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IRAN

POWER REPORT

INCLUDES 10-YEAR FORECASTS TO 2025

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Iran Power Report Q2 2016

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BMI Industry View

BMI View: The signing of the Joint Comprehensive Plan of Action between the Iranian government and the PG+1, comprised of the five permanent members of the Security Council and Germany, an agreement aimed at bringing an end to sanctions on Iran through agreement on the country's nuclear programme, has precipitated considerable activity among foreign investors looking to take advantage of the country's considerable market for electricity, both in terms of domestic supply and export.

Since the signing of the agreement, several companies, many of them European, and several government delegations have visited Iran, signing agreements with the government aimed at installing a number of new power plants in the country. In Q116, Iranian authorities announced potential co-operation over nuclear power plants with both Hungary and Japan.

However, **BMI**'s forecasts for the power sector remain quite cautious, for the time being. **BMI** predicts Iran's total power generation to be 258.11TWh in 2016, an increase of 1.55% on 2015's 254.17TWh. Between 2017 and 2025, **BMI** forecasts this output to increase at a year-on-year (y-o-y) average rate of 2.27% to 319.79TWh by 2025.

According to **BMI**'s research, Iran will have 80,864.37MW of installed capacity in 2016, representing a 0.57% increase on 2015's 80,409.30MW. During the period 2017 to 2025, this figure will increase at an average year on year rate of 2.0%, reaching 96,508MW by 2025.

A number of factors underscore the cautious nature of our forecasts. In recent years, Iran's economy has not performed well. It underwent a 10% contraction in real terms across the period 2012 to 2015. The government predicts a rapid rebound in economic growth, at a rate of 8% y-o-y. However, we predict that the economy will grow at just over 4% per year. The upside is limited by the poor outlook for oil and gas prices and limitations on the removal of sanctions, with the US government maintaining 'primary' sanctions. Indeed, while non-US firms and foreign subsidiaries of US firms will now be permitted to conduct business in Iran, US companies will not. Moreover, some European firms have decided to remain on the sidelines for now, since doing business with companies linked to Iran's Republican Guard will remain a punishable offence.

All these factors limit the prospects for growth in consumer and industrial power demand in Iran, while also limiting the resources - fiscal and professional - available for investment in the sector.

Modest growth in the Iranian power sector will continue to be driven by gas-to-power, as the government seeks to take advantage of the country's abundant natural gas wealth. The government will also push ahead with its programme of converting older simple cycle units to combined cycle technology, thereby increasing efficiency and boosting capacity.

The nuclear deal has paved the way for the signing of a raft of deals with governments and companies in Europe, Russia and Asia, who plan on investing in developing new power plants to supply the country's 80m people, as well as for export.

According to **BMI**'s research, these agreements are likely to bear fruit from 2019, when the first plants will be commissioned. This can be seen in the moderate rise in installed capacity from this date. This sharp rise can be seen in the contrast between the y-o-y percentage increase between 2016 and 2019, which **BMI** forecasts to be an average of 0.63%, versus an increase between 2019 and 2024 of 2.31%. This represents y-o-y average additions of 354.12MW and 1,711MW for each respective period.

However, despite growing investor confidence, **BMI**'s research suggests Iran will fall short of its ambitious targets during the period 2017-2024. Even when new investments begin to be commissioned after 2019, the government will fall short of its stated target of adding 5GW per year.

Latest Updates And Structural Trends

- Germany's **Siemens** announced in March 2016 that it had signed a deal with Iran's **Mapna Group**, with the latter acquiring technology to manufacture over 20 gas turbines. The two firms also signed an MoU for further work in Iran's power sector.
- Iran's Atomic Energy Organization announced in March 2016 that it was seeking to co-operate with Japan in building several small nuclear plants, according to the Tehran Times.
- Iran in February 2016 announced that it was evaluating a potential project, in cooperation with Hungary, to design a 25MW nuclear reactor, which would then be marketed across Africa and Asia. If successful, a 100MW reactor may then be launched, again for sale across continents.
- Greece's energy ministry stated in February 2016 that it was in talks with Iran to secure a supply of natural gas for local needs, which could be followed by further shipments through Greece to other European markets. This news followed an agreement between Greece's **Hellenic Petroleum** and Iran for the latter to supply the former with crude oil, which would be refined by the Greek entity, with some refined output finding its way back to Iran.
- In October 2015, Germany's Green Energy 3000 GmBH signed a memorandum of understanding with the **Khuzestan District Electricity Company** (KDEC) to install 100MW of solar power in the southwestern city of Ahvaz. The Ahvaz MoU follows the signing of an agreement in August between the German and Iranian governments in August, which aims to generate 100MW of wind power, plus 400MW of solar in Khuzestan.

- Iranian press reported the government had signed a series of agreements which could lead to the installation of around 1GW of new solar capacity in Khuzestan.
- In early November, it was reported the government had signed an agreement worth USD6bn with an unnamed European company to install 4,250MW of new capacity, much of it made up of wind power, in the country.
- Italy's **Fata**, part of **Finmeccanica**, has also reportedly signed a preliminary agreement with the **Ghadir Investment Company** to build a power plant in Iran. The agreement could be worth up to USD543mn.
- It was also reported in the Iranian press the government had held a series of talks with South Korean energy companies, which aimed at developing renewables plants. The companies reportedly included **Hyundai**, **Tucson**, and **LSLC** companies, as well as the Export-Import Bank of Korea.
- Several government delegations have visited Tehran with a view to fostering cooperation in the electricity sector. This includes a September visit by Spain's Industry, Energy and Tourism Minister Jose Manuel Soria to see energy minister Hamid Chitchian, during which the two discussed cooperation on renewable energy and a visit from Russian Energy Minister Alexander Novak, aimed at exploring cooperation on power issues between Iran and Russia.
- There has also been considerable progress on the strengthening of Iran's electricity trade with its neighbours, including the launching of a new round of talks aimed at building a 400kV line from the Turkmen city of Mary to the Iranian city of Sarakhs, and negotiations between the Iranian and Armenian governments to increase their gas for power trade by 75%.

Table: Headline Power Forecasts (Iran 2015-2021)

	2015e	2016f	2017f	2018f	2019f	2020f	2021f
Generation, Total, TWh	254.169	258.109	262.237	267.329	272.720	278.931	285.940
Consumption, Net Consumption, TWh	209.1	212.9	217.4	222.8	228.8	235.1	241.6
Capacity, Net, MW	80,409.3	80,864.4	81,214.1	81,926.7	83,685.4	85,656.4	87,470.6

e/f = BMI estimate/forecast. Source: EIA, UN Data, BMI

SWOT

Iran Power SWOT

Strengths

- Iran has abundant reserves of hydrocarbon wealth, providing the basis for long-term energy self-sufficiency. It is estimated to hold the world's second-largest gas reserves and fourth-largest oil reserves. It also has some hydroelectric resources, abundant sunlight, and despite international opposition, continues to pursue its nuclear power ambitions.
- Iran's high access rate - almost 100% - means the country is an enormous market for sale of electricity.
- Iran currently trades power with Afghanistan, Armenia, Azerbaijan, Iraq, Pakistan, Turkey and Turkmenistan.

Weaknesses

- The price of natural gas to residential and industrial consumers is state controlled at extremely low prices, undermining profitability.
- Iran's economy continues to be hamstrung by the low price of oil and gas, meaning it will continue to be difficult for the government to raise prices and cut subsidies.

Opportunities

- Iran is believed to have the potential to produce some 6.5GW of electricity from wind energy, as well as significant solar power potential.
- The country is surrounded by nearby states, such as India and Pakistan, which face a shortage of electricity, providing an opportunity for Iran to increase production for export.
- Iran's government has mooted that it intends to allow foreign power developers to export a portion of the power they produce to neighbouring countries. This is a potentially enormous market that could be opened up to private companies if the government makes good on its promise.
- Easing of sanctions by US government from Q116 creates major opportunities for foreign firms, after years of under investment.

Iran Power SWOT - Continued

Threats	▪ Sanctions withdrawal will be phased and gradual with potential for major hiccups along the way. ▪ Despite poor government finances, there is little prospect that power subsidies will be cut over the medium-term, amid fears of unleashing unrest.

Industry Forecast

Iran Snapshot

Table: Country Snapshot: Economic and Demographic Data (Iran 2015-2019)

	2015e	2016f	2017f	2018f	2019f
Nominal GDP, USDbn	465.8	420.4	445.6	480.8	523.2
GDP per capita, USD	5,860	5,224	5,472	5,837	6,283
Real GDP growth, % y-o-y	0.4	2.8	3.5	4.6	5.2
Population, mn	79.1	80.0	80.9	81.8	82.6

e/f = BMI estimate/forecast. Source: National sources, BMI

Table: Country Snapshot: Economic and Demographic Data (Iran 2020-2025)

	2020f	2021f	2022f	2023f	2024f	2025f
Nominal GDP, USDbn	558.0	592.5	620.0	649.8	681.4	709.1
GDP per capita, USD	6,631	6,970	7,225	7,504	7,802	8,051
Real GDP growth, % y-o-y	4.0	3.6	3.9	3.9	3.7	3.4
Population, mn	83.4	84.1	84.8	85.4	86.0	86.5

f = BMI forecast. Source: National sources, BMI

Table: Country Snapshot: Power Sector

Access to Electricity, % of population	**100.0**
Quality of Electricity Supply (Value)	5.0/7
Quality of Electricity Supply (Rank)	58/140

Source: World Economic Forum - Global Competitiveness Report 2015-2016, World Bank, BMI

Iran Power Forecast Scenario

BMI View: *BMI forecasts Iran's total power generation to be 258.11TWh in 2016, an increase of 1.55% on 2015's 254.17TWh. Over the rest of the period, BMI forecasts this output to increase at a year-on-year (y-o-y) average rate of 2.27%, to 319.79TWh by 2025.*

Electricity Generation And Power Generating Capacity

Table: Total Electricity Generation Data And Forecasts (Iran 2014-2019)

