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# Colombia

## Power Report

Includes 10-year forecasts to 2027





# Contents

<b>Key View</b>	<b>4</b>
<b>SWOT</b>	<b>5</b>
Power SWOT	5
<b>Industry Forecast</b>	<b>6</b>
Colombia Snapshot	6
Colombia Power Forecast Scenario	7
<b>Industry Risk/Reward Index</b>	<b>18</b>
Latin America Power RRI: LNG Terminal Propels Panama, Economic Crisis Weighs On Nicaragua	18
Colombia Power Risk/Reward Index	27
<b>Market Overview</b>	<b>29</b>
Key Policies And Market Structure	29
Colombia Power Projects Database	31
<b>Competitive Landscape</b>	<b>36</b>
<b>Company Profile</b>	<b>38</b>
Interconexión Eléctrica SA	38
<b>Regional Overview</b>	<b>40</b>
Latin America Renewables: Three Markets To Watch	40
<b>Power Glossary</b>	<b>44</b>
<b>Power Methodology</b>	<b>44</b>

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## Key View

**Key View:** Colombia's power sector will remain vulnerable to deficits during drought with continued reliance on hydroelectric power for the majority of its electricity supply between 2018 and 2027. The development of new non-hydroelectric renewable power capacity and expansion of the national grid infrastructure will present investment opportunities over the coming decade. Growing investment in the country's renewables sector will be facilitated by auction-style tendering which will increase private sector participation and grow the renewables sector rapidly through to 2027.

HEADLINE POWER FORECASTS (COLOMBIA 2017-2022)						
Indicator	2017e	2018f	2019f	2020f	2021f	2022f
Generation, Total, TWh	73.4	76.1	76.1	78.7	83.1	87.1
Consumption, Net Consumption, TWh	61.7	63.8	65.7	67.9	70.3	72.7
Capacity, Net, MW	17,357.3	17,701.3	17,930.4	18,357.3	19,916.4	20,925.2

e/f = Fitch Solutions estimate/forecast. Source: UPME, EIA, IEA, IRENA, Fitch Solutions

### Latest Updates And Structural Trends

- Reports have indicated that higher sea-surface temperatures in the equatorial Pacific indicate the high likelihood of an El Niño weather event from late 2018 into early-to-mid 2019. El Niño conditions have the effect of reducing rainfall in Colombia which commonly results in drought, as illustrated in 2015. As a result, we have boosted our forecast for thermal power generation over 2019, compensating for reduced hydropower output. We anticipate that thermal power supply will return to normal levels over the course of the year 2020 before levelling off to a slow but steady growth rate between 2021 and 2027. We note that the dynamic nature of weather events poses a risk to our forecast and will monitor the situation over the coming quarters.
- Work is continuing at the 2,400MW Hidroituango project with repair, reinforcement, tunneling and investigative projects expected to delay completion by up to three years. **EPM** general manager Jorge Londoño de la Cuesta stated to the press that works included a rock-reinforcement project, closure of the collapsed diversion tunnel, boring of a new diversion tunnel, cessation of water flowing through the machine room, completion of the interior wall and investigation to definitively identify the cause of the tunnel's collapse. We have maintained our forecast completion date for the final phase of the project at 2023.
- The **Sloane Energy Group** has announced plans to construct a 1,125MW ultra-supercritical coal-fired power plant at the site of its La Luna coal mine near the town of El Paso, Cesar Department. The company plans to begin the process of tendering for the construction contract before the end of 2018 with completion scheduled for 2023. The project is still in its early stages and is therefore not included in our forecasts; however, we note that delays on the construction of the Hidroituango hydroelectric dam project offers an upside risk to our thermal power outlook as government seeks to ensure sufficient power supply to meet growing demand.
- Colombia is set to conduct its first non-hydropower renewables auction scheduled for January 2019. Reports indicate that the government will auction off contracts for the development of between 1GW and 1.5GW of solar, wind and biomass capacity via 10-year public-private-partnership agreements. The commercial operations deadline is set for December 2022 with a specified minimum capacity per project of 10MW.
- Colombia's Ministry of Energy and Mining will continue to upgrade and expand its power transmission network under its 2031 expansion plan. This plan includes the connection of new projects, greenfield developments in unconnected areas, expansion of substations and investigation and possible development of new interconnections with Ecuador. Documentation on the 2031 expansion plan here are no fewer than 34 projects which received approval for construction in 2016 and are expected to become operational between 2019 and 2023, illustrating the relatively high number of projects undertaken each year in the Colombian power transmission system.

