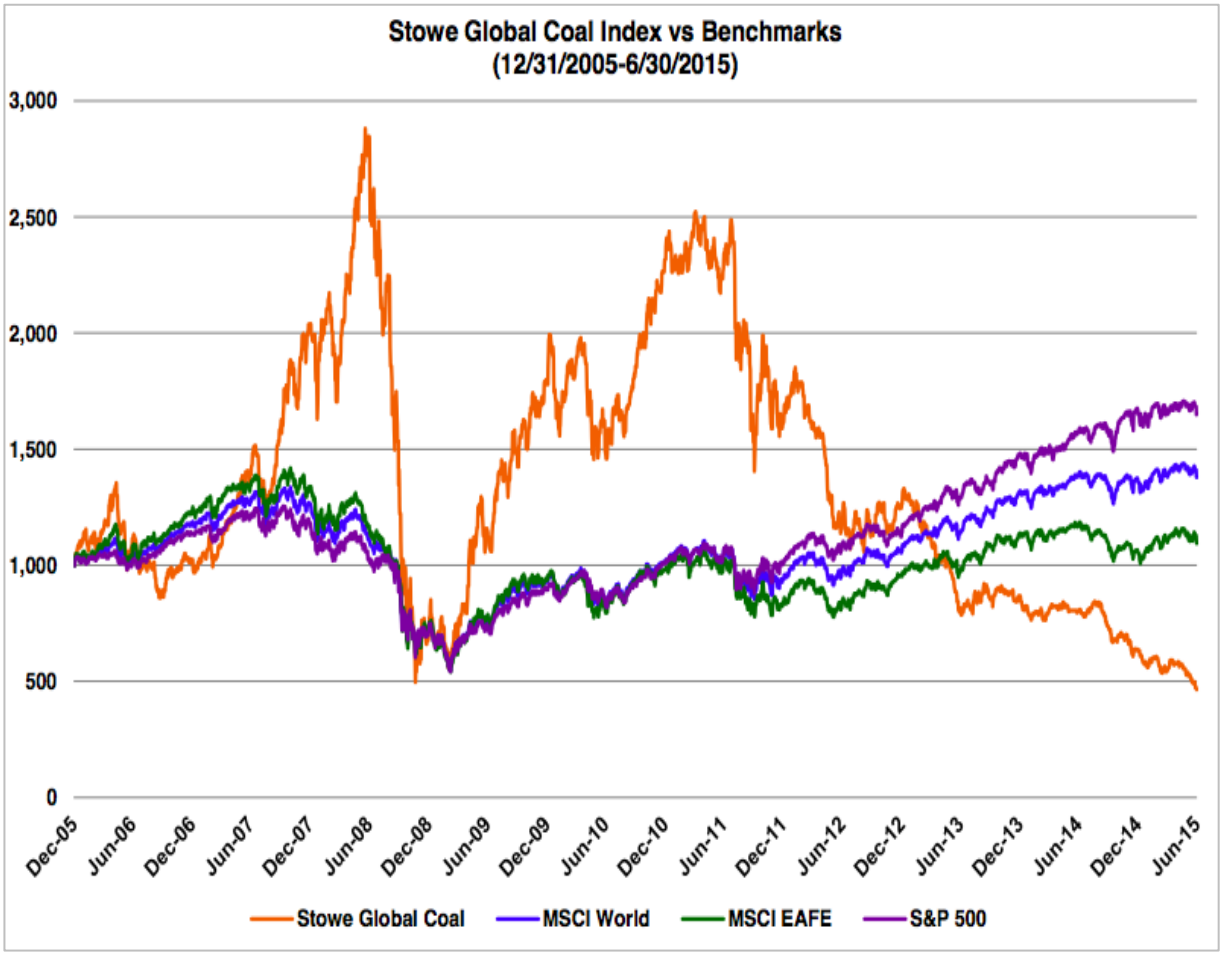
Coal-Fired Electricity Generation Today Is Hobbled by Risk

Two of the central themes today in the world's energy markets are the slowing rate of growth across the global economy and declining commodity prices. As commodity prices have dropped, investment decisions that relied on high energy prices are being challenged, especially in the fossil-fuel sector.[15] As a result energy sector companies have lost market capitalization and face credit-rating downgrades.[16]

The coal industry in particular is coming off of a capital expenditure binge that ran from 2007 to 2011.[17].As a result, coal companies all over the world today are in financial distress and are struggling with uncompetitive operational costs (graph 6). The debt and unfunded liabilities of U.S. coal producers were $US70 billion in 2015,[18] suggesting that the coal industry itself is no longer viable. The April bankruptcy filing of Peabody Energy, the single largest private-sector coal producer in the world, drove this point home. And Peabody is no outlier. Dozens of other coal producers have filed for bankruptcy, including, in addition to Peabody, two of the other U.S. coal majors, Alpha Natural Resources and Arch Coal. The recent proposed sale by Vattenfall, the state-owned Swedish utility, of its lignite assets in Germany at an estimated write-down of between US$2.7-3.3 billion also shows the urgency felt by many owners to get rid of their coal and lignite assets in order to cap their losses in the sector.[19]

[14] Renewable Energy and Jobs, Annual Review 2015, IRENA
[15] Panorama, 'Barometer of Sector Risks in the World, April 2016, Coface
[16] 'Moody's places energy and metals & mining issuers on review for downgrade', 22 January 2016, Moody's
[17] Sanzillo T., 'Energy Poverty, Then and Now': How Coal Proponents Have It Wrong', March 2016, IEEFA
[18] http://www.mckinsey.com/industries/metals-and-mining/our-insights/downsizing-the-us-coal-industry
[19] 'Vattenfall Offloads German lignite mines to Czech consortium' April 18 2016, FT, http://www.ft.com/intl/cms/s/0/6e541cf2-056e-11e6-96e5-f85cb08b0730.html#axzz4AEPCt2wq

Graph 6: Stock Performance of Coal Companies



Source: Stowe Global Coal Index, June 2015, stowe.snetglobalindexes.com/pdf/coal-Presentation.pdf

Coal has been perhaps the single greatest wealth-destruction machine in the world over the past five years as stock prices for publically held companies have dropped by 60-100%. This dramatic capital loss reflects the blunt reality that coal has fallen radically out of favor and that the industry today is crippled by excessive financial leverage brought about by poorly timed debt-fueled acquisitions or greenfield coal expansions. Most coal companies are hobbled by significant annual operating losses and too much debt.

This collapse has occurred as global financial systems move away from higher-risk fossil fuel investments in order to avoid stranded-asset risks and to capitalize on opportunities in low-emissions technology. Norway's Government Pension Fund Global, the world's largest sovereign wealth fund, made headlines in 2015 with its decision to divest its coal holdings[20] and recently announced that it had divested from 48 companies.[21] The Norwegian move was followed by similar decisions by insurance conglomerates Allianz, AXA and KLP and by Stanford University, the District of Columbia Retirement Board, and the Rockefeller Family

[20] Sanzillo T., 'The Case for Divesting Coal from the Norwegian Government Pension Fund Global', May 2015, IEEFA
[21] Norges Bank Investment Management, Observation and Exclusion of Companies, April 14 2016, http://www.nbim.no/en/responsibility/exclusion-of-companies