	2014	2015e	2016f	2017f	2018f	2019f
Generation, Total, TWh	250.836	254.169	258.109	262.237	267.329	272.720
Generation, Thermal, % of total generation	91.923	92.008	91.946	91.868	91.928	92.077
Generation, Coal, TWh	0.449	0.459	0.464	0.469	0.477	0.484
Generation, Coal, % y-o-y	-0.599	2.230	1.100	1.250	1.720	1.410
Generation, Coal, % total electricity generation	0.179	0.180	0.180	0.179	0.179	0.178
Generation, Natural Gas, TWh	169.853	172.910	176.195	179.631	184.337	189.591
Generation, Natural Gas, % y-o-y	1.700	1.800	1.900	1.950	2.620	2.850
Generation, Natural Gas, % of total electricity generation	67.715	68.030	68.264	68.500	68.955	69.519
Generation, Oil, TWh	60.275	60.486	60.663	60.811	60.935	61.038
Generation, Oil, % change y-o-y	0.419	0.350	0.292	0.244	0.204	0.170
Generation, Oil, % of total electricity generation	24.030	23.798	23.503	23.189	22.794	22.381
Generation, Nuclear, TWh	6.413	6.413	6.420	6.421	6.424	6.430
Generation, Nuclear, % y-o-y	0.200	0.010	0.100	0.022	0.040	0.100
Generation, Nuclear, % of total electricity generation	2.557	2.523	2.487	2.449	2.403	2.358
Generation, Hydropower, TWh	13.375	13.405	13.699	13.863	14.113	14.127
Generation, Hydropower, % change y-o-y	0.500	0.220	2.193	1.200	1.800	0.100
Generation, Hydropower, % total electricity generation	5.332	5.274	5.307	5.287	5.279	5.180
Hydro-Electric Pumped Storage, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Hydro-Electric Pumped Storage, % total electricity generation	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Non-Hydropower Renewables, TWh	0.471	0.496	0.669	1.041	1.043	1.050
Generation, Non-Hydropower Renewables, % change y-o-y	98.545	5.262	34.890	55.693	0.182	0.645
Generation, Non-Hydropower Renewables, % of total electricity	0.188	0.195	0.259	0.397	0.390	0.385

e/f = BMI estimate/forecast. Source: National sources, BMI

Table: Total Electricity Generation Data And Forecasts (Iran 2020-2025)

	2020f	2021f	2022f	2023f	2024f	2025f
Generation, Total, TWh	278.931	285.940	293.629	301.816	310.525	319.793
Generation, Thermal, % of total generation	92.235	92.398	92.556	92.710	92.864	93.020
Generation, Coal, TWh	0.489	0.499	0.514	0.524	0.534	0.545
Generation, Coal, % y-o-y	0.980	2.000	3.000	2.000	2.000	2.000
Generation, Coal, % total electricity generation	0.175	0.174	0.175	0.174	0.172	0.170
Generation, Natural Gas, TWh	195.658	202.506	209.999	217.979	226.480	235.539
Generation, Natural Gas, % y-o-y	3.200	3.500	3.700	3.800	3.900	4.000
Generation, Natural Gas, % of total electricity generation	70.146	70.821	71.518	72.222	72.935	73.654
Generation, Oil, TWh	61.125	61.198	61.259	61.310	61.353	61.389
Generation, Oil, % change y-o-y	0.143	0.119	0.100	0.083	0.070	0.059
Generation, Oil, % of total electricity generation	21.914	21.402	20.863	20.314	19.758	19.197
Generation, Nuclear, TWh	6.433	6.435	6.438	6.441	6.443	6.446
Generation, Nuclear, % y-o-y	0.040	0.040	0.040	0.040	0.040	0.040
Generation, Nuclear, % of total electricity generation	2.306	2.251	2.193	2.134	2.075	2.016
Generation, Hydropower, TWh	14.169	14.240	14.354	14.490	14.635	14.789
Generation, Hydropower, % change y-o-y	0.300	0.500	0.800	0.950	1.000	1.050
Generation, Hydropower, % total electricity generation	5.080	4.980	4.889	4.801	4.713	4.625
Hydro-Electric Pumped Storage, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Hydro-Electric Pumped Storage, % total electricity generation	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Non-Hydropower Renewables, TWh	1.057	1.062	1.066	1.073	1.079	1.086
Generation, Non-Hydropower Renewables, % change y-o-y	0.644	0.499	0.367	0.660	0.615	0.572
Generation, Non-Hydropower Renewables, % of total electricity	0.379	0.371	0.363	0.356	0.348	0.340

f = BMI forecast. Source: National sources, BMI

Table: Electricity Generating Capacity Data And Forecasts (Iran 2014-2019)

	2014	2015e	2016f	2017f	2018f	2019f
Capacity, Net, MW	80,051.4	80,409.3	80,864.4	81,214.1	81,926.7	83,685.4
Capacity, Net, % y-o-y	0.6	0.4	0.6	0.4	0.9	2.1
Capacity, Conventional Thermal, MW	67,617.8	67,922.1	68,173.4	68,446.1	69,130.6	70,858.8
Capacity, Conventional Thermal, % y-o-y	0.4	0.5	0.4	0.4	1.0	2.5
Capacity, Conventional Thermal, % of total capacity	84.5	84.5	84.3	84.3	84.4	84.7
Capacity, Nuclear, MW	915.0	915.0	915.0	915.0	915.0	915.0
Capacity, Nuclear, % y-o-y	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Nuclear, % of total capacity	1.1	1.1	1.1	1.1	1.1	1.1
Capacity, Hydropower, MW	10,732.6	10,786.2	10,810.0	10,837.0	10,865.2	10,895.6
Capacity, Hydropower, % y-o-y	0.5	0.5	0.2	0.3	0.3	0.3
Capacity, Hydropower, % of total capacity	13.4	13.4	13.4	13.3	13.3	13.0
Capacity, Non-Hydroelectric Renewables, MW	786.0	786.0	966.0	1,016.0	1,016.0	1,016.0
Capacity, Non-Hydroelectric Renewables, % y-o-y	20.6	0.0	22.9	5.2	0.0	0.0
Capacity, Non-Hydroelectric Renewables, % of total capacity	1.0	1.0	1.2	1.3	1.2	1.2

e/f = BMI estimate/forecast. Source: National sources, BMI

Table: Electricity Generating Capacity Data And Forecasts (Iran 2020-2025)

	2020f	2021f	2022f	2023f	2024f	2025f
Capacity, Net, MW	85,656.4	87,470.6	89,450.1	91,608.4	93,957.0	96,508.3
Capacity, Net, % y-o-y	2.4	2.1	2.3	2.4	2.6	2.7
Capacity, Conventional Thermal, MW	72,800.3	74,584.0	76,530.6	78,650.5	80,955.0	83,456.5
Capacity, Conventional Thermal, % y-o-y	2.7	2.5	2.6	2.8	2.9	3.1
Capacity, Conventional Thermal, % of total capacity	85.0	85.3	85.6	85.9	86.2	86.5
Capacity, Nuclear, MW	915.0	915.0	915.0	915.0	915.0	915.0
Capacity, Nuclear, % y-o-y	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Nuclear, % of total capacity	1.1	1.0	1.0	1.0	1.0	0.9
Capacity, Hydropower, MW	10,925.0	10,955.6	10,988.5	11,026.9	11,071.0	11,120.9
Capacity, Hydropower, % y-o-y	0.3	0.3	0.3	0.4	0.4	0.5
Capacity, Hydropower, % of total capacity	12.8	12.5	12.3	12.0	11.8	11.5
Capacity, Non-Hydroelectric Renewables, MW	1,016.0	1,016.0	1,016.0	1,016.0	1,016.0	1,016.0

Electricity Generating Capacity Data And Forecasts (Iran 2020-2025) - Continued						
	2020f	2021f	2022f	2023f	2024f	2025f
Capacity, Non-Hydroelectric Renewables, % y-o-y	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Non-Hydroelectric Renewables, % of total capacity	1.2	1.2	1.1	1.1	1.1	1.1

f = BMI forecast. Source: National sources, BMI

According to **BMI**'s research, Iran will have 80,864.37MW of installed capacity in 2016, representing a 0.57% increase on 2015's 80,409.30MW. During the period 2017 to 2024, this figure will increase at an average y-o-y rate of 2.0%, reaching 96,508MW by 2025.

A number of factors underscore the cautious nature of our forecasts. In recent years, Iran's economy has not performed well. It underwent a 10% contraction in real terms across the period 2012 to 2015. The government predicts a rapid rebound in economic growth, at a rate of 8% y-o-y, while consensus independent forecasts are largely in the realm of 5-6%, based largely upon the lifting of American sanctions in Q116.

However, we predict that the economy will grow at just over 4% per year. The upside is limited by the poor outlook for oil and gas prices and limitations on the removal of sanctions, with the US government maintaining 'primary' sanctions. Indeed, while non-US firms and foreign subsidiaries of US firms will now be permitted to conduct business in Iran, US companies will not. Moreover, some European firms have decided to remain on the sidelines for now, since doing business with companies linked to Iran's Republican Guard will remain a punishable offence.

All these factors limit the prospects for growth in consumer and industrial power demand in Iran, while also limiting the resources - fiscal and professional - available for investment in the sector. Growth in the Iranian power sector will continue to be driven by gas-to-power, as the government seeks to take advantage of the country's abundant natural gas wealth. The government will also push ahead with its programme of converting older simple cycle units to combined cycle technology, thereby increasing efficiency and boosting capacity.

BMI's research forecasts thermal generation to account for some 237.32TWh during 2016, a 1.48% increase on 2015's 233.85TWh. This is equivalent to around 92% of Iran's total electricity output. In terms of installed capacity, thermal generation options make up 68,173MW.

Between the period 2016 and 2025, **BMI** forecasts thermal's share of total generation in Iran to increase from just under 92% to just over 93%, or 297.47TWh.

As a proportion of thermal capacity, natural gas fired generation will comprise some 74.24% in 2016, equivalent to 176.2TWh. This is equivalent to 68.26% of total electricity generated. As a percentage, natural gas' share of generation output will steadily increase during the period 2016 to 2025. By the end of the period, Iran will generate 235.54TWh from natural gas, equivalent to a y-o-y average increase of over 3%. According to **BMI**'s research, the benefits of the signing of the Joint Comprehensive Plan of Action in terms of new investment in gas fired power generation will begin to be seen in 2018, when a series of new gas fired power plants will be commissioned.

However, increasing investment in new gas fired technology forms only a part of the government's plan for taking advantage of Iran's abundant natural gas reserves. The government is also pursuing a strategy of converting older simple cycle gas fired power plants to combined cycle technology, thereby increasing efficiency and boosting output.

Iran's first combined cycle power plant, a 968MW facility was inaugurated in Reshvanshahr in December 2012. The following year, former Iranian Energy Minister Majid Namjou announced the government intended to convert a further 12 thermal units to combined cycle. Speaking in January 2015, current Energy Minister Hamid Chitchian pledged to expand the country's generation capacity by converting a further 8,000MW to combined cycle technology. According to the Ministry of Energy, these conversions will boost the efficiency of the plants from 32% to 47%.

In terms of new gas-fired generation capacity, the Ministry of Energy announced in May 2015 that construction of three power plants had begun. Construction of the new plants is scheduled to be completed in mid-2016, with full output from the plants expected after three years. According to the Ministry, a further 2,000MW of new gas-fired capacity will come online during 2016. In February 2015, the government announced it had brought a 328MW gas-fired power plant online in Balouchestan Province.

Generation from oil based fuel will account for 60.66TWh in 2016, a figure which will increase slightly to 61.39TWh by 2025, a negligible rise. As a percentage of output, oil based fuel accounts for 25.56% of total thermal output and 23.50% of total output. This will decline to 20.64% and 19.20% by 2025, a result of a governmental push to use less oil based fuels because they generate electricity at a higher cost.

Coal has never played a central role in Iran's power sector. **BMI** forecasts its use to decline slightly during 2016 to 2025, from 0.18% to 0.17%.