# SWOT

## Power SWOT

### SWOT Analysis

#### Strengths

- High level of access to electricity with a 97% electrification rate.
- Colombia has successfully implemented a wholesale electricity market.
- High level of privatisation means reduced government revenues from lower oil prices will not endanger investment in the power sector.
- Colombia's regulatory framework for the power sector is robust, with a track record of minimal and appropriate interventions from the government.

#### Weaknesses

- Heavy dependence on hydropower leaves Colombia vulnerable to drought-related electricity shortfalls and spikes in wholesale electricity prices.
- A weak external environment has exposed Colombia's overdependence on US trade and oil.
- A lack of adequate transmission infrastructure in key regions has undermined the expansion of Colombia's renewables sector.
- Although some advances have been made, there is still a pressing structural reform agenda; substantial progress on this will be integral to promoting sustainable long-term economic growth.

#### Opportunities

- Real GDP growth in Colombia will pick up in 2023-2026 driven by increasing private consumption and investment.
- The threat to the country's energy supply caused by cyclical El Niño events will ensure continuing government support for the development of alternative sources of electricity.
- Strengthening power interconnection with energy-hungry Central America creates upside potential for the revenue of Colombian power generators.
- Colombia presents significant potential for the continued development of utility-scale wind and solar power projects.

#### Threats

- While the peace agreement is a positive step overall, recent events confirm our view that a peace deal between the Colombian government and FARC is unlikely to be fully implemented, especially under newly elected President Ivan Duque.
- Despite clear improvements, ongoing civil violence persists, carried out by insurgent groups and criminal gangs.
- Corruption is perceived to be high, which will deter inbound investment.
- Rising oil prices will inhibit the growth of heavy-industry, which is a key consumer of electricity.



# Industry Forecast

## Colombia Snapshot

### COUNTRY SNAPSHOT: ECONOMIC AND DEMOGRAPHIC DATA (COLOMBIA 2017-2022)

Indicator	2017e	2018f	2019f	2020f	2021f	2022f
Nominal GDP, USDbn	311.1	337.6	354.7	374.8	395.2	416.5
Real GDP growth, % y-o-y	1.8	2.6	3.2	3.6	3.7	3.6
GDP per capita, USD	6,340	6,824	7,115	7,462	7,814	8,180
Population, mn	49.07	49.46	49.85	50.22	50.58	50.92

e/f = Fitch Solutions estimate/forecast. Source: DANE, World Bank, Fitch Solutions

### COUNTRY SNAPSHOT: ECONOMIC AND DEMOGRAPHIC DATA (COLOMBIA 2022-2027)

Indicator	2022f	2023f	2024f	2025f	2026f	2027f
Nominal GDP, USDbn	416.5	438.8	462.3	486.9	512.9	545.2
Real GDP growth, % y-o-y	3.6	3.7	3.7	3.7	3.7	3.6
GDP per capita, USD	8,180	8,563	8,966	9,390	9,836	10,402
Population, mn	50.92	51.24	51.56	51.85	52.14	52.41

f = Fitch Solutions forecast. Source: DANE, World Bank, Fitch Solutions

### COUNTRY SNAPSHOT: POWER SECTOR

Access to electricity, % of population	97.0
Quality of electricity supply (value)	4.8/7
Quality of electricity supply (rank)	79/137

Source: World Economic Forum - Global Competitiveness Report 2017-2018, World Bank, Fitch Solutions

## Colombia Power Forecast Scenario

Colombia's power sector will remain vulnerable to deficits during periods of drought as it continues to depend on hydroelectric power to meet the majority of its electricity demand. Government plans to develop non-hydroelectric renewable power sources and expand the national grid into areas with high potential for solar and wind generation will present investment opportunities in the coming decade. While growing investment is evident in the country's renewables sector, we maintain our view that Colombia will require considerably greater levels of investment in non-hydroelectric power capacity in order to avoid deficits during times of low rainfall.