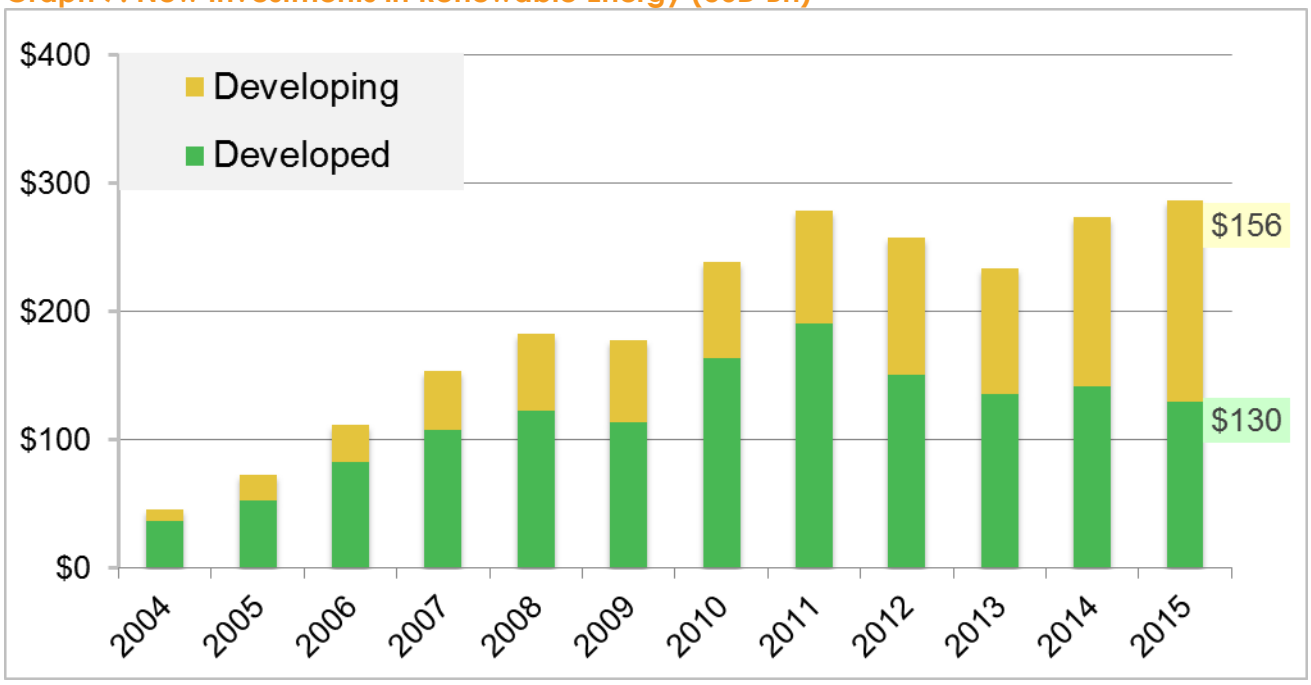
Fund. Similar decisions are being weighed by dozens of other institutional investors, including the California Public Employees' Retirement System (CalPERS), the biggest public pension fund in the U.S.

Meanwhile, multinational development banks and financial institutions are imposing more restrictions on coal. The OECD Export Credit Group is reducing its subsidies for coal-fired power plants. World Bank and European Bank for Reconstruction and Development (EBRD) policies forbid investing in coal or coal-fired generation[22] except in rare and exceptional circumstances.[23]

Renewables Are the Main Component in 21st-Century Diversification Strategies

Renewable energy accounted for 90% of new electricity generation globally in 2015, vastly outweighing investments in fossil-fuel-generated electricity. The developing world accounted for more than half of these investments (graph 7), a trend that suggests enormous potential in markets where demand for electricity-generation development is high.

Graph 7: New Investments in Renewable Energy (USD Bn)

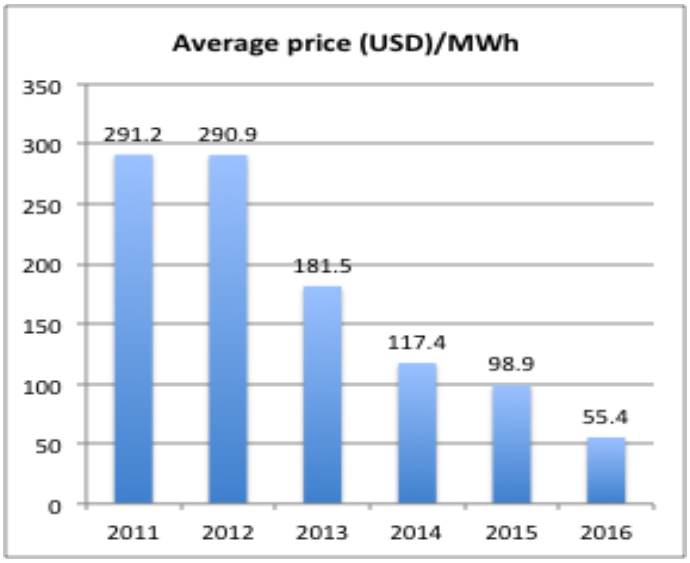


Source: *Global Trends in Renewable Energy Investments 2016, UNEP*

[22] http://www.worldbank.org/en/news/feature/2013/07/16/world-bank-group-direction-for-energy-sector
[23] http://www.ebrd.com/what-we-do/sectors-and-topics/ebrd-energy-strategy-switch-coal.html

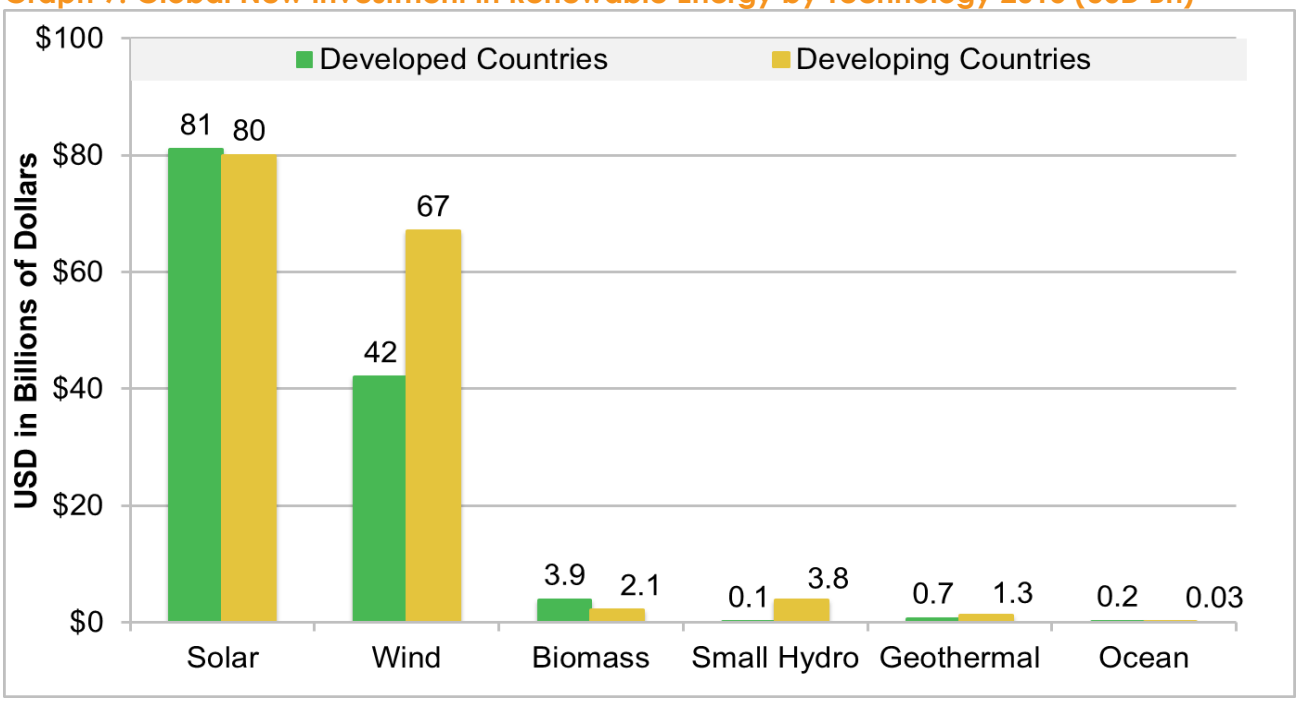
Renewables offer clear advantages over the competition. Renewables push the innovation curve, opening new possibilities for advances that will not likely be seen in the fossil-fuels sector. Renewables prices are deflationary, that is, once up-front installation costs are paid a renewable-energy generator has almost zero operational costs. Globally, the cost of solar electricity continues to decline at a double-digit annual rate.[24] This trend has momentum: with every doubling of installed capacity costs decline by 26.3%.[25] Auction results for solar plants have shown an almost five-fold decrease over the last five years (graph 8), while a recent unsubsidized bid of 2.99c/KWh for new solar in Dubai beat a coal-fired power plant commissioned in October 2015.[26] With inevitable improvements in storage technology,[27] the cost curve of renewables will come down more.