The Iranian government has ambitious plans to increase electricity generation from nuclear power plants. Iran currently has one operating nuclear power plant, the 1,000MW Bushehr power station. This began commissioning in 2011, and was handed over from its Russian operators to the Iranian government in October 2015.

In December 2013, reports suggested the Iranian and Russian authorities were in talks to begin building a second reactor at Bushehr during 2014, although this start date has since been missed. In September 2014, Iran announced it intended to build two new reactors, with an estimated capacity of 2,000MW, at the site and that it had signed an agreement with Russia's **Rosatom** to undertake the work. The success of negotiations on Iran's nuclear plans in July has provided impetus to these plans. Shortly after the deal was finalised, Iran's Atomic Energy Agency announced that China planned to build a further two nuclear power plants in the country.

However, despite these plans, and despite renewed confidence that the country will be able to generate more power from nuclear following the signing of the Joint Comprehensive Plan of Action in July, **BMI**'s research does not suggest nuclear will play a more prominent role in the country's generation makeup than it currently does. **BMI** forecasts Iran's output from nuclear in 2016 will be 6.42TWh, equivalent to some 2.5% of total generation capacity. However, **BMI**'s research suggests this figure will not substantially increase between 2016 and 2025, reaching only 6.45TWh by the end of the period. This is equivalent to an average year on year increase of just over 0.05%. To a large extent, this conservative forecast is because the international community remains hostile to further nuclear development in Iran.

Output from hydropower is forecast to increase by just under 1% y-o-y between 2016 and 2025, from 13.7TWh to 14.64TWh. In terms of installed capacity, this represents an increase from 10,809MW to11, 071MW.

BMI does not forecast there to be a substantial increase in generation from non-hydropower renewables sources between 2016 and 2025. Generation from non-hydropower renewables during 2016 is forecast to be 0.67TWh, equivalent to just 0.26% of total generation output. **BMI** forecasts this figure to reach 1.09TWh by 2025, representing an increase to 0.34% of total generation capacity.

That said, the Iranian government's plans for non-hydropower renewables are very ambitious, aiming to add 5GW of new renewable capacity by 2020. The government has also taken steps to promote its renewables sector, having adopted a German style feed in tariff to offer a fixed rate for renewables projects some ten years ago.

International sanctions have long prevented international developers from investing. However, the removal in sanctions in Q216 may provide upside potential. Foreign investors are increasingly interested in taking advantage of the country's considerable renewable potential, including an estimated 30GW of wind potential, particularly following the signing of the Joint Comprehensive Plan of Action. **BMI** has already pointed to several indicators that companies are interested in investing in the country's renewables sector, including Berlin based **GI Umweltconsult**, a developer, planning to invest EUR300mn in wind projects from 2016, and **Nordex SE** also looking to enter the market.

Several further deals have been signed which point to the future development of the country's renewables sector. In October 2015, Germany's **Green Energy 3000 GmBH** and the **Khuzestan District Electricity Company** (KDEC) signed a memorandum of understanding to install 100MW of solar power in the southwestern city of Ahvaz, as announced by head of the KDEC Mahmoud Janqorban. This followed an August agreement between the German and Iranian governments aiming to develop 100MW of wind and 400MW of solar power in Khuzestan.

Since the signing of the Joint Comprehensive Agreement, it has also been reported that Indian and South Korean companies have signed agreements with the Iranian government which could result in the installation of 1GW's worth of new solar capacity in Khuzestan.

During 2016, **BMI** forecasts wind capacity will make up some 89.86% of Iran's total non-hydropower renewables output, equivalent to 0.60TWh from 400MWs' worth of units. However, despite the signing of the above mentioned deals since the Joint Comprehensive Plan of Action, **BMI** does not forecast output from wind power to increase substantially by 2024, increasing to just 0.63TWh, equivalent to a y-o-y average increase of just over 0.5%.

Contributions from solar and biomass to Iran's overall generation matrix are only marginal. Solar projects currently supply 0.06TWh, a figure which **BMI** estimates to remain the same going through to 2024. Iran's biggest solar plant is in Mashad. It produces about 72,000kWh annually, which is sufficient power to meet the requirements of Razavi Khorasan Province. Electricity from biomass is also currently 0.01TWh. This figure will double by 2024.

Electricity Consumption

Table: Total Electricity Consumption Data And Forecasts (Iran 2014-2019)

	2014	2015e	2016f	2017f	2018f	2019f
Consumption, Net Consumption, TWh	206.0	209.1	212.9	217.4	222.8	228.8
Consumption, Net Consumption, % y-o-y	2.4	1.5	1.8	2.1	2.5	2.7
Consumption, Net Consumption, KWh per capita	2,636.6	2,643.4	2,659.6	2,685.2	2,723.2	2,769.0

e/f = BMI estimate/forecast. Source: BMI, EIA

Table: Total Electricity Consumption Data And Forecasts (Iran 2020-2025)

	2020f	2021f	2022f	2023f	2024f	2025f
Consumption, Net Consumption, TWh	235.1	241.6	248.4	255.5	263.1	271.3
Consumption, Net Consumption, % y-o-y	2.8	2.8	2.8	2.9	3.0	3.1
Consumption, Net Consumption, KWh per capita	2,818.8	2,872.3	2,929.5	2,991.3	3,060.1	3,136.2

f = BMI forecast. Source: BMI, EIA

BMI forecasts Iran's net electricity consumption in 2016 will be 212.88TWh, a 1.8% increase on 2015's 209.12TWh. This figure will rise to 271.27TWh by 2025.

Measured per capita, **BMI** forecasts Iran's electricity consumption in 2016 will be 2,659.63TWh, representing a slight increase on 2015's 2,643.44TWh. By 2025, this figure will rise to 3,136.22TWh, according to **BMI**'s research.

According to **BMI**'s research, industry and construction will account for 34.75% of total consumption in 2016, equivalent to 73.97TWh. This figure will rise to 98.8TWh by 2025, equivalent to 36.41% of total consumption.

Industry and construction is followed by households as the next highest consumer group, which accounts for 29.45% of consumption, or 62.69TWh. **BMI** forecasts consumption by households to increase somewhat over the next 10 years, reaching 74.08TWh, equivalent to 27.31% of total consumption.

During 2016, agriculture will account for 13.8% of total consumption, equivalent to 29.39TWh. This figure is forecast to increase rapidly during the period, reaching 42.03TWh by 2025, equivalent to 15.49% of total consumption.

Owing to the high level of subsidies the government pays to keep electricity prices low, Iran's per capita electricity consumption is very high compared to the regional average, and almost 100% of the country's population has access to electricity. This means the government often struggles to meet demand during peak hours.

The government has begun a programme to reduce these subsidies, cutting them by 25% in 2014, then again by 20% in 2015. This is a politically difficult move for the government, as it means electricity prices for all consumers are rising. However, in order to attract private sector investment in the sector - which the government is now trying to do - it is of vital importance that prices are raised.

Transmission And Distribution, Imports And Exports

Table: Electric Power T&D Losses Data And Forecasts (Iran 2014-2019)

	2014	2015e	2016f	2017f	2018f	2019f
Electric power distribution losses, TWh	37.7	37.8	38.1	39.2	39.7	40.2
Electric power distribution losses, % of output	15.0	14.9	14.8	14.9	14.8	14.8

e/f = BMI estimate/forecast. Source: BMI

Table: Electric Power T&D Losses Data And Forecasts (Iran 2020-2025)

	2020f	2021f	2022f	2023f	2024f	2025f
Electric power distribution losses, TWh	40.9	41.2	41.4	41.5	41.4	41.3
Electric power distribution losses, % of output	14.7	14.4	14.1	13.7	13.3	12.9

f = BMI forecast. Source: BMI

Table: Trade Data And Forecasts (Iran 2014-2019)						
	2014	2015e	2016f	2017f	2018f	2019f
Total Net Imports, TWh	-7.1	-7.2	-7.1	-5.7	-4.9	-3.7

e/f = BMI estimate/forecast. Source: BMI, EIA

Table: Trade Data And Forecasts (Iran 2020-2025)						
	2020f	2021f	2022f	2023f	2024f	2025f
Total Net Imports, TWh	-2.9	-3.1	-3.8	-4.9	-6.0	-7.2

f = BMI forecast. Source: BMI, EIA

BMI forecasts transmission and distribution losses during 2016 to be 14.8% of total electricity produced, or equivalent to 38.1TWh. In terms of electricity lost, **BMI** forecasts this figure to rise to 41.3TWh by 2025, although as a percentage of total power produced, this figure will fall slightly, to 12.9%.

Tavanir is responsible for electricity transmission. Iran has three main power distribution networks: the interconnected network, which serves all of Iran, apart from remote eastern and southern areas, using 440kV and 230kV transmission lines; the Khorassan network, which serves the eastern Khorossan province; and the Sistan and Baluchistan network, which serves the remote south eastern provinces of Sistan and Baluchistan. The government's goal is to join these three networks to establish one national grid.

The government's current five-year investment plan for the power sector sees USD9.8bn spent on the transmission system and a further USD7.1bn ploughed into distribution. Iran has three main power distribution networks and the government's goal is to join these to form one national grid. Additional links to the power grids of neighbouring states are likely in order to facilitate greater regional supply flexibility and accommodate Iranian power exports.

Iran currently exports to the neighbouring countries of Afghanistan, Iraq, Pakistan, Turkmenistan, Azerbaijan, Armenia and Turkey. In June 2015, Iranian Deputy Energy Minister Hoshang Falahatian said the government planned to increase electricity exports to about 25billion KWh in the next three years, from about 8 billion KWh. One of the Iranian electricity sector's main strengths is its proximity to neighbouring

power markets which suffer from considerable power deficits and which lack their own natural resources to fuel power plants.

Since the signing of the Joint Comprehensive Plan of Action in July 2015, these plans have progressed well. In November 2015, the Tehran Times printed the government had initiated a new round of talks with the Government of Turkmenistan to build a 400kV line from the Turkmen city of Mary, to the Iranian city of Sarakhs. Iranian Deputy Energy Minister Houshang Falahtian met with Vice Chairman of the Turkmenergo State Power Corporation to accelerate development of the line. The meeting followed a series of bilateral accords signed between the two countries in March.

Iran and Armenia are also in the process of negotiating an increase in their gas for electricity trade. Iranian Oil Minister Bijan Namdar Zanganeh and Armenian Energy and Natural Resources Minister Yervand Zakharyan agreed to raise Iran's exports of gas to Armenia in exchange for boosting the country's imports of electricity from its neighbour in early October 2015. In March 2015, the Armenian energy minister Armen Movsisian said Armenia planned to increase its imports of gas from Iran to two billion cubic metres per year, an increase of almost 75%.

Currently, Iran has the capability to export 300MW to Armenia, whose grid is connected with those of Georgia, Russia and Turkey. In August 2015, the Export Development Bank of Iran signed an agreement to build a third power line connecting Iran with Armenia. The Bank pledged to commit some 80% of the total cost, equivalent to USD91mn of USD117mn, with the Armenian government committed to make up the difference. The interconnection is expected to be commissioned within an eighteen month period.