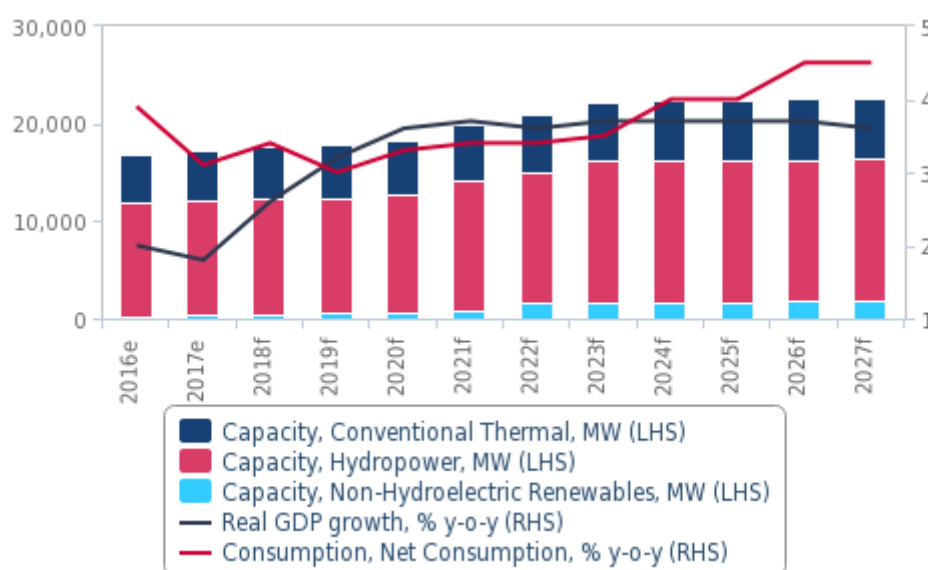
The impact of El Niño was the main driver of developments in the Colombian power market in 2016. Its effect on Colombia's hydropower output led us to revise our estimates for power generation in 2015 and our forecasts in 2016. The main trend was a sharp fall in hydropower generation, which forced additional diesel and natural gas-fired power plants to be dispatched, and coal-fired generation to be ramped up. While the increase in thermal power generation has spiked wholesale power prices and has required that the government make regulatory adjustments to generator compensation, the availability of excess thermal capacity dispatchable during periods of poor hydrology helped Colombia to avoid power cuts, albeit narrowly.

The country's hydrology cycle returned to normal in 2017, and we expect that the sizeable pipeline of new hydropower and non-hydroelectric renewable power plants to support our upbeat growth outlook for Colombia over the long term. We forecast that between 2018 and 2027, total power-generating capacity and total electricity generation will increase by an annual average of 2.8% and 3.1% respectively. We forecast power consumption to expand by an annual average of 3.7% over the same period.

Reports in late 2018 have indicated that atmospheric scientists expect an El Niño event to impact Colombia from November 2018 into 2019. As a result, we have revised down our hydropower generation forecast from last quarter and boosted expected output from biomass and thermal power through 2019. We note that the severity of the El Niño poses the greatest risk to our forecasts with the extent of its impact on annual rainfall being the most prominent factor effecting hydropower output. For now, we foresee a moderate reduction in hydropower output in 2019, but updates on rainfall levels throughout the year will inform our forecasts.

### Post El Niño, Cautiously Optimistic Outlook

Colombia - Power Installed Capacity By Technology & Selected Indicator Growth Rate



e/f = Fitch Solutions estimate/forecast. Source: EIA, IEA, IRENA, Fitch Solutions

## Thermal Generation And Capacity Forecast

**Key View:** Colombia's thermal power generation will grow at a modest rate between 2018 and 2027. Lower hydropower generation under El Niño conditions in 2019 will necessitate higher thermal power output. Oil-fired generation will decrease after 2019, offset by increasing power supply from non-hydropower renewables. We note the downside risk to our thermal power forecast in the event of a weaker El Niño event, having predicated our outlook on long-range weather forecasts available at the time of writing.