Graph 8: Global Auction Results for Solar Power Plants



Source: BNEF (2016 for 1q only)

Graph 9: Global New Investment in Renewable Energy by Technology 2015 (USD Bn)



Source: Renewables Global Status Report 2016, REN21

[24] Buckley T., 'Global Solar Deployment Accelarates, June 2, 2016, IEEFA
[25] Buckley T., 'Carpe Diem: Eight Signs that Now is Time to Invest in Global Energy Market Transformation', IEEFA, November 2015
[26] http://www.lankabusinessonline.com/dubai-receives-solar-power-bid-cheaper-than-coal/
[27] 'Q1'16 growth in energy storage signals coming trends', June 2, 2016, SNL

The trend toward investment in renewables is especially notable in emerging economies. China installed 15-18 gigawatts (GW) of new solar capacity in 2015 and added 7 GW in the first three months of 2016, increasing its cumulative installed solar capacity to 50 GW.[28] IEEFA sees China adding an additional 22 GW of wind-powered electricity and 18 GW of solar resources in 2016 alone (70 percent of it utility scale).[29] By 2020, China—whose economy is closely managed by powerful central planners—is aiming to get 20% of its electricity from renewables, up from 10% at the end of 2014. India's plans are even more ambitious as it expects to increase its renewable capacity to 175 GW by 2022, which would be equivalent to 33% of its total estimated electricity-generation capacity.[30]

IEEFA sees the world on the verge of exponential—rather than linear—growth for new renewable-energy technologies, especially in solar and electricity battery storage. Wind-powered energy continues to make strides in innovation as well. Such progress is not unlike that seen in the rise of mobile phones, the Internet and portable computers. Once a critical mass is achieved, market shifts are can occur in months rather than decades.[31]

The rate of innovation across the fossil-fuel sector, by contrast, continues to be lumbering, slow, and increasingly behind the times. This point has been made lucidly by no less an authority than Jeffrey Immelt, the chairman and CEO of General Electric in this passage from a bestselling Thomas Friedman book on the new global economy:

> "Today, on the power side, we're still selling the same basic coal-fired power plants we had when I arrived. You can't look back at the last thirty years and say that the market in energy has worked."[32]

Titans of innovation worldwide share Immelt's perspective. Bill Gates, for one, puts coal in its place by noting that if Thomas Edison were to come back today he would note that the only difference between modern coal plants those from his time is that today's are bigger.[33]

Capital Flows Favor Renewables

Global investment in new renewable power capacity totaled US$266 billion in 2015, more than double the amounts allocated to new coal and natural gas fired power generation capacity.[34]

And renewable energy attracts a broad pool of investors. For example, large utilities companies invest directly in renewables, driven in part by political and consumer pressure to get more of their energy from clean sources. Independent power producers invest increasingly in renewables, as do private equity funds, pension funds and insurance companies with long-term holding strategies. Other major investors in renewables include Yield Cos, an emerging asset class that bundles renewable-energy holdings into tradable holdings, and closed-end funds, which invest in the development, construction or operational

[28] Buckley T., 'Energy Sector Advances: China and India', May 9, 2016, IEEFA
[29] Buckley T., Renewable-Energy Records in China Suggest a Reshaping of the Global Energy Economy, April 6, 2016, IEEFA
[30] IEEFA estimates that by 2022, in addition to 175Gwh renewable energy capacity, India will have 286GwH thermal, 10 Gwh nuclear and 58 Gwh hydro electricity generation capacity
[31] Tim Buckley, Carpe Diem: Eight Signs That Now is Time to Invest in Global Energy Market Transformation', IEEFA, November 2015
[32] Hot Flat and Crowded, New York: Farrar, Strauss and Giroux, 2008
[33] http://www.theatlantic.com/magazine/archive/2015/11/we-need-an-energy-miracle/407881/
[34] 'Renewables 2016 Status Reports', REN21

phase renewable energy assets to achieve certain yields from year to year.[35] [36]

Investment in renewable power and fuels in developing countries in 2015 exceeded that in developed economies. The greatest growth was in China, India and Brazil with significant increases in South Africa, Mexico and Chile (graphs 7 and 9).

In fact, in 2015, US$100 billion in global capital was committed to renewables in India alone: Four of the world's largest solar manufacturers (Trina Solar (China), JA Solar (China), Hanwha Q CELLS (Germany) and Longi (China)) have announced plans to build Indian solar-manufacturing capacity and global energy companies (EDF Energies Nouvelles (France), ENEL Green Power (Italy), ENGIE (France)) are acquiring major Indian renewable project-development firms. North American companies—alongside those from Europe and Asia—also are accelerating renewables project development in India.[37]

Capital is being deployed aggressively in Latin America and South America, as well. Nacional Financiera, or Nafin, the Mexican development bank, recently put $US4 billion into financing nine wind projects while Chile secured $3.4 billion in outside capital for solar project development in 2015.[38]

Wall Street has taken an active role in the growing flow of capital pouring into renewable-energy development. Citibank has doubled its lending target $US100 billion, Goldman Sachs has committed $US150 billion to renewable energy investment by 2025, and Bank of America has set $US50 billion goal for green-energy projects. Australian and French Banks have made similar commitments, as have multinational economic development banks, including the Asian Development Bank, which doubled annual spending on climate-change initiatives to US$6 billion by 2020.