Overall, **BMI** forecasts Iran's net electricity imports to remain roughly static during the period 2017 to 2025. According to a recent report released by the Iranian energy ministry, Iran exported 6.539bn kWh of electricity between March and November 2015, whilst it imported 2,648mkWh.

In August, delegates from Iran and Pakistan met in Tehran to finalise a power purchase agreement which would allow Iran to export 1,000MW to Pakistan. The two countries originally came to an agreement on power cooperation in May 2012. Reportedly, Iran has agreed to pay 70% of the cost, with Pakistan making up the difference. The agreement has received a significant boost with the signing of the recent deal with the P5+1 on Iran's nuclear programme.

Iran also signed an agreement with the Turkish government to boost cooperation on electricity issues between the two countries in July 2015. Interconnection between the two is a relatively straightforward process because the grids are so compatible. Turkey lacks natural resources of its own for power generation,

so Iran's power export ambitions are highly compatible with the Turkish government's long term energy plans.

Industry Risk/Reward Index

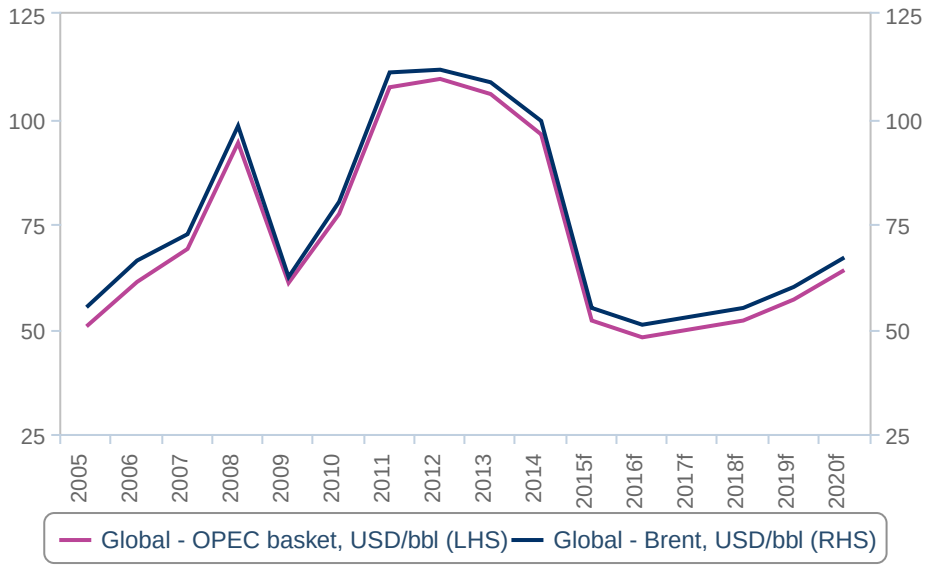
MENA Power Risk Reward Index

***BMI View**: The biggest risk to the GCC power sector - which currently offers the best combination of risks and rewards within our MENA RRI - is fiscal consolidation due to lower oil prices. Rationalised spending could curb government-led investment in new capacity among GCC countries in 2016, allowing Iran, Egypt and Morocco to play catch-up, as their rewards scores improve thanks to better growth prospects and significant pledges of power sector investment.*

We emphasise that, although our Middle East and North Africa (MENA) Risk Reward Index (RRI) remains largely unchanged this quarter, the broader economic outlook is set to deteriorate significantly on the back of lower oil prices. To this end, our Oil & Gas team has downgraded its Brent oil price forecast from USD54/bbl to USD51/bbl for 2016 after a weaker-than-anticipated end to 2015. Our core view is that oversupply in the global oil markets will not relent over the first half of 2016 and we only expect a soft recovery in prices - reinforced by OPEC'S decision not to cut production at its December 4 meeting.

Low Oil Prices Will Curb Power Sector Investment

BMI - Brent And OPEC Basket Oil Price Forecasts



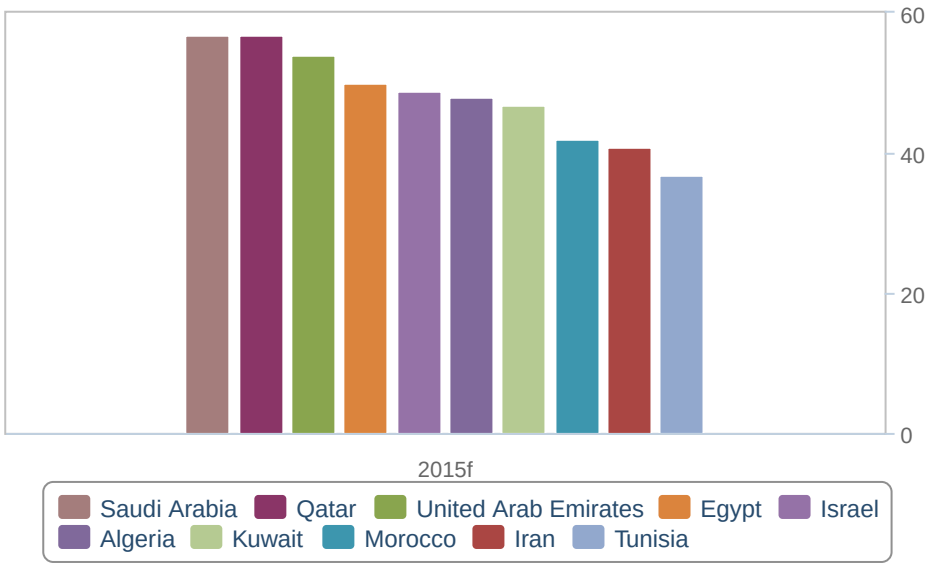
f = BMI forecast. Source: BMI

In this context, the biggest risks to our power sector forecasts for the MENA region stem from fiscal consolidation in countries that rely heavily on government spending to drive growth in power infrastructure. Having relied on reserves to finance large fiscal deficits in 2015, we believe that the Gulf Cooperation Council (GCC) countries will increasingly consolidate their spending in 2016; subsidy cuts are likely (which could curb domestic energy consumption), as are delays and cancellations to projects that are not viewed as imperative. These dynamics could in turn curb the rewards on offer and heighten the risks to entry in some of the region's power and renewables markets.

Beyond the GCC, the economic outlook is more positive due largely to base effects - especially in Iran and Egypt, where the economies have stagnated over the last four years. Our CR team also highlights that Morocco is emerging as a regional outperformer in North Africa as it moves to boost its competitiveness and establish its position as an exporter to Europe - with investment in the power and renewables sector flowing into the country.

GCC Continuing To Outperform

MENA Power Risk/Reward Index (Scores Out Of 100)



**Higher Score = Lower Risk. Source: BMI*

GCC Slower Growth Amid Lower Oil Prices

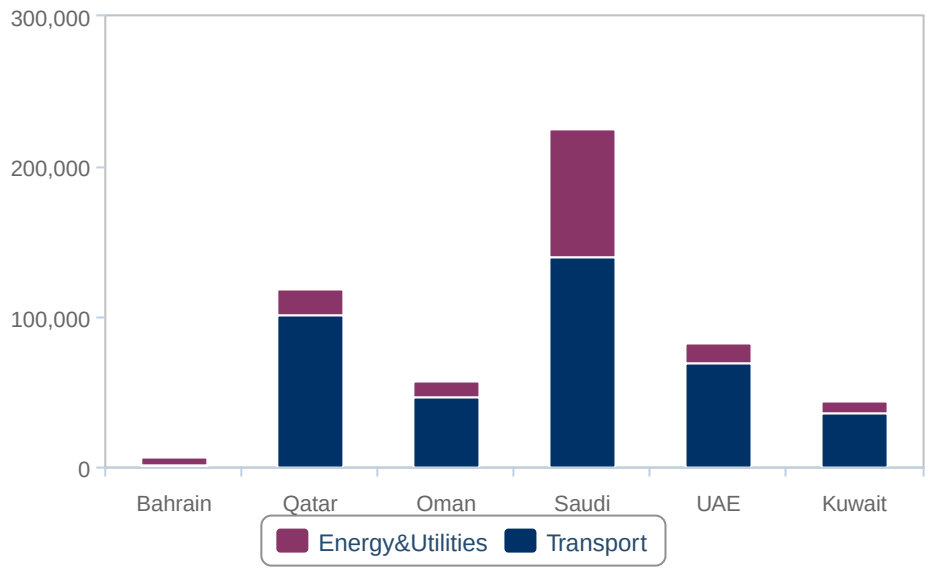
Saudi Arabia, Qatar and the UAE are once again the top three countries in our MENA Power Risk Reward Index (RRI), due to a combination of low risks and relatively high rewards. Investment in the power capacity should remain robust as governments move to support power sector development via foreign reserves, the issuance of more debt, and greater use of private-public partnership (PPPs) to attract foreign investment. Nevertheless, a more sombre assessment of the region's prospects among international investors and the Fed's interest rate hiking cycle will fuel a rise in financing costs - curbing investment in non-essential power capacity.

Saudi Arabia is at the top of our MENA RRI and we believe the government will continue to spend on power infrastructure as it attempts to keep pace with surging electricity demand and diversify the oil-heavy power mix so as to preserve oil for export (rather than burning it domestically).

Nevertheless, growth in power capacity will tail off - curbing future rewards scores. This will happen as the government reduces spending as it eases into fiscal consolidation and moves away from the expansionary policies. Our CR team anticipates that capital expenditure (capex) will be cut by 18% in 2016, compared to 2014 levels. This raises the risk of cancellations or delays to some of the more ambitious (and expensive) projects in the power sector - particularly new solar and nuclear capacity.

Limited Power Sector Opportunities

GCC - Value Of Infrastructure Project Pipeline, USDmn



Source: BMI Infrastructure Key Projects Database

Qatar has fallen to second place in our RRI this quarter due to revisions to our forecasts for capacity expansion. On the rewards side of the equation, Qatar's vast financial resources and position as the world's preeminent liquefied natural gas (LNG) exporter will see it register strong macroeconomic growth and continue to expand gas-fired power capacity. The big problem facing investors in the power sector is that Qatar is focusing on a handful of large projects (see chart above) - with the dominant position of state-owned players set to limit the number of contracts available to private investors (hence the decline in rewards scores). Equally, the widespread availability of natural gas will limit investment in segments like renewables, despite government plans to diversify into solar power.