### Latest Updates

- Reports have indicated that higher sea-surface temperatures in the equatorial Pacific indicate the high likelihood of an El Niño weather event from late 2018 into early-to-mid 2019. El Niño conditions have the effect of reducing rainfall in Colombia which commonly results in drought, as illustrated by the drought of 2015. As a result, we have boosted our forecast for thermal power generation over 2019, compensating for reduced hydropower output. We anticipate that thermal power supply will return to normal levels over the course of the year 2020 before levelling off to a slow but steady growth rate between 2021 and 2027.
- The **Sloane Energy Group** has announced plans to construct a 1,125MW ultra-supercritical coal-fired power plant at the site of its La Luna coal mine near the town of El Paso, Cesar Department. The company plans to begin the process of tendering for the construction contract before the end of 2018 with completion scheduled for 2023. The project is still in its early stages and is therefore not included in our forecasts. We note that delays on the construction of the Hidroituango hydroelectric dam project offer an upside risk to our thermal power outlook as the government seeks to ensure sufficient power supply to meet growing demand.

### Structural Trends

Over our 10-year forecast period we expect coal-fired generation to grow at a slow rate of only 1.1% y-o-y between 2018 and 2027. Nevertheless, coal will continue to play an important role in Colombia's power generation mix, accounting for 11.6% of total electricity output in 2018; however, with new hydropower and non-hydroelectric renewable capacity coming online within our forecast period, we expect that figure to fall to 9.5% by 2027.

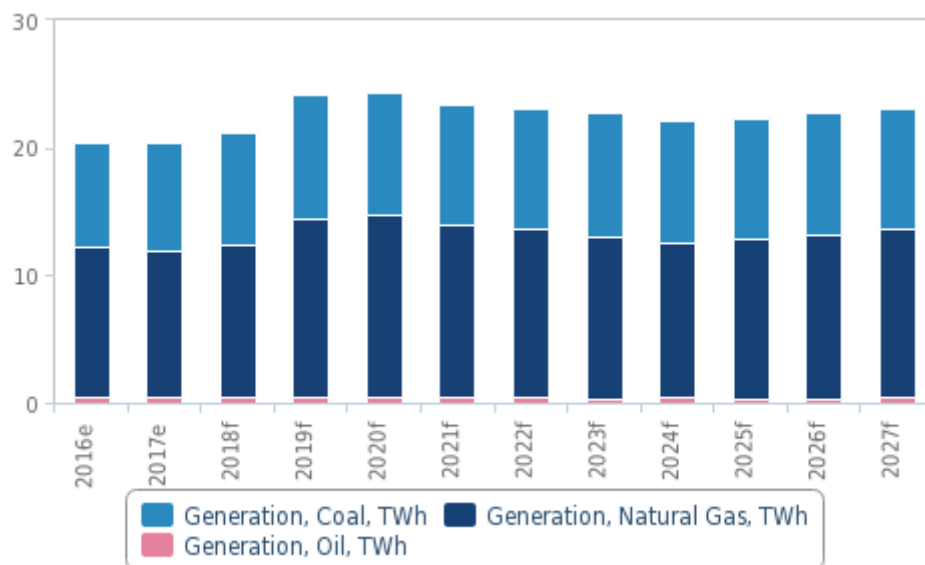
Natural gas will remain the dominant source of thermal power generation with its share increasing from around 56.3% in 2018 to 57.4% in 2027. We highlight that there is upside potential for this forecast as gas-fired generation is ramped up in Colombia to make up for lower hydropower supply in periods of drought; this was the case in 2015. We also note that since the gas-supply deficit experienced in 2015, Colombia's government has begun to focus on increasing local gas production as well as the possibility for high-volume gas imports to secure the gas-fired power sector to meet future demand. This offers an upside risk to our forecast for gas-fired power generation in Colombia.