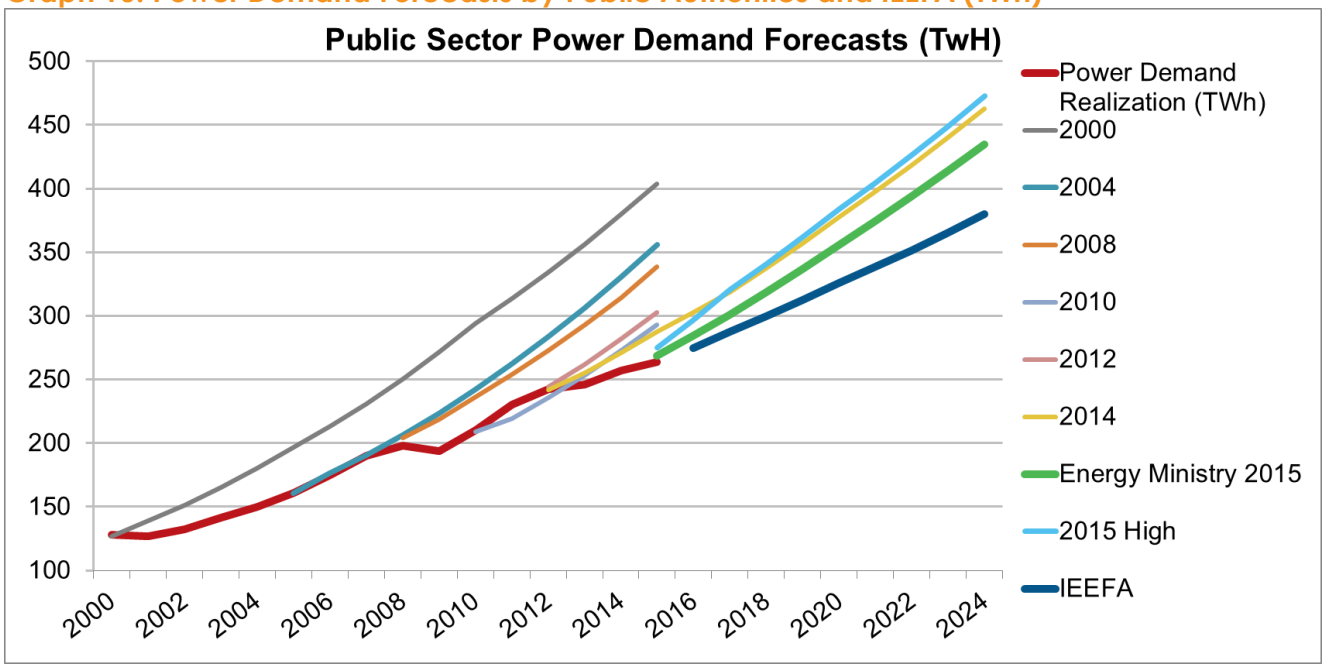
C. Turkey Is at a Crossroads

Oversupply and Competition: The Turkish Electricity Market Has Evolved Dramatically in Recent Years

The power generation market in Turkey is oversupplied as the result of a slowdown in economic growth and official forecasts in the past that overstated the need for new generating capacity (graph 10).

[35] http://cleanenergypipeline.com/Resources/CE/ResearchReports/The%20European%20Renewable%20Energy%20Investor%20Landscape.pdf
[36] 'The European Renewable Energy Investor Landscape', 2014, Global Capital Finance and Clean Energy Pipeline
[37] 'India's Electricity Sector Transformation', August 2015, IEEFA
[38] 'Global Trends in Renewable Energy Investments 2016' UNEP and BNEF

Graph 10: Power Demand Forecasts by Public Authorities and IEEFA (TWh)



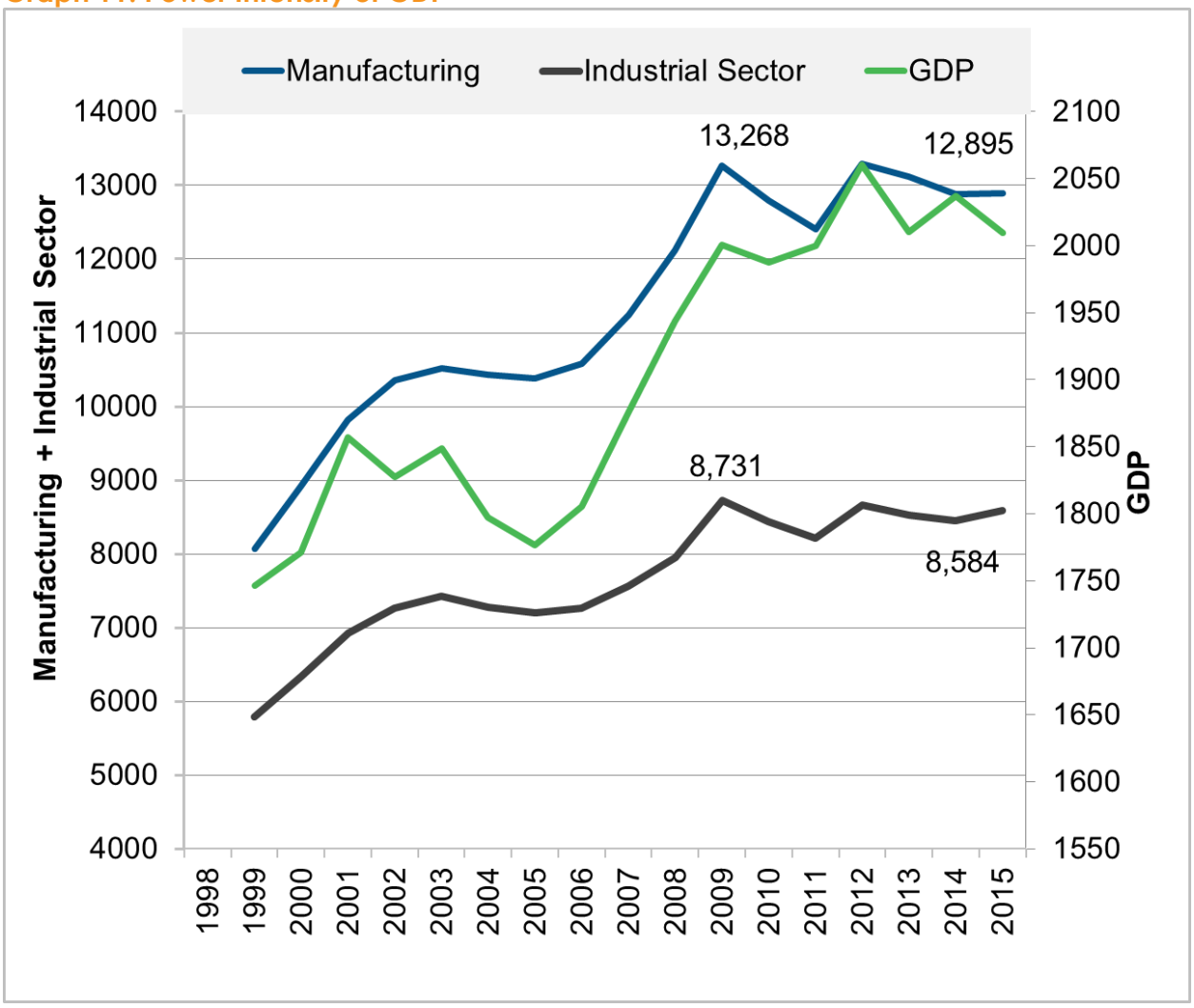
Source: TEIAS and IEEFA Calculations

After having grown on average by 5.5% per year from 2002 to 2011, the Turkish economy has plateaued growth-wise at about 3.3% annually since 2012.[39] Official forecasts in retrospect have overestimated GDP growth and have failed to project the decrease in industry's share of the economy (graph 11). Energy intensity in both the industrial and manufacturing sectors in Turkey peaked in 2009 and has stayed at about the same levels since then. Even if manufacturing's share of GDP increases to over 20% in line with the government's Five Year Development Plan, manufacturing is not likely to be as intensive as before. What's more likely is that advancements in manufacturing processes and technologies will maintain or improve energy intensity in check across the economy.[40]

Assuming GPD growth of about 4% until 2024 (the International Monetary Fund's forecast is 3.5%) and steady levels of energy intensity, IEEFA sees electricity demand being 6% below the Turkish government forecasts by 2018 and 15% below those forecasts by 2024 (graph 10).