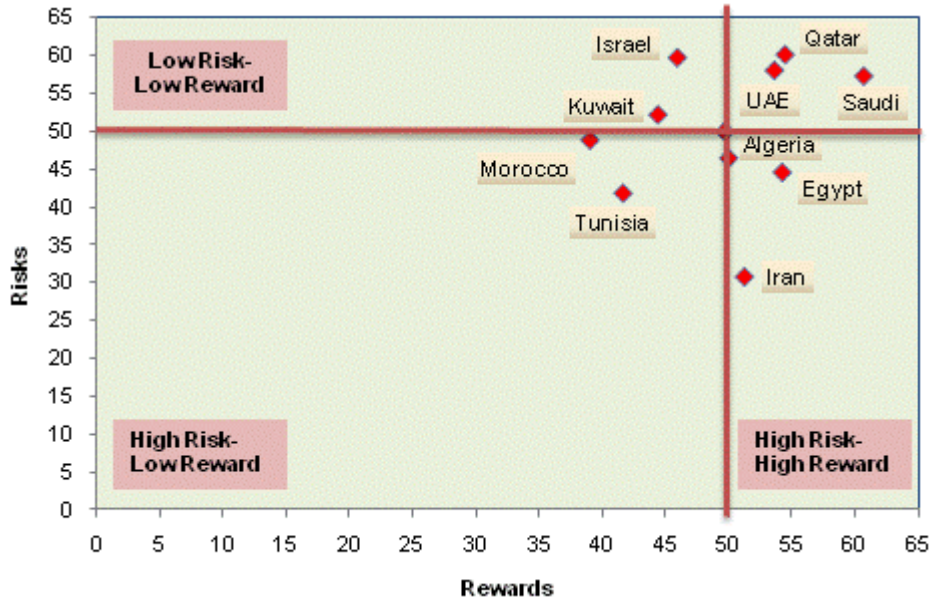
Economic growth in the **UAE** will slow over the coming quarters, but the outlook is still impressive thanks to the strengthening non-oil economy. The UAE has the fiscal buffers and foreign reserves to continue to finance spending on new installed capacity and political risks are limited meaning the emirate is third in our index. Dubai is positioning itself as a major investment destination for international solar power developers, underpinning our broader outlook for strong growth in solar capacity.

Bright Spots Beyond The GCC

Iran's economy will post the largest uptick in growth among MENA countries over the coming years and we expect almost all sanctions to be lifted by the end of Q216 as the country complies with inspections of its nuclear programme. We do not expect a flood of investment in 2016, and emphasise that the real changes in the economy will only occur from 2017 when US companies begin to invest, but the removal of sanctions will unlock significant foreign investment opportunities. We believe the power sector is set to be a major beneficiary. European companies such as Denmark's **Vestas**, as well as a number of German financiers, have already shown interest in Iran's nascent wind power sector.

GGC Still Offers Best Combination Of Risks And Rewards

MENA Power Risk*/Reward Index, Scores Out Of 100



**Higher score = lower risk. Source: BMI*

Among oil importers, **Egypt** is the power market for which our outlook is the most positive - as reflected in the country's fourth position in our RRI. We expect economic growth to gather steam due to relative political stability, pent-up demand and a weak currency (we expect the government to let the Egyptian pound depreciate by around 10% in 2016). In the power sector, despite concerns about the operating

environment (with concerns about security rising after a Russian airliner was blown up over the Sinai), growth will be driven by fixed investment and a large project pipeline. The outlook for gas-fired capacity has been lifted by huge pledged investment from German conglomerate Siemens and the discovery of the Zohr gas field, which is set to make the country a net gas exporter again when it comes online in 2020/21. Power sector investors will also be drawn by pledged to liberalise the gas sector by 2020.

We also expect an uptick in investment in the power sector **Morocco** - in order to keep pace with industrial electricity demand. We hold a positive long-term view of Morocco's economic growth prospects, particularly for exports, and expect diversification and geographical advantages (such as its proximity to the Western European market and the more rapidly-growing economies in MENA and SSA) to ensure continued gains in competitiveness over the coming years. FDI inflows into the automobile and aerospace industries will require reliable and relatively cheap power supply - necessitating investment in power capacity. The construction of the world's largest solar CSP power plant is also a major boon for renewable and a sign of intent on the part of the government - potentially lifting RRI scores in the quarters to come.

Table: MENA Power RRI

	Industry Rewards	*Country Rewards*	*Rewards*	*Industry Risks**	*Country Risks**	*Risks**	*Power R/R Ratings*
Saudi Arabia	63.25	51.20	58.62	49.93	62.41	55.28	57.45
Qatar	48.25	66.40	55.23	53.31	70.46	60.66	57.13
UAE	58.00	45.20	53.08	49.39	67.63	57.21	54.52
Egypt	56.50	47.80	53.15	44.37	47.23	45.60	50.51
Israel	36.00	57.00	44.08	57.19	64.74	60.42	49.80
Algeria	46.00	54.40	49.23	40.99	55.60	47.25	48.54
Kuwait	40.00	49.40	43.62	42.08	72.31	55.04	47.61
Morocco	38.00	39.20	38.46	50.16	50.41	50.27	42.59
Iran	52.00	37.60	46.46	24.82	42.51	32.40	41.54
Tunisia	29.50	42.20	34.38	46.37	41.75	44.39	37.89
Regional Average	*46.75*	*49.04*	*47.63*	*45.86*	*57.50*	*50.85*	*48.76*

**Higher score = lower risk. Source: BMI*

Iran Power Risk/Reward Index

BMI View: *Despite the signing of the Joint Comprehensive Plan of Action on Iran's nuclear programme in July 2015, and accompanying prospects for increased foreign investment in industry, Iran's scores have remained largely stable in recent quarters, both in terms of both industry and country risk and reward. The low oil price means economic growth continues to be sluggish. The government is struggling to raise the price of electricity for fear of popular protest, a factor which may adversely affect the government's ability to attract foreign investment. That said, things may change if international sanctions - particularly 'primary' US sanctions - are lifted for an extended period and if there is an upturn in the global price of oil.*

Rewards

Industry Rewards

Iran's Industry Reward score rating has not undergone a significant increase, despite the partial lifting of sanctions in Q116. We will await substantive evidence of foreign investment in the sector, alongside a further easing of sanctions, before making any dramatic changes to our outlook. The Iranian power sector's greatest asset remains its near complete coverage of the population in terms of access. However, owing to the fact there is limited room for expansion in this regard, forecasts for growth in consumption at the household level over the next five-year period are low, bringing down the country's overall Industry Reward Score to just below the regional average.

Country Rewards

Despite the partial lifting of sanctions in Q116, Iran scores poorly for this variable. The country scores very low on predictions for economic growth over the coming five years - measured by capita and real GDP - dragging down its overall Country Reward rating. Again, low economic growth rates may mean the government struggles to raise electricity prices, despite its plans, and this is likely to have an effect on the attractiveness of the market. Growth remains sluggish because the relaxing of international sanctions has yet to take effect. Similarly, Iran also scores very low in terms of predictions for inflation levels during the next five years. That said, the country continues to score well on its import dependency rating, both in raw materials and electricity imports.

Risks

Industry Risks

In terms of risks to realisation of potential returns in the power sector, Iran scores poorly for all four main variables. Iran is likely to remain a highly protected market for some time to come, despite the partial lifting of US sanctions, meaning poor scores for liberalisation and the transparency of tendering. The financing outlook is restricted, given continued constraints on accessing external financial markets and the pressure on government revenues generated by the oil and gas price bear market. There also appears little prospect of a significant move into renewables, for the time being.

Country Risks

Iran's Country Risk Score remains low, but stable. The country continues to score very poorly on perceptions of corruption in government and fares similarly in terms of the weakness and ineffectiveness of government institutions. That said, Iran continues to perform relatively well for external risk and on policy continuity. Sluggish growth and the low price of oil means the government has had little success in bringing down the food and subsidy bill. Political unrest could occur if the government tries to achieve this too quickly. The country scores averagely compared to its neighbours on short term political stability.

Market Overview

Key Policies And Market Structure

BMI View: *Iran's power sector is primarily controlled by state-owned utility* ***Tavanir****. Power plant construction is handled by the* ***Iran Power Development Company*** *(IPDC), a wholly owned subsidiary of Tavanir, which is also responsible for electricity transmission and distribution. However, in recent years the government has taken steps towards privatisation, with a number of power plants having been sold off in IPOs, and further privatisations planned over the coming years. Eventually, Tavanir may be broken up as part of a broader privatisation package.*

Regulation And Competition

Iran has received several offers for investment in the form of loans and build-operate-transfer (BOT) contracts. BOT contracts allow investors to build and operate the generating facility between 15 and 20 years, after which time the plant is turned over to the Energy Ministry. Negotiations have taken place with international energy firms on expansion plans for power plants at Bandar Abbas, Shaid Rajai, Alborz, Ramin and Kerman.

However, progress on moving forward with the BOT arrangements has been relatively slow - not aided by the challenging political climate that acts as a deterrent for foreign investors - with Western sanctions in particular constraining the ability of firms to invest. Following the agreement between Iran and the international community over the country's nuclear programme, which will see external sanctions on Iran reduced, there is potential for a rise in international investment over the coming years. However, it will be a phased and piecemeal process, potentially also with setbacks along the way.

In June 2009, Iran's first BOT power plant became fully operational, when the last of six 159MW open-cycle gas turbine generating sets comprising the Chehelsotun power plant in South Isfahan were brought online. The 950MW gas-fired plant was developed by a 50:50 joint-venture (JV) between the Iranian investment house **IHAG** and local power contractor **Mapna**. The first unit at the Chehelsotun plant was brought on line in 2005.

In February 2010, Iran began privatising a number of the country's power plants.

IPOs have been the preferred method of privatisation. This is the method which has been used to privatise stakes in other state-owned companies over the past few years. Iran has the financial infrastructure in place to successfully carry out the IPO, but there is concern as to the identities of potential subscribers.

Pricing

Electricity prices are heavily subsidised in Iran placing a heavy burden on the government's fiscal health. In 2008, the government enacted a subsidy reform plan in an effort to improve the government's financial position and curb consumption to leave room to boost electricity exports. Gas and petrol prices are also heavily subsidised, and in an effort to improve efficiency and conservation of energy, the government is likely to continue in its efforts to raise prices, which will leave more Iranian gas production for electricity generation purposes. A second phase of this subsidy reform plan was initiated in 2014 with Tavanir announcing a further 25% price hike - and an additional 20% hike at the beginning of 2015, which has gone some way towards restraining consumption and raising the potential for the country to boost its export sector. With international oil prices having corrected downwards so heavily in recent years, the government is unlikely to be capable of continuing to fund its regime of energy subsidies, and further reforms are likely in the coming months and years.