Oil-fired power will remain a minor source of electricity generation in the country, used most commonly as a reserve source of power generation when needed. The high cost of operating oil power generators is the primary cause for this and will ensure that oil power remains a small minority contributor towards Colombia's total power output, contributing an average of 1.9% of thermal power and 0.5% of total domestic output between 2018 and 2027.

Changes to our forecast this quarter are informed by reports of emerging El Niño conditions in the equatorial Pacific region. Environment minister Ricardo Lozano stated that Colombia is expecting reduced rainfall and drought moving into early 2019. Recognising that this will result in reduced hydropower generation, we anticipate an increase in thermal power output over 2019 as the government attempts to ensure electricity supply to meet demand. Overall, we expect thermal power generation to increase by 13.9% in 2019, reducing to normal levels over the course of the following years. We note the downside risk to our thermal power forecast in the event of a weaker El Niño event, having predicated our outlook on long-range weather forecasts available at the time of writing.



El Niño Boosts Thermal Power Generation  
Colombia - Thermal Power Generation & Growth Rate By Source



e/f = Fitch Solutions estimate/forecast. Source: EIA, IEA, Fitch Solutions

## Hydropower Generation And Capacity Forecast

**Key View:** Colombia will maintain its dependence on hydropower to supply the majority of its total electricity output between 2018 and 2027. Despite significant delays on the 2,400MW Hidroituango project, new hydroelectric capacity coming online will drive growth in hydropower generation to reach an average rate of 3.4% y-o-y over the next decade. However, the incoming El Niño will result in reduced rainfall and possibly drought, causing hydropower generation to decrease significantly in 2019.

### Latest Updates

- Work is continuing at the 2,400MW Hidroituango project, with repair, reinforcement, tunneling and investigative projects expected to delay completion by up to three years. **EPM** general manager Jorge Londoño de la Cuesta stated that works included a rock-reinforcement project, closure of the collapsed diversion tunnel, boring of a new diversion tunnel, cessation of water flowing through the machine room, completion of the interior wall and investigation to definitively identify the cause of the tunnel's collapse. We have maintained our forecast completion date for the final phase of the project at 2023.
- We have revised down our hydropower generation forecast for Colombia in 2019. This revision is informed by reports of emerging El Niño conditions observed in the equatorial Pacific Ocean. Atmospheric scientists predict that the El Niño will intensify into 2019, reducing rainfall in Colombia. We anticipate that total hydropower generation will decrease during this period as government works to ensure water security during drought. We expect hydropower generation to decrease by about 6% in 2019, rising slowly through 2020 and reaching normal levels by 2021. We note that the dynamic nature of weather events poses a risk to our forecast, as the intensity of its impact on rainfall directly correlates with hydropower generation.

### Structural Trends

Hydropower dominates the power generation mix in Colombia in periods of normal hydrology. In dry years, however, the share of hydropower generation falls significantly as the El Niño weather phenomenon affects rainfall and thus hydropower output. This was the case in 2015-2016, prompting us to revise our estimates and forecasts for these years in the previous quarters.

As a result of El Niño, hydropower generation fell by 9.8% to 44.39TWh in 2015. With thermal power capacity dispatched to ensure that growing power demand was met, the share of hydropower in the Colombian electricity mix decreased from 71.9% in 2014 to

65.9% in 2015. With the worst of El Niño considered over, hydropower generation went back up to normal levels in 2017, growing by 16.5%.

Reports of emerging El Niño conditions observed in the equatorial Pacific Ocean have emerged once again. Atmospheric scientists predict that the El Niño will intensify into 2019, reducing rainfall in Colombia. We anticipate total hydropower generation to decrease during this period as the government works to ensure water security during drought. We expect hydropower generation to decrease by about 6%, in 2019, rising slowly through 2020 and reaching normal levels by 2021. Improving hydrology after the 2019 El Niño, and the commissioning of new hydropower plants support our forecast for hydropower generation to grow by an annual average of 4.7% between 2020 and 2027. Our overall forecast for hydropower generation over the decade 2018 to 2027 sits somewhat lower, at an average rate of 3.4% y-o-y.