[39] For Turkey's quarterly GDP figures, turkstat.gov.tr; annual growth figures cbt.gov.tr
[40] Yenigun-Dilek, 'Model and Mindset Limits to Turkey's Growth', May 19 2015, LongViewTurkey.com

Graph 11: Power Intensity of GDP



Source: TEIAS, Turkstat and IEEFA Calculations

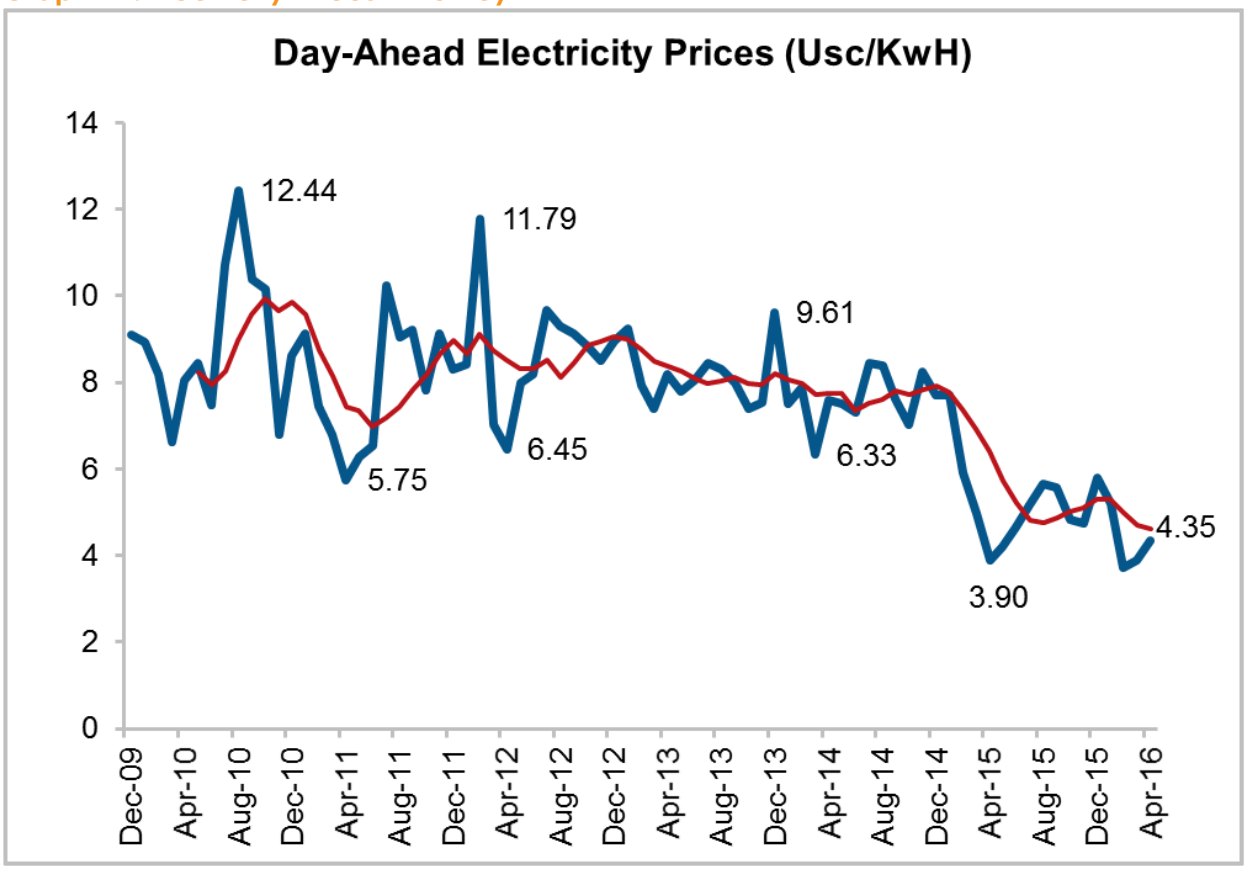
Turkish power-sector dynamics are also being affected by liberalization of energy markets[41], a change that encourages competition. This shift, coupled with lower commodity prices and the entrance of renewables, has driven electricity prices in Turkey to all-time lows (graph 12) and left some natural gas- and coal-fired plants out of the day-ahead market in which electricity prices are determined according to daily demand and supply. As of February 2016, the amount of electricity generated from lignite-and natural gas-fired plants fell by 10% and 18%, respectively, compared to the same period in 2015 (graph 13), and some natural gas plants have decreased or stopped production.[42] Coal and natural gas will remain under considerable pressure as the Turkish markets is further liberalized, as competitive markets develop, and as oversupply persists. Suppliers with high operating costs will most likely be forced out of business.[43]

[41] Turkey's energy market has been going through major transformation via privatizations, changes in regulation and market structure. While number of companies active in the sector is being increased by privatizations, creation of an energy markets operations company (EPIAS) in 2015 has enable hourly electricity prices to be based on market demand and supply

[42] BİS Energy Stopped Production Due to High Input Costs', 29 November 2016, EnerjiGazetesi.com

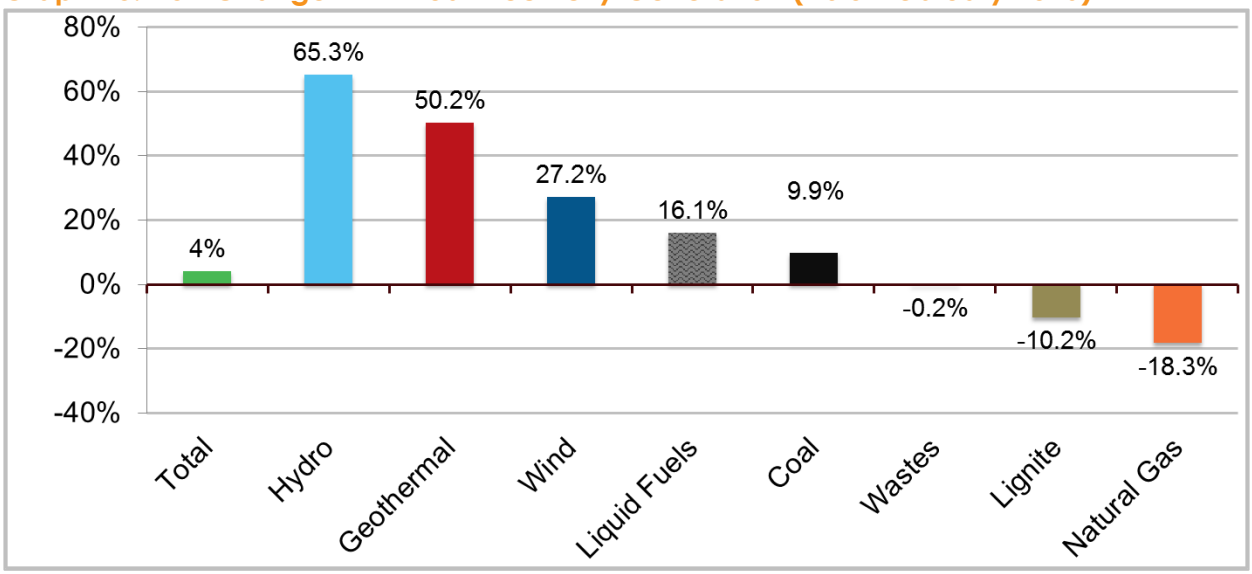
[43] Hatem E. 'Elektrikte Arz Fazlası Siddetlenebilir; Zorlanan Piyasadan Cikar', Nisan 7 2016, hurriyet.com.tr

Graph 12: Electricity Prices in Turkey



Source: EPIAS

Graph 13: YoY Change in Annual Electricity Generation (As of February 2016)



Source: TEIAS

Turkey Has the Political Will to Diversify Its Energy Mix

Turkey has doubled its installed natural-gas capacity over the past 10 years. The natural gas share of power generation nationally rose to a peak of 49% before dropping to 37% by the end of 2015. The government's plan is to reduce that number to 30% by 2023. Political risk, especially as it relates to Turkey's biggest natural gas provider, Russia,[44] has increased the urgency behind this strategic objective.

Turkey has the political will to change its energy mix. Yet Turkish leaders decided to pursue a questionable strategy for achieving this goal, however, aiming to reduce its reliance on natural gas by turning to domestically produced lignite, of which it has vast reserves (14.1 billion tonnes), most of which is of low quality.[45] After declaring 2012 the Year of Coal,[46] the government began extending policies to support the development of lignite projects by subsidizing power plant capital expenditures as well as operating costs for lignite mines. The government has announced plans for 71 new coal-fired plants[47] (table 2), which could increase the coal's share of electricity generation to as much as 45% by 2025, up from 28% today.[48] Government plans also include adopting additional subsidies for lignite-fueled power plants through annual electricity tenders and by introducing priority dispatch from the plants.