Iran Power Projects Database

Table: Key Power Projects Database

Project	Value, USDmn	Capacity, MW	Companies	Time-frame	Status
Gas-fired power plant	10,000	6,000	Power Grid Corp of India Ltd (PGCIL), National Thermal Power Corp (NTPC)	2009-	At planning stage. The project includes a 1,500km high voltage transmission link to transfer power to India. 5,000MW may be transmitted to India and 1,000MW to Pakistan
177 dams construction project	na	na	na	na	Approved November 2008
Gas-fired power plant near to Zahedan	na	1,000	na	2009-	Announced 2010
8 electricity power plants in Khuzestan	na	6,000	na	2008-	Announced
Bushehr nuclear power plant	11,000	700	Rosatom, Atomstroyexpert	1994-2011	Completed
Iran-Russia electricity grid link	na	na	na	2008-	Contract awarded
2x new nuclear reactors, Bushehr	TBC	TBC	Rosatom State Nuclear Energy Corporation	2014-	Construction imminent (Q116)
Cycle power plant, Heris, East Azerbaijan province	675	1,200	Zenel Co, Tavanir	2008-	na
Iran-Turkey transmission line	1,500	2,000	na	na	Contract awarded
Rudbar-E-Lorestan hydropower project, Rudbar River, Zagros Mountain	9.52	450	PAPyry Infrastructure & Environment business group	2011-2014	na

Key Power Projects Database - Continued

Project	Value, USDmn	Capacity, MW	Companies	Time-frame	Status
Ghadir solar and wind power plant	4,500	1,000	na	na	Contract awarded 2011
Iran-Armenia 3rd electricity transmission line	110	650	na	na	At planning stage 2011
Tehran biomass plant	na	2	na	2010	Announced
Jarandaq wind power plant, Qazvin	na	60	na	na	Feasibility studies/EIA under way
Karachilare (Ghareh Chilar) hydropower plant, Aras River	na	130	Farab Co Iran	na	At planning stage 2013
Armenia-Iran electricity transmission line	na	1,200	Sanir	na	Approved. An Iranian consortium of private sector firms to provide financial assistance of USD571mn.
Expansion of Aras River hydropower plant to 1.7GW	na	na	na	na	na

na = not available. Source: BMI

Competitive Landscape

BMI View: *Having been dominated for so long by state-owned power utility* ***Tavanir****, Iran's electricity market, following the signing of the Joint Comprehensive Plan of Action in July 2015 is now being opened up to new competition. Over the last few months, a raft of agreements have been signed with companies in Europe, Russia and Asia, aimed at taking advantage of the country's considerable demand for electricity. Plans to break up Tavanir as part of a broader privatisation package have long been in the pipeline and some steps towards greater levels of privatisation in the sector have been taken over the past year.*

An amendment to Article 44 of the Iranian Constitution in 2004 allowed for the privatisation of state-owned companies, and in 2007 Supreme Leader Ayatollah Ali Khamenei called for the process to be sped up. In spite of this constitutional mandate, privatisation has historically proceeded very slowly, in large part due to resistance among parts of the regime to ceding control of the state-dominated economy to the private sector.

Nevertheless, the move towards increased involvement of the private sector has gathered steam in recent years. In June 2009, Iran's first build, operate, transfer (BOT) power plant became fully operational, when the last of six 159MW open-cycle gas turbine generating sets in the Chehelsotun power plant in South Isfahan were brought online. The 950MW gas-fired plant - the first to be completed in Iran under a BOT agreement, was developed by a 50:50 joint venture (JV) between Iranian investment house **IHAG** and local power contractor **Mapna**.

In February 2010, Iran's deputy energy minister, Mohammad Behzad, announced plans to privatise 20 power plants by September 2010, the end of the first half of the 2010/11 Iranian calendar year. Behzad said a proposal for privatising six new power plants had been submitted to the Iranian Privatization Organization and a further four would be proposed by the end of the year, according to the Mehr News Agency. These 10 joined 10 other power plants that were already approved for privatisation.

The power plants were privatised via an initial public offering (IPO). This is the method which has been used to privatise stakes in other state-owned companies over the past few years.

Construction of 10 power plants was transferred to the private sector, state-utility Tavanir stated in June 2010, according to a report in Iran Daily, although no further details were disclosed. The country needs 5GW of new electrical power every year, which requires private participation, according to Tavanir's Deputy Head, Gholam Reza Khoshkholq.

The signing of the Joint Comprehensive Plan of Action has facilitated the privatisation process, and prospects for increased private sector participation in the Iranian power sector have also been boosted by government hints that it will relax rules allowing private sector companies to export some of the power they produce.

Major developments in the power sector since July 2015 include:

- Germany's **Siemens** announced in March 2016 that it had signed a deal with Iran's **Mapna Group**, with the latter acquiring technology to manufacture over 20 gas turbines. The two firms also signed a memorandum of understanding (MoU) for further work in Iran's power sector.
- Iran's Atomic Energy Organization announced in March 2016 that it was seeking to co-operate with Japan in building several small nuclear plants, according to the Tehran Times.
- Iran in February 2016 announced that it was evaluating a potential project, in co-operation with Hungary, to design a 25MW nuclear reactor, which would then be marketed across Africa and Asia. If successful, a 100MW reactor may then be launched, again for sale across continents.
- Greece's energy ministry stated in February 2016 that it was in talks with Iran to secure a supply of natural gas for local needs, which could be followed by further shipments through Greece to other European markets. This news followed an agreement between Greece's **Hellenic Petroleum** and Iran for the latter to supply the former with crude oil, which would be refined by the Greek entity, with some refined output finding its way back to Iran.
- Russia's **Rosatom State Nuclear Energy Corporation** confirmed in February 2016 that work would soon get underway on building two more nuclear power units at Bushehr, after a deal was signed to carry out this work in November 2014.
- An October 2015 memorandum of understanding (MoU) between Germany's **Green Energy** 3000 GmBH and the **Khuzestan District Electricity Company** (KDEC) to install 100MW of solar power in the southwestern city of Ahvaz, as announced by head of the KDEC Mahmoud Janqorban. German companies have been at the forefront of movement to take advantage of the opening up of the Iranian electricity market. The Ahvaz MoU follows the signing of an agreement in August between the German and Iranian governments in August, which aims to generate 100MW of wind power, plus 400MW of solar in Khuzestan.
- Since the signing of the Joint Comprehensive Plan of Action, the Iranian government has also signed a deal with Indian and South Korean companies, also aimed at establishing energy parks in Khuzestan. Theoretically, these agreements could result in the generation of 1GW of solar power.
- In early November, the government announced it had signed an agreement worth USD6bn with an unnamed European company to install 4,250MW of new capacity in the country. Iranian press quoted government spokesman Mohammed Baqer Nobakht as saying the deal could see the Euopean firm establish up to 3,250MW of wind power plants in the country. The developer has not yet been named, but the government has approved establishing plants totalling 3,250MW at Tabriz, Miyaneh and Aras in northwestern Iran, and Zahedan in southeast Iran.
- Italy's **Fata**, part of **Finmeccanica**, has also signed a preliminary agreement with the **Ghadir Investment Company** to build a power plant in Iran. The agreement could be worth up to USD543mn.

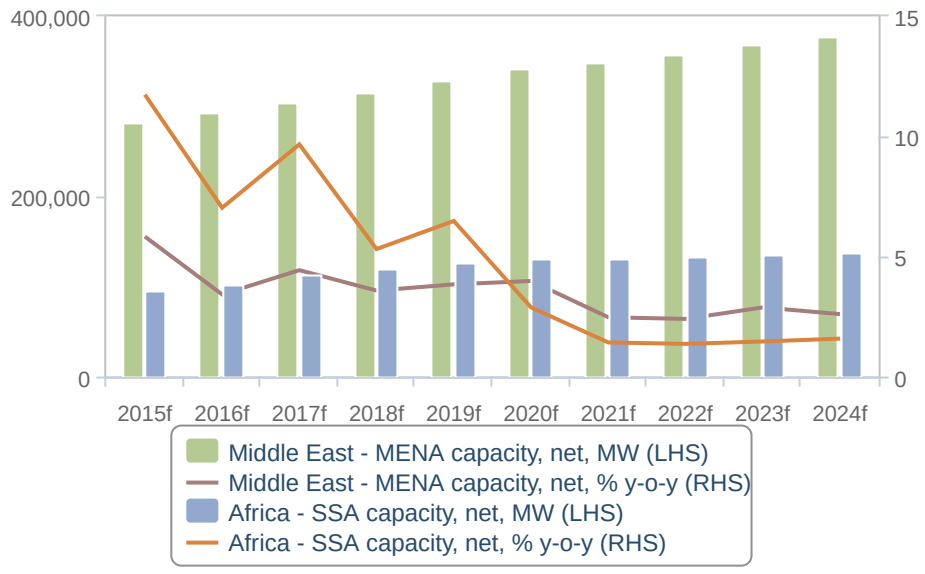
Regional Overview

BMI View: *Markets across the Middle East and Africa region will continue to vary considerably in terms of their levels of development, potential growth opportunities and their generation mixes over our 10-year forecast period. We highlight three themes this quarter: ongoing power crises across the region, lower oil prices will restrain spending on energy plans and China's increasing footprint in the region.*

Within the Middle East and Africa (MEA) region there are stark differences between the power markets within the two sub-regions - the Middle East and North Africa (MENA) and Sub Sahara Africa (SSA). These differences are based on the size and maturity of the component power markets, the level of development, potential growth on offer and the generation mix within the sub-regions. MENA power markets - particularly those in the Gulf Cooperation Council (GCC) - are far more developed than their SSA counterparts and have strong project pipelines. Conversely, SSA power markets are characterised by insufficient power infrastructure, power shortages and a history of underinvestment. These trends will remain pertinent across our 10-year forecast period to 2024.

Varying Growth Trajectories

Power Capacity By Region

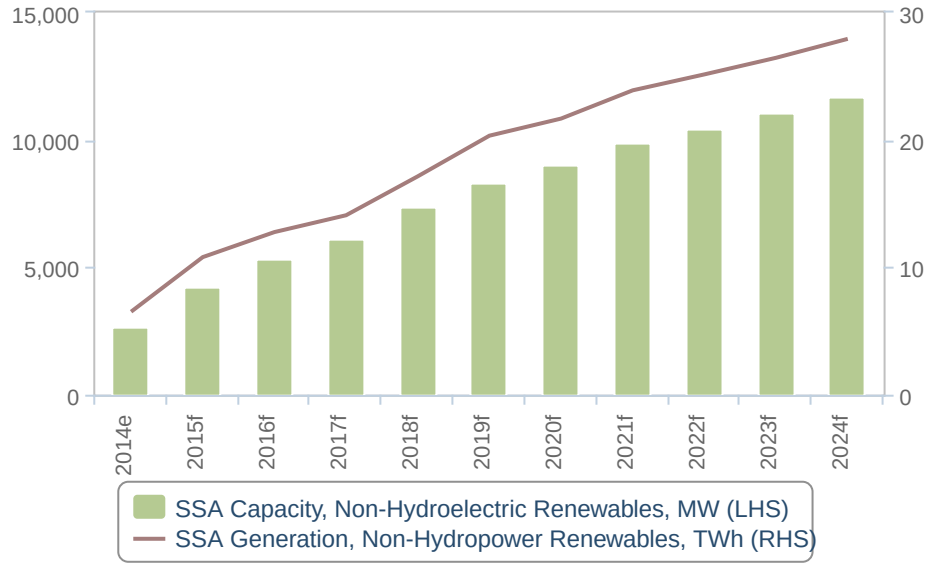


f = BMI forecast. Sources: EIA, BMI

Thermal fuels dominate the MEA electricity generation mix, with natural gas being the fuel of choice for the MENA region and coal taking top spot in SSA - due to the prominence of coal in SSA's largest power market, South Africa. That said, we expect to see a gradual shift to cleaner fuels in SSA over the next decade, particularly natural gas and renewables - with coal's role slipping from 54% in 2015 to 48% in 2024. We will see gains in natural gas-fired generation in countries such as Nigeria, Ghana, Mozambique and Cote d'Ivoire. In fact, in December 2015, power company Gigawatt Mozambique announced the successful commissioning of its USD200.79mn gas-fired power station at Ressano Garcia near the border of Mozambique and South Africa.