We highlight that this forecast is based on a scenario in which no further drought of the scale of El Niño hits Colombia from 2020 through to 2027. Colombia's vulnerability to new disruptive weather phenomena creates a downside risk to our forecast for hydropower generation. Moreover, a milder or more severe impact from the current El Niño on Colombia's hydro plants than initially expected could prompt us to revise our forecast over the coming quarters.

In early 2018, **Empresas Públicas de Medellín (EPM)** secured a USD1bn loan through the **Inter-American Development Bank (IDB)** for the construction of the 2,400MW Ituango hydroelectric dam project known as Hidroituango. According to the deal, the IDB agreed to provide an initial loan of USD300mn with a 12-year term with **Banco Santander, BNP Paribas, KfW IPEX-Bank** and **Sumitomo Mitsui Banking Corporation** agreeing to provide an additional USD650mn in finance. The China Co-Financing Fund for Latin America and the Caribbean, which is administered by the IDB, will provide the remaining USD50mn. Upon completion, the facility is expected to generate around 13.9GW of electricity annually.

Since early 2018 the Hidroituango Project has suffered a series of devastating landslides and rockfalls brought on by a combination of seasonal changes and seismic activity. Rockfalls blocked the tunnels which redirect and drain the flow of the river around the construction site, and landslides displaced a massive volume of water within the reservoir, resulting in the evacuation of over 25,000 people for fear of devastating flooding. The dam's floodgates were opened in an effort to drain the reservoir to a safe level, flooding the turbine rooms and causing extensive damage to the project's equipment. In order to account for the repairs and the resumption of construction, we have pushed back our forecast completion date for the project by two years. We now expect the first unit of phase one to come online in 2021, the remaining three units of phase one to come online in 2022 and all four units of phase two to come online in 2023.

EPM general manager Jorge Londoño de la Cuesta stated that repair, tunnelling and assessment works were scheduled through 2018 and into 2019 on the project. These works include:

- rock-reinforcement
- closure of the collapsed diversion tunnels via cement filling
- boring of a new high-volume diversion tunnel and evacuation of water in the reservoir
- blockage of water flowing through the machine room used to divert water after the collapse of the diversion tunnel
- investigation and assessment to definitively identify the cause of the tunnel's collapse
- completion of the interior wall.

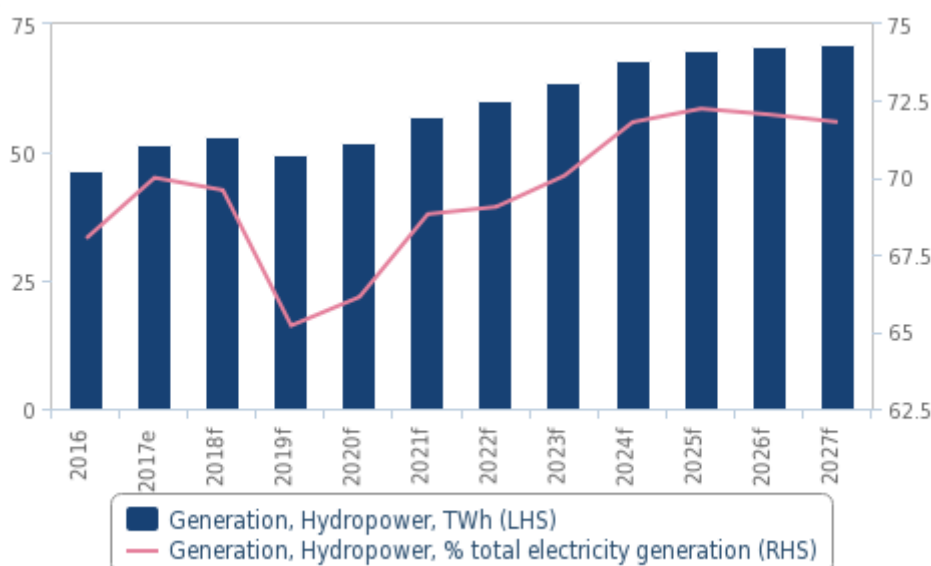
We note that the massive cost of repairs required to get the project back on track will pose an obstacle for the project as the initial budget at close of finance will now be drastically lower than the total cost at completion. In this respect, EPM has announced plans to sell assets to the value of between COP3.5trn (USD1.2bn) and COP4trn (USD1.38bn).