Table 2: Lignite and Hard-Coal Fueled Power Existing and Pipeline Capacity in Turkey*

	Existing Capacity(MwH)			Existing (Number of Plants)		
	Lignite	Hard-Coal+ Asphaltite	Total	Lignite	Hard-Coal +Asphaltite	Total
In operation	8,757	6,672	15,429	14	11	25
	Pipeline Capacity (MwH)			**Pipeline (Number of Plants)**		
	Lignite	Hard-Coal+ Asphaltite	Total	Lignite	Hard-Coal+ Asphaltite	Total
Licensed	290		290	1		1
Construction	1,320	1,455	2,775	1	2	3
Permitted	8,512	3,720	12,232	3	12	15
Pre-Permit	4,991	36,192	41,183	10	36	46
Announced	19,800		19,800	6		6
Total	**34,913**	**41,367**	**76,280**	**21**	**50**	**71**

Source: IEEFA calculations based on the available announcements on the projects

[44] An internationalized conflict broke out between Turkey and Russia in November 2015 when Turkey shot down a Russian fighter, accusing it to cross over to the Turkish border from Syria. Russia has been imposing economic sanctions to Turkey since then with restrictions to agricultural good imports from Turkey and suspensions on touristic trips to Turkey. The conflict deepened when Gazprom, Russian gas exporter, reduced gas supplies to Turkish companies in February 2016. Sector representatives then said the Turkish private sector and Gazprom were in talks over the future of a 10.25 % price discount, but the Russian side canceled this discount unilaterally, underlining "disagreements over the gas price'. Since then Gazprom and Turkish private gas importers agreed on the 2016 price; but the conflict between Gazprom and Botas, Turkish pipeline operator, continues over the discounted gas price. Botaş appealed to the International Chamber of Commerce (ICC) regarding the delay of the discount agreement between the two state companies.

[45] According to Ministry of Energy and Natural Resources, around 68% of the total lignite reserves in Turkey are low calorie (below 2000 kcal/kg), with 23,5% between 2000-3000 kcal/kg, 5,1% between 3000-4000 kcal/kg, and 3,4% is above 4000 kcal/kg grading. Source: http://www.enerji.gov.tr/en-US/Pages/Coal

[46] '2012 Yilini Komur Yili Ilan Ettik', 20 May 2012, Haberler.com
Source: http://www.haberler.com/enerji-bakanligi-mustesari-kilci-2012-yilini-komur-3638472-haberi/

[47] For geographical distribution and licensing status of coal fire power plants in Turkey, see http://www.iklimadaleti.org/i/upload/turkiyede-termik-santraller-EN.pdf

[48] Garanti Bank, Electricity Market Report, October 2015

Turkey's Move Toward Lignite-Fired Power Brings Serious Financial Risk

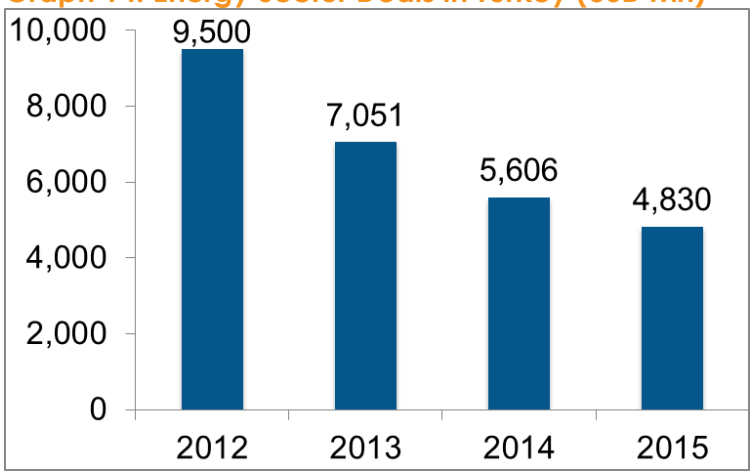
Turkey will need close to an additional 40GW of electricity-capacity investment over the next decade (according to its likely growth trajectory and current demand growth). Financing for fossil-fuel-based plants is limited, however: Existing natural-gas-powered plants already are not profitable because of oversupply in the Turkish power market and because the operation expenditure margins of lower efficiency CCGTs (combined-power cycle plants) are not competitive at current market prices.[49] Due to high operating costs, some natural gas plants have already closed down[50] or decreased their capacity utilization rates, and there is no appetite either on the public or private side to renew the contracts with CCGT plants.[51]

Even though some greenfield coal plants secured financing in 2012-2014, the appetites of investors have fallen sharply because of high operational costs, environmental regulations, added safety standards and current electricity prices. The value of energy sector investment deals in Turkey almost halved from U.S.$9.5 billion in 2012 to US$4.8 billion in 2015 with the average deal size dropping to US$ 107 million from US$216 million (graph 14).

Turkish banks are pressing for a solution to non-performing loans across the coal sector. Loan defaults are on the rise and banks are facing difficulty floating US$50 billion of total credits to the energy sector.[52] Bankers in Turkey say they are unlikely to extend credits to the coal sector under current market conditions but would consider doing so under a feed-in-tariff scheme.[53]

The drop in the supply of institutional investment capital to the coal sector and the reduced appetite of both Turkish and international banks for coal and lignite investments increases the pressure for expensive subsidies. Yet subsidies, as outlined in the new electricity law amendment, aren't likely to improve return on investment in the medium term and could create longer-term stranded-asset problems across the Turkish economy.

Graph 14: Energy Sector Deals in Turkey (USD Mn)



Source: Energy Deals Annual Review 2015, PwC Turkey

[49] 'Enerji Sektoru Sıkıntılı Gunler Geciriyor', 28 July 2015, EnerjiEnstitusu.com Source: http://enerjienstitusu.com/2015/07/28/enerji-sektoru-sikintili-gunler-yasiyor/
[50] 'BİS Enerji Yüksek Üretim Maliyeti Nedeniyle Faaliyetlerini Durdurdu', 29 November 2016, EnerjiGazetesi.com
[51] Kuleli K., 'Turkey Power 2015, Global Business Reports, p. 32
[52] 'Enerji Kredileri Bankaları Zorluyor', E. Saglam, Hurriyet, April 25, 2016
[53] Hatem E. 'Elektrikte Arz Fazlası Siddetlenebilir; Zorlanan Piyasadan Cikar', Nisan 7 2016, hurriyet.com.tr

Turkey's Plan for Lignite Expansion Brings Serious Economic Risks

The current economic climate creates a quandary for Turkey's energy planners. The general lower-price environment for fossil fuels, coal included, has driven down electricity prices in a trend that benefits households and businesses. A low-price environment, however, compounds investment risk for existing power plants as revenues drop below levels needed to repay debt and to fund operations.

Low prices also undermine the ability of the unsubsidized market to finance new coal and lignite plant construction. Yet, the latest new electricity law amendment, which offers a mechanism to support lignite-fueled power plants, is likely to lead to negative economic, financial, environmental and social consequences that would damage Turkey's economy for decades to come.

For example, subsidizing lignite power plant development at a time of excess supply would put the Turkish economy at risk in a number of ways:

- **A rapid, subsidized lignite-fueled power plant build-out would put upward pressure on currently low electricity prices**. The new electricity law currently does not detail how tender prices for electricity from the lignite-fired power plants would be determined. IEEFA estimates that the initial cost of the new subsidies for lignite plants would be US$1.1 billion per year, assuming the minimum price bid on the annual tenders is on average ¢US8/KWh and market prices remain at ¢US4.5/KWh. This cost, if passed through to consumers, would raise the market price of electricity by 19%. If the generation from lignite-fueled power plants increases as planned by the government, the annual cost of the subsidies could rise to as high as $US2 billion and could raise electricity market prices by as much as 29%. The core uncertainty is by whom the burden of subsidy would be carried.