Renewables Gaining

SSA - Non Hydro Renewables Capacity And Generation

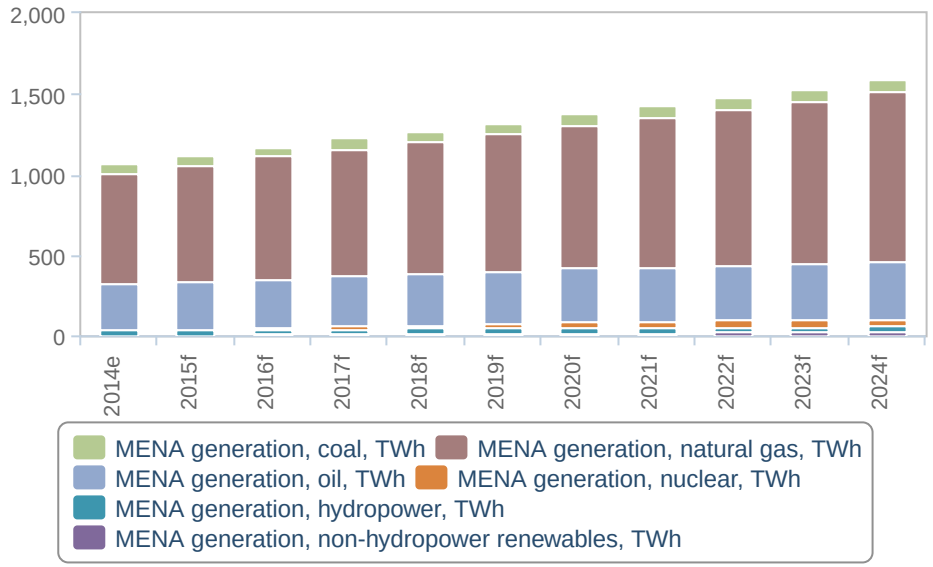


e/f = BMI estimate/forecast. Source: EIA, BMI

Renewable capacity in SSA will grow by nearly 180% between 2015 and 2024, driven primarily by South Africa, Ethiopia and Kenya. However, we are seeing a gradual expansion of renewable energy across the wider SSA region as governments increase their support for the sector. In early December 2015, Africa launched an initiative, dubbed the African Renewable Energy Initiative, which entails the installation of 10GW of renewable energy capacity on the continent by 2020 and aims to generate a minimum of 300GW by 2030. The African Development Bank (AfDB) is one of the primary sponsors of the initiative, but the governments of France and Germany are also supporting the plan.

Diverging Power Mixes

MEA Electricity Generation By Type



e/f = BMI estimate/forecast. Source: EIA, BMI

We note that the share of oil in the power markets of the MEA region will decrease, particularly in the Gulf Cooperation Council (GCC). This is a result of countries wanting to preserve oil for export rather than burning it in domestic power generation.

We highlight a number of key themes across the MEA power markets this quarter:

- **Ongoing Power Crisis Across MEA**

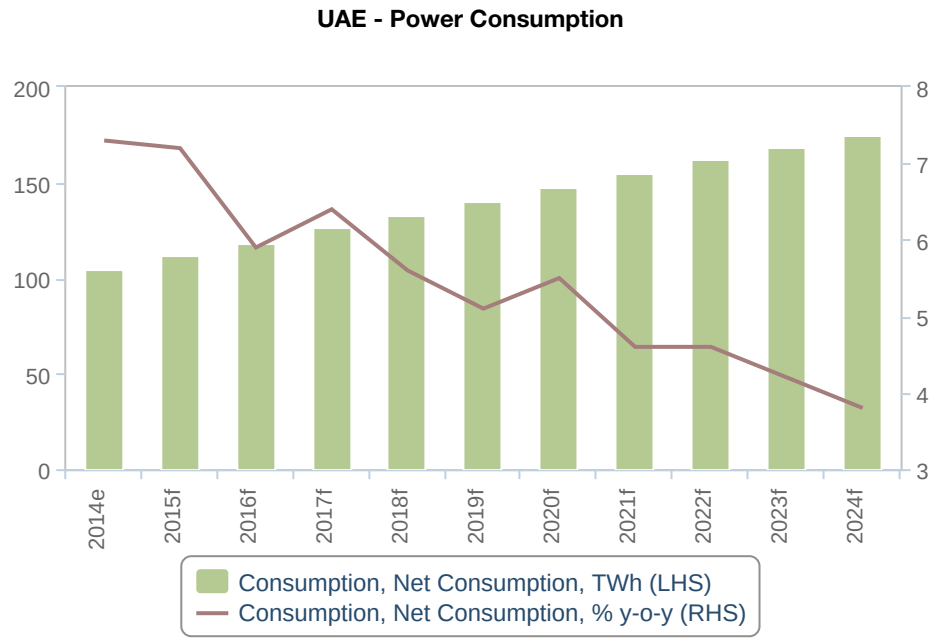
We have previously highlighted in our analysis that many of the SSA power markets suffer from ongoing power shortages and outages - stemming from drought and its effects on hydropower, underinvestment in new capacity, mismanagement at state-owned utilities, fuel shortages and a failure to enact reforms to encourage private investment. Countries suffering from power crises in SSA include South Africa, Ghana, Zimbabwe, Ethiopia and Uganda. We are also witnessing power shortages in the MENA region as well, particularly those countries that are suffering from deteriorating security situations; for example, Jordan and Lebanon. In fact, the Lebanese power sector is plagued by inefficiencies, a lack of installed capacity and underinvestment - stemming from years of regional instability, civil conflict and political unrest. In a

regional context, Lebanon has the lowest installed power generating capacity out of all the countries included in our MENA coverage. The underdeveloped state of the power sector leads to widespread load shedding and blackouts, having a detrimental impact on social and economic growth in the country.

- **Lower Oil Prices To Restrain Spending On Energy Plans**

Lower global oil prices will have a varying impact on the MEA region as both net oil importers and net oil exporters adjust to a sustained period of lower prices. We maintain that many of the biggest Middle Eastern markets (the exporters) - particularly Saudi Arabia, UAE and Kuwait - will remain resilient to lower prices owing to their significant fiscal buffers and large foreign reserves. Nevertheless, we are seeing counties alter their energy plans to take into account the lower oil price environment. For example, Saudi Arabia has pared back its ambitious solar and nuclear plans and the UAE is focusing on energy efficiency, in order to reduce consumption and limit subsidies.

Tackling Surging Power Consumption



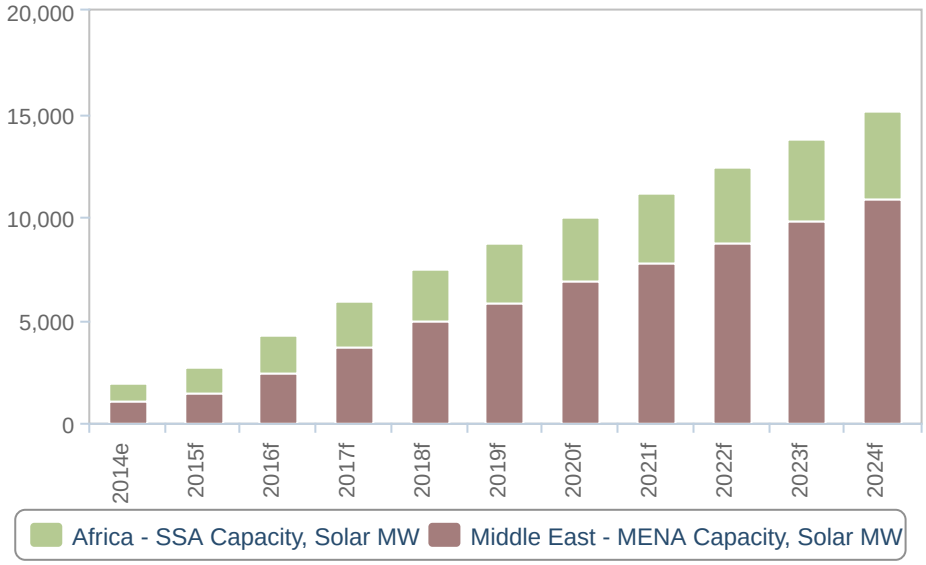
e/f = BMI estimate/forecast. Source:EIA, BMI

- **China Increasing Footprint In MEA**

China has built up immense operational, financial and infrastructure capacity in Sub-Sahara Africa (SSA) over the past decade and this is continuing within the power sector - with Chinese companies playing a dominant role in SSA's coal and hydropower industries. There are also growing opportunities within the non-hydro renewables sector for Chinese manufacturers, who can capitalise on the growing demand for solar components across SSA and MENA.

Demand For Solar Components Increasing

Solar Capacity By Region



e/f = BMI estimate/forecast. Source: EIA, BMI

Chinese panels are supplying utility-scale projects (for example the 200MW flagship solar project in Ghana and the 50MW Garissa project in Kenya) and rural electrification off-grid projects in Tanzania and Uganda. Furthermore, Chinese manufacturers are starting to develop manufacturing facilities in the region, with China's **Jinko Solar** setting up solar panel factories in Kenya and South Africa. Most recently, in mid-December, the UAE signed a Memorandum of Understanding (MoU) with China to pave the way for collaboration on sustainability projects, including renewable energy. Specifically, UAE

company **Masdar** and the **Masdar Institute** forged a MoU with Chinese companies including **China Vanke**, **China Merchants New Energy Group** and research institute **BGI**.

Glossary

Table: Glossary Of Terms	
bn: billion	**IPP: independent power producer**
capex: capital expenditure	km: kilometres
CEE: Central and Eastern Europe	kW: kilowatt (10^3 watts)
CHP: combined heat and power plants	kWh: kilowatt hour
DoE: US Department of Energy	LNG: liquefied natural gas
e/f: estimate/forecast	MEA: Middle East and Africa
EBRD: European Bank for Reconstruction and Development	mn: million
EIA: US Energy Information Administration	MoU: memorandum of understanding
EM: emerging markets	MW: megawatt (electric) (10^6 watts)
EU ETS: European Union Emissions Trading System	MWh: megawatt hour
EU: European Union	na: not available/applicable
EWEA: European Wind Energy Association	NGL: natural gas liquids
FDI: foreign direct investment	OECD: Organisation for Economic Co-operation and Development
FiT: feed-in tariff	OPEC: Organization of the Petroleum Exporting Countries
FTA: free trade agreement	PV: solar photovoltaics
GDP: gross domestic product	RES: renewable energy sources
GHG: greenhouse gas	R&D: research and development
GW: gigawatt (10^9 watts)	t: metric ton = tonne (1 t = 1,000 kg)
GWh: Gigawatt hour (1 GWh = 3.6 TJ)	TPES: total primary energy supply
GWEC: Global Wind Energy Council	trn: trillion
IAEA: International Atomic Energy Agency	TW: terawatt (10^{12} watts)
IEA: International Energy Agency	TWh: terawatt hour (1 TWh = 3.6 PJ)
IMF: International Monetary Fund	-
IPO: initial public offering	-

Source: BMI

Methodology

Methodology And Sources

Industry Forecast Methodology

BMI's industry forecasts are generated using the best-practice techniques of time-series modelling and causal/econometric modelling. The precise form of model we use varies from industry to industry, in each case determined, as per standard practice, by the prevailing features of the industry data being examined.