In terms of capacity, we highlight the following projects among the hydropower plants expected to come online over the coming decade:

- The 352MW Porvenir II plant, which is being developed by **Celsia** and is scheduled to come online in 2020.

- Celsia's 19.9MW San Andres run-of-river hydropower project which is expected to begin operations in 2020.
- The 2,400MW Ituango hydropower complex, initially scheduled to come online in 2018, completion was later postponed to 2019 while the second phase was scheduled to be commissioned in 2022. With the rockfalls, landslides and flooding events of 2018, we have now adjusted our forecast and expect final completion in 2023.

Hydro To Continue Dominating The Power Mix  
Colombia - Hydropower Generation & Share Of Total Electricity Mix



e/f = Fitch solutions estimate/forecast. Source: EIA, IEA, IRENA, Fitch Solutions

## Renewables Generation And Capacity Forecast

**Key View:** Non-hydropower renewables will be the fastest growing method of electricity generation in Colombia, more than tripling in capacity from 2018 to 2027. Solar and wind power will be the focal points of growth in the sector, while the relatively high cost of geothermal power projects will prevent its development within the next decade. Despite high levels of growth, non-hydropower renewables will remain a minority contributor to the overall national electricity supply, starting from a low base.

### Latest Updates

- Colombia is set to conduct its first non-hydropower renewables auction in January 2019. Reports indicate that government will auction off contracts for the development of between 1GW and 1.5GW of solar, wind and biomass capacity via 10-year public-private partnerships. The commercial operations deadline (COD) is set for December 2022 with a specified minimum capacity per project of 10MW.
- We note that **Enel Green Power** and Celsia currently dominate our Key Projects Database in terms of renewable power projects planned, illustrating the point that Colombia remains attractive to investors in the sector. We highlight the deregulation of the renewables industry in 2014, high solar and wind power potential, improving operational environment and the government's intention to diversify its power sector as the main drivers of growth in Colombian non-hydropower renewables over the coming decade.
- We have revised up our forecasts for non-hydropower renewables in Colombia following the confirmation of investor interest in the upcoming auction. We now expect an average annual growth rate of 12.7% in non-hydroelectric renewable power generation between 2018 and 2027. Moreover, we anticipate a 51.9% increase in renewables generation in 2022 as a direct result of projects coming online from the 2019 auction.

## Structural Trends

Colombia is reported to hold considerable potential for the development of wind, solar and even geothermal power, but the country's renewables sector is currently at a nascent stage and well behind the level of development registered by its Latin American peers.

Although the non-hydropower renewable energy sector in Colombia has seen progress over the past year in the form of several wind and solar projects being planned by private investors in the country and registered by the Ministry of Energy and Mining (UPME), the majority of these projects are still far from entering the development phase.

Colombia's first commercial-scale solar power facility was brought online in late 2017 by local energy group Celsia, under the name Celsia Solar Yumbo, with a capacity of just under 10MW. The facility is fully integrated into the national grid with an annual output of about 0.016TWh, however, the country remains an underperformer in non-hydroelectric renewables when compared with its regional peers.

Even excluding the region's heavyweights Brazil and Mexico, and after accounting for 200MW of installed biomass power capacity, Colombia's renewables industry is a notable laggard in Latin America. This is steadily improving as we expect for a total of 166MW of new renewable power capacity to come online in 2018. Nevertheless, Colombia remains an underperformer in the region and will require continuing support from government and private investors on future renewable power projects in order to meet the regional benchmark.

This underperformance has resulted from the combined effect of sufficient power supply from conventional power sources, at least in times of normal rainfalls and a lack of adequate transmission infrastructure:

- Thermal and hydropower projects currently under development in Colombia are expected to be sufficient to meet growth in power demand until 2019, according to the latest power expansion scenario released by the country's energy planning agency UPME. This has so far prevented the Colombian government from following the example of most Latin American countries, which held auctions to contract power from renewables projects (see *'Auctions Support Renewables Growth Outperformance In Latin America', March 9 2017*).
- La Guajira is reportedly the Colombian region with the best natural resources for wind and solar power generation; the government estimates that the region has a potential of 3,500MW of wind and 2,500MW of solar. The area is isolated from the country's main power grid, representing a clear obstacle for the development of the projects that are planned for the region.