Table 3: Estimated Cost of New Electricity Law

		Current Situation	By 2018
Electricity Production in Lignite-Powered Plants	MWh	32,120,000	57,000,000
Electricity market price	¢US/KWh	4.5	4.5
Subsidized price	¢US/KWh	8.0	8.0
Additional cost	¢US/KWh	3.5	3.5
Cost of the subsidy scheme	$US Bn	1.1	2.0
Additional Cost	¢US/KWh	0.85	1.32
Upward Pressure on the market price (Per KWh)		19%	29%

Assumptions:

- For reasons of simplicity, electricity prices for 2018 and USD/TL rates are taken constant
- It is assumed here that the accepted tender price would be around ¢US8/KWh
- It is assumed that electricity demand will increase up to 300TWh by 2018

- **The subsidy scheme in the new law would undercut recent efforts to liberalize Turkish energy markets.** Adding a significant amount of higher-priced lignite-fired generation to Turkey's electricity portfolio would distort the price of electricity. Turkey has been liberalizing its energy markets since the beginning of the 2000s by privatizing public companies, opening up the energy sector to private investment, and letting electricity prices be determined under day-ahead and intra-day bidding markets. An electricity grid working on market principles chooses the least-cost option first. Adding a new fleet of subsidized lignite plants would distort the market, and the new financing schemes would require new plants to run as much as possible (even if less expensive options are available for dispatch) in order to pay debt costs and avoid default.
- **The rapid addition of new lignite-fired power plants would lock in the costs of these plants at a time of slow or declining growth in the demand for power and damage.** Turkey's energy plan assumes that the country's GDP and energy demand will continue to grow at the same high rates as in past years. However, Turkey's current and future growth rates are likely to be lower than official forecasts, and the large expansion in new lignite plants would create excess generating capacity whose costs would have to be paid by consumers and businesses whether or not that capacity is needed. This would increase the potential for defaults on bank loans by existing generators that are not subsidized and have large fixed costs.
- **By trying to improve its energy security through a dramatically increased dependence on lignite and coal, Turkey would be choosing a risky path significantly out of step with the energy transformation occurring globally and in other important emerging economies.** Large developing countries around the world are modernizing and expanding their energy capacity by adding large amounts of renewable resources. Gains from deflationary prices in renewables and through efficiency improvements would be enormous in Turkey's case, while the heavy economic and financial burdens from subsidizing the coal and lignite sector would be lasting, negatively impacting consumers, businesses, the public sector, and, ultimately, the power generators themselves.
- **The potential for defaults and stranded assets from a dramatic increase in new lignite power plants would undermine the Turkish banking sector.** Turkey's banks have proved resilient over the past 10 years, the result of prudent regulation and sound balance sheets, fostering confidence in the overall Turkish economy. The deteriorating financial performance of coal companies has burdened the banking sector, however, and further exposure, especially to the risks inherent in lignite power plants would create a long-term imbalance for banks.
- **Turkey's international credibility would be placed at risk if the country were to expand its lignite fleet as proposed and in a time of increasing pressure on governments to speed up investments in renewables and end the subsidies to fossil fuels,**[54] Agreements such as COP21 and the Global Climate Accord are likely to increase carbon restrictions and other greenhouse gas emissions limits. If Turkey were to pursue its proposed lignite

[54] http://www.euractiv.com/section/climate-environment/opinion/governmental-support-of-fossil-fuels-no-longer-defensible/

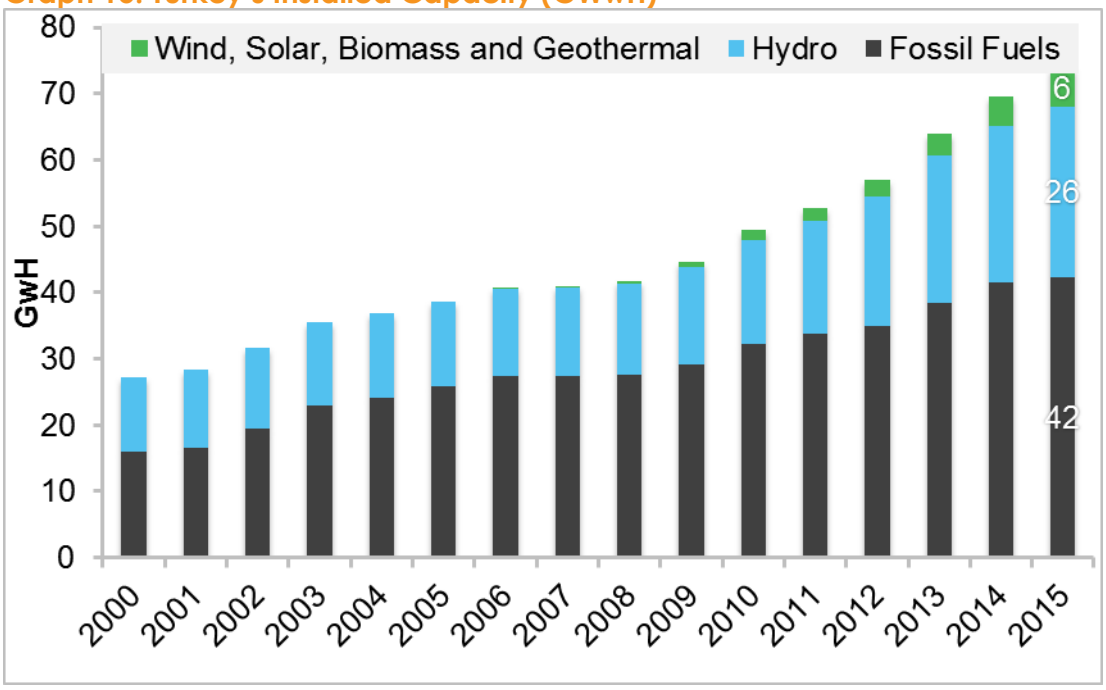
expansion, it would probably be impossible to deliver on its pledge to decrease carbon emissions by 20% by 2030.

Turkish Renewables: Less Financial and Economic Risk, More Benefits

Turkey has vast potential wind, solar and hydro resources, a fact acknowledged by government planners.[55] Renewable investments in Turkey are supported prudently by feed-in tariffs that allow solar, wind, biomass and hydro plant electricity producers to sell electricity at pre-determined prices (tables 4 and 5). Additional tariffs support domestic use of renewable capital goods.

With such policies in place, Turkey has increased its wind, solar, biomass and geothermal capacity from almost zero at the beginning of 2009 to almost 5.7 GW, or 8.8% of installed capacity by the end of 2015 in addition to 26 GW of hydro capacity (35% of total). Most of the installed capacity in Turkey's renewables sector is wind-powered (4.5 GW) while solar produces 0.3 GW (graph 15), an amount that falls far short of its potential.