Common to our analysis of every industry is the use of vector autoregressions. They allow us to forecast a variable using more than the variable's own history as explanatory information. For example, when forecasting oil prices, we can include information about oil consumption, supply and capacity.

When forecasting for some of our industry sub-component variables, however, using a variable's own history is often the most desirable method of analysis. Such single-variable analysis is called univariate modelling. We use the most common and versatile form of univariate models: the autoregressive moving average model (ARMA).

In some cases, ARMA techniques are inappropriate because there is insufficient historic data or data quality is poor. In such cases, we use either traditional decomposition methods or smoothing methods as a basis for analysis and forecasting.

We mainly use OLS estimators and in order to avoid relying on subjective views and encourage the use of objective views, we use a 'general-to-specific' method. We mainly use a linear model, but simple non-linear models, such as the log-linear model, are used when necessary. During periods of 'industry shock', for example poor weather conditions impeding agricultural output, dummy variables are used to determine the level of impact.

Effective forecasting depends on appropriately selected regression models. **BMI** selects the best model according to various different criteria and tests, including but not exclusive to:

- R^2 tests explanatory power; adjusted R^2 takes degree of freedom into account;
- Testing the directional movement and magnitude of coefficients;
- Hypothesis testing to ensure coefficients are significant (normally t-test and/or P-value);
- All results are assessed to alleviate issues related to auto-correlation and multi-collinearity.

BMI uses the selected best model to perform forecasting.

Human intervention plays a necessary and desirable role in all of our industry forecasting. Experience, expertise and knowledge of industry data and trends ensure analysts spot structural breaks, anomalous data, turning points and seasonal features where a purely mechanical forecasting process would not.

Sector-Specific Methodology

- **Generation And Consumption Data**

A number of principal criteria drive our forecasts for each generation and consumption variable, with the following identity forming the basis of our forecast model:

"Total consumption = total generation + total net imports - transmission and distribution losses"

- **Total Generation**

Total generation is defined as the process of producing electric energy or the amount of electric energy produced by transforming other forms of energy, commonly expressed in kilowatthours (kWh) or related units.

While gross electricity production is measured at the terminals of all alternator sets in a station, and thus includes the energy taken by station auxiliaries and losses in transformers that are considered integral parts of the station, net electricity production is defined as gross production less own use of power plants.

According to the International Energy Agency (IEA), the difference between gross and net production is generally observed to be about 7% for conventional thermal stations, 1% for hydro stations and 6% for nuclear.

Historical figures for electricity generation are based on data published by the US Energy Information Administration (EIA) and the World Bank, and consider net electricity production. Whenever possible, we compare these data with accounts published by government/ministry sources and official data of the companies operating in each country.

BMI's electricity generation forecasts examine the sector with a bottom-up approach, forecasting electricity production for each resource in order to calculate the value of total generation. The regression model used

to calculate generation considers real GDP, industrial production, fixed capital formation, population and fiscal expenditure.

- **Total Consumption**

Total consumption is commonly expressed in kilowatt hours (kWh) or related units.

Historical figures for electricity consumption are based on data published by the EIA. Whenever possible, we compare these data with accounts published by government/ministry sources and official data of the companies operating in each country. Our electricity consumption forecasts are based on a regression similar to the model illustrated above for electricity generation.

- **Total Net Imports**

Historical figures for net imports are computed as total imports, minus total exports, based on data from the EIA. Our total net imports forecasts are calculated as total consumptions, minus total generation, plus transmission and distribution losses.

- **Transmission And Distribution Losses**

Transmission and distribution losses include electric energy lost due to the transmission and distribution of electricity. Much of the loss is thermal in nature.

Our historical figures for electricity transmission and distribution losses are computed as generation, plus net imports, minus consumptions. However, transmission and distribution losses are calculated using a regression model in the forecasts.

- **Electricity Generating Capacity Data**

Electricity generation capacity is defined as the maximum output, commonly expressed in megawatts (MW) or related units, that generating equipment can supply to system load, adjusted for ambient conditions.

Historical figures for electricity generation capacity are based on data published in UN statistical databases. Whenever possible, we compare these data with accounts published by government/ministry sources and official data of the companies in each country.

Our electricity generation capacity forecasts examine the sector with a bottom-up approach, forecasting capacity for each resource to calculate the total value of capacity in each country. Our electricity generation capacity forecasts are based on a regression similar to the model illustrated above for electricity generation.

Sources

BMI uses publicly available information to compile the country reports and collate historical data. Sources used in power industry reports include those from international bodies mentioned above, such as the EIA, the World Bank and the UN as well as local energy ministries, officially released company figures, national and international bodies and associations and news agencies.

Risk/Reward Index Methodology

BMI's Risk/Reward Index (RRI) provide a comparative regional ranking system evaluating the ease of doing business and the industry-specific opportunities and limitations for potential investors in a given market. The RRR system divides into two distinct areas:

Rewards: Evaluation of a sector's size and growth potential in each state, and also broader industry/state characteristics that may inhibit its development. This is broken down into two sub-categories:

- Industry Rewards. This is an industry-specific category taking into account current industry size and growth forecasts, the openness of market to new entrants and foreign investors, to provide an overall score for potential returns for investors.
- Country Rewards. This is a country-specific category, and factors in favourable political and economic conditions for the industry.

Risks: Evaluation of industry-specific dangers and those emanating from the state's political/economic profile that call into question the likelihood of anticipated returns being realised over the assessed time period. This is broken down into two sub-categories:

- Industry Risks. This is an industry-specific category whose score covers potential operational risks to investors, regulatory issues inhibiting the industry and the relative maturity of a market.
- Country Risks. This is a country-specific category in which political and economic instability, unfavourable legislation and a poor overall business environment are evaluated.

We take a weighted average, combining industry and country risks, or industry and country rewards. These two results in turn provide an overall Risk/Reward Index, which is used to create our regional ranking system for the risks and rewards of involvement in a specific industry in a particular country.

For each category and sub-category, each state is scored out of 100 (100 being the best), with the overall Risk/Reward Index a weighted average of the total score. Importantly, as most countries and territories evaluated are considered by **BMI** to be 'emerging markets', our score is revised on a quarterly basis. This

ensures the score draws on the latest information and data across our broad range of sources, and the expertise of our analysts.

Indicators

In constructing these scores, the following indicators have been used. Almost all indicators are objectively based.

Table: Power Risk/Reward Index Indicators

	Rationale
Rewards	
Industry Rewards	
Electricity capacity, MW, 5-year average	Objective measure of size of sector, based on BMI's power forecasts. The larger the sector, the greater the opportunities.
Electricity generation, GWh, 5-year average	Objective measure of size of sector, based on BMI's power forecasts. The larger the sector, the greater the opportunities.
Electricity generation, %, 5-year average	Objective measure of growth potential, based on BMI's power forecasts. Rapid growth results in increased opportunities.
Electricity consumption, GWh, 5-year average	Objective measure of size of sector, based on BMI's power forecasts. The larger the sector, the greater the opportunities.
Electricity consumption, %, 5-year average	Objective measure of growth potential, based on BMI's power forecasts. Rapid growth results in increased opportunities.
Access to electricity, % of population	Objective measure of size of sector. The larger the sector, the greater the opportunities. Low electricity coverage is proxy for pre-existing limits to infrastructure coverage.
Country Rewards	
Real GDP growth, %, 5-year average	Proxy for the extent to which structure of economy is favourable to the power sector. The more substantial the growth rate, the greater the demand and the need for additional generation.
GDP per capita, %, 5-year average	Proxy for the extent to which structure of economy is favourable to the power sector. The more substantial the growth rate, the greater the demand and the need for additional generation.
Population, % change y-o-y	Proxy for extent to which demographic dynamics are favourable to power sector. The more substantial the growth rate, the greater the demand and the need for additional generation
Imported raw material dependence	Objective measure taken from BMI's Oil & Gas service. It gives an indication of a renewables market's exposure to thermal fuel imports, namely gas.
Electricity import dependence	Objective measure of sector. Denotes underlying risks to the security of power sector. The lower the imports, the greater the energy security.
Inflation, 5-year average	Proxy for the extent to which structure of economy is favourable to the power sector. The lower the inflation, the better the financial outlook of power projects.
Risks	
Industry Risks	
Liberalisation level	Subjective evaluation against BMI-defined criteria. Evaluates barriers to entry.

Power Risk/Reward Index Indicators - Continued	
	Rationale
Financing	Objective measure from BMI's Infrastructure Project Finance scores. It quantifies the risks to both raising financing and repayment of project loans over the course of a project's life
Renewables outlook	Objective measure taken from our Infrastructure service. Used as a gauge to measure the potential and sophistication of renewable sector
Transparency of tendering process	Subjective evaluation against BMI-defined criteria. Evaluates predictability of operating environment.
Country Risks	
Short-term political stability	From BMI's Country Risk Index (CRI). Denotes health of political structure, including various indicators such as policy making-process, social stability and security/external threats and policy continuity.
Policy continuity	Subjective score from CRI. Denote predictability of policy over successive governments.
External risk	From CRI. Denotes vulnerability to external shock, which is principal cause of economic crises.
Institutions	From CRI. Denotes strength of legal institutions in each state. Security of investment can be a key risk in some emerging markets.
Corruption	From CRI. Denotes risk of additional illegal costs/possibility of opacity in tendering/ business operations, affecting companies' ability to compete.

Source: BMI

Given the number of indicators/datasets used, it would be inappropriate to give all sub-components equal weight. The following weighting has been adopted:.

Table: Weighting Of Indicators	
Component	**Weighting, %**
Rewards	65, of which
Industry Rewards	40, of which
Electricity capacity, MW, 5-year average	10
Electricity generation, GWh, 5-year average	5
Electricity generation, %	8
Electricity consumption, GWh	5
Electricity consumption, %	8
Access to electricity, % of population	4
Country Rewards	25, of which
Real GDP growth, %, 5-year average	5
GDP per capita, %, 5-year average	5

Weighting Of Indicators - Continued	
Component	**Weighting, %**
Population, % change	5
Imported raw material dependence	3.5
Electricity import dependence	3.5
Inflation, 5-year average	3
Risks	35
Industry Risks	20, of which
Liberalisation level	4
Financing	6
Renewables outlook	6
Transparency of tendering process	4
Country Risks	15, of which
Short-term political stability	4
Policy continuity	2
External risk	3
Institutions	3
Corruption	3

Source: BMI