Graph 15: Turkey's Installed Capacity (GWwH)



Source: TEIAS

[55] National Renewable Energy Action Plan for Turkey, December 2014, Ministry of Economy and Natural Resources

Table 4: Technical Potential of Renewable Energy in Turkey (MW)

Energy Source	MW
Geothermal	31,500
Biomass	16,000
Solar PV	3,871,500
Wind	114,000
Small Hydro	6,800

Source: Acar S. et.al 2015 [56]

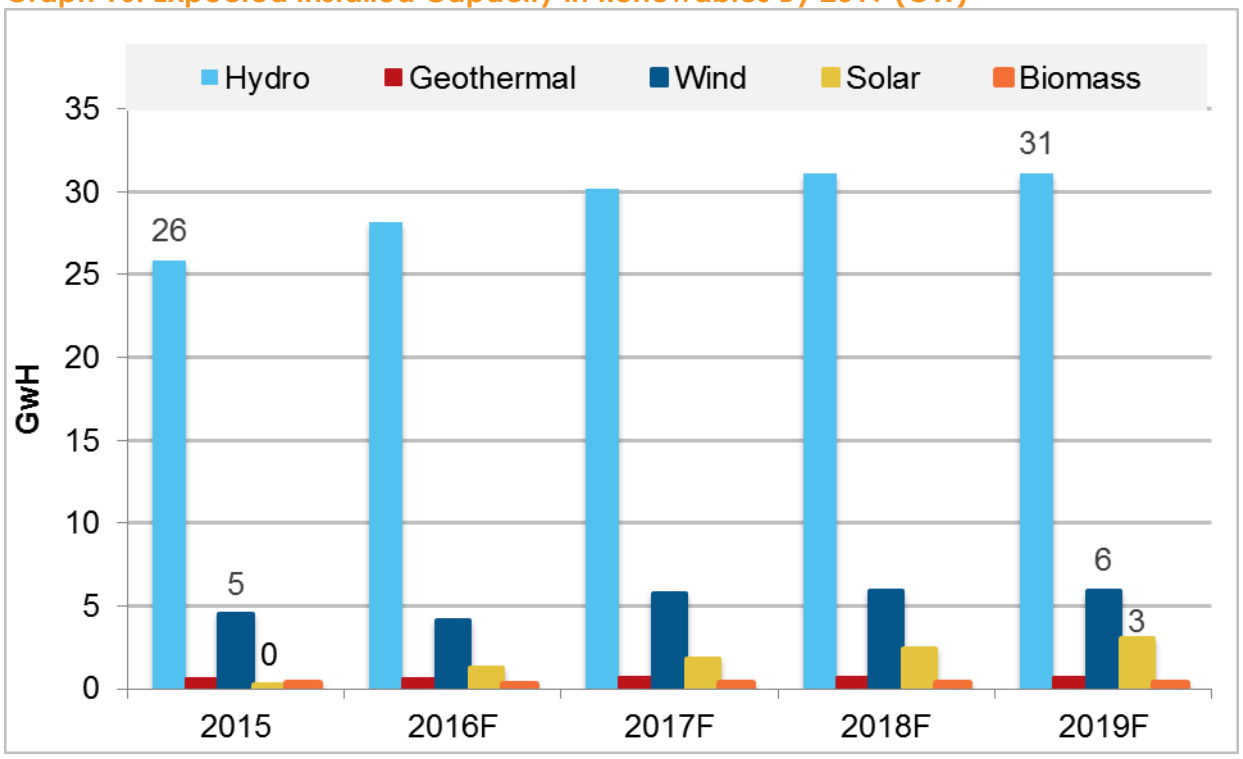
Table 5: Feed-in-Tariff Payments for the Renewables

	UsCents/KWH
Biogas and biomass	13.3
Solar	13.3
Geothermal	10.5
Hydro	7.3
Wind	7.3

Source: Ministry of Energy and Natural Resources

According to the latest official projections,[57] Turkey will see an additional 17 GW of renewables installed capacity by 2019. While 4 GW of the additions would come from wind and solar, by these projections, hydro capacity additions would total 5 GW. Renewables (excluding hydro) would make up 11% of total installed capacity by the end of 2019 (graph 16).

Graph 16: Expected Installed Capacity in Renewables By 2019 (GW)



Source: TEIAS

These projections, and current national energy-development plans, fall shockingly short of the potential for solar. Turkey receives the highest average solar radiation in the EU (for which it is an active candidate for membership) after Spain, Portugal, Malta and Cyprus. Its mere 0.3 GW installed solar capacity pales in comparison to Spain's 7GW and Germany's 40 GW. And

[56] Acar S., Kitsen L., and Bridle R., 'Subsidies to Coal and Renewable Energy in Turkey', March 2015, ISSD
[57] 2015-2019 Strategic Plan, TEIAŞ, July 2015

with only 3 GW of planned solar capacity by the end of 2019, Turkey is not keeping up with the broader energy market transformation.

While Turkey—to its credit—has a feed-in-tariff mechanism in place that gives renewable investments a lift, the government is not doing nearly as much as it could to support renewables. Hurdles remain especially for solar. By merely streamlining the regulatory process and reducing administrative lead times for new small-scale rooftop solar investments, Turkey could easily unleash its solar potential.[58]

Turkey today can add renewable resources incrementally, allowing for flexibility in responding to changes in demand forecasts and avoiding being burdened with additional excess capacity when projected demand loads do not materialize.

Equally important, by adopting more ambitious targets in renewables—especially in solar—Turkey can compete better with other emerging economies vying for global capital. The strong international investor interest in the India's renewable energy market demonstrates the potential for such investments in Turkey. Under the current policy and market structure, Turkey has room to improve its solar energy policy and take advantage of technological improvements and international financial interest in the renewable energy.

Financial markets favor renewables, and Turkey can secure financing easily both at the domestic and international level due to foreign currency feed-in-tariff,[59] available both at the domestic and international level.

Table 6: Power Generation of the Feed-in-Tariff Mechanism Renewable Energy Participants (GWh)

	2012	2013	2014	2015	2016
Biomass + biogas	374	751	926	575	179
Geothermal	487	858	1,437	0	507
Hydro	2,296	529	1,073	2,116	9,982
Wind	2,082	0	2,379	2,732	4,328
Total	5,239	2,137	5,814	5,423	14,996

Source: YEKDEM

[58] Bavbek G.,'Solar Photovoltaic Sector in Turkey: Prospects and Challenges', May 2015, EDAM
[59] '2015 Electricity Market Report: 2015-2022 Projections, October 2015, Garanti Bank

D. Conclusion: Turkey Is at Risk of Choosing the Wrong Path

Turkey is at risk of becoming a less competitive economy if it does not join the global energy transition to renewable resources.

While the Turkish economy has made progress in recent years, it is stuck today in a middle-income trap[60] in which it is at risk of exhausting its labor and natural resource advantages. Countries that find themselves in such situations are unable to keep up with other more economically developed nations. The challenge of the middle-income trap is to move to productivity and innovation-led growth, which require investments in infrastructure and education.

Because it has a relatively high current account deficit, Turkey must support investments that result in the highest value-added results, both directly and indirectly. Given the costs and relatively low-skilled labor nature of the lignite and coal industry, Turkey would not be making the best of use its resources by expanding its coal-fired electricity fleet.

Increasing its investment in renewables, on the other hand, would promote broad economic benefits that would include more technology-intensive, high-skilled and better-paying jobs.

If it were to provide proposed subsidies to support expansion of its lignite-fired electricity industry, Turkey would risk placing upward pressure on low electricity prices, undermining the banking sector and disrupting its progress toward liberalize energy markets. Rapid additions of lignite-fired power plants would lock in the cost of these plants at a time of declining demand.

Trying to secure the energy supply through subsidies in lignite, even if it is domestically produced, is an economically unviable, unsustainable and financially insecure alternative compared to renewables. Energy security only through capacity installments in fossil fuels is not the sole choice—as once thought. Betting on energy security through the coal sector subsidies would risk not only the energy market transformation of the past 15 years but would also freeze the financing capabilities of the Turkish energy sector.

With the technological path it provides, deflationary cost structure, environmental and low emission benefits it creates, renewable energy has the potential to provide greater benefits and a better economic alternative for Turkey on its path to becoming a more competitive economy.

[60] Prof. Dr. Erinç Yeldan, Kamil Taşcı, Assoc. Dr. Ebru Voyvoda, Mehmet Emin Özsan, 'Escape From Middle Income Trap: Which Turkey?, 2012, Turkonfed