Despite our bearish outlook on the growth of Colombia's non-hydro renewables sector, we maintain that it will have only a minor role in the country's power mix over our 10-year forecast period. We expect renewables will represent just 3.4% of the total power generation mix in 2027, while hydropower and thermal power generation will account for around 70.7% and 25.9% respectively.

That said, we highlight a number of factors that could see the industry's growth accelerate significantly over the coming years:

- The country has a considerable number of renewables projects at the planning stage and awaiting an opportunity to be contracted. According to the UPME's June 2018 projects registry, 374 solar power projects and 19 wind power projects are registered as ready to be developed to meet Colombia's future power needs - accounting for a total of over 3,850MW and over 3,090MW, respectively. While these figures account for every single incomplete project registered with the UPME and is therefore not an entirely accurate representation of future growth, it does offer an encouraging indicator of the country's more welcoming stance on renewables.
- Colombia's exposure to a risk of insufficient power supply during periods of abnormally low rainfalls, coupled with the high costs of backup thermal power generation, should give the government an incentive to diversify its power mix with non-hydro renewables resources. The Colombian power system was put under strain by the latest El Niño.
- In March 2018 the Ministry of Mines and Energy issued Decree 0570 which establishes guidelines for long-term renewable power generation contracts for under a mechanism that is complementary to the existing mechanisms in the Wholesale Energy

Market. The government also announced that it has adopted the necessary regulations for the creation of a public fund that will finance renewables and energy efficiency projects (FENOGE).

- The adoption of an auction scheme for renewable power development contracts via 10-year PPP agreements will standardise and streamline the contracting and approval process, increasing competitiveness in the market. Colombia's first renewables auction will take place in January 2019 with a COD set for December 2022, boosting renewables capacity in that year as projects from the 2019 auction come online.

## Electricity Generation And Power Generating Capacity

TOTAL ELECTRICITY GENERATION DATA AND FORECASTS (COLOMBIA 2016-2021)						
Indicator	2016e	2017e	2018f	2019f	2020f	2021f
Generation, Total, TWh	68.3	73.4	76.1	76.1	78.7	83.1
Generation, Thermal, % of total generation	29.785	27.827	27.879	31.761	30.911	28.143
Generation, Coal, TWh	8.026	8.458	8.838	9.686	9.621	9.453
Generation, Coal, % y-o-y	4.383	5.381	4.486	9.598	-0.670	-1.740
Generation, Coal, % total electricity generation	11.749	11.525	11.613	12.726	12.226	11.373
Generation, Natural Gas, TWh	11.858	11.515	11.935	13.984	14.228	13.487
Generation, Natural Gas, % y-o-y	-5.503	-2.897	3.650	17.170	1.740	-5.210
Generation, Natural Gas, % of total electricity generation	17.358	15.690	15.683	18.375	18.080	16.225
Generation, Oil, TWh	0.464	0.449	0.444	0.502	0.477	0.453
Generation, Oil, % change y-o-y	25.882	-3.178	-1.199	13.174	-5.040	-5.000
Generation, Oil, % of total electricity generation	0.679	0.612	0.583	0.660	0.606	0.545
Generation, Nuclear, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Nuclear, % of total electricity generation	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Hydropower, TWh	46.480	51.377	52.970	49.622	52.041	57.209
Generation, Hydropower, % change y-o-y	4.720	10.536	3.100	-6.320	4.874	9.932
Generation, Hydropower, % total electricity generation	68.036	70.007	69.604	65.200	66.130	68.824
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	1.488	1.590	1.916	2.313	2.328	2.521
Generation, Non-Hydropower Renewables, % change y-o-y	3.3	6.8	20.5	20.7	0.7	8.3
Generation, Non-Hydropower Renewables, % of total electricity	2.179	2.166	2.517	3.039	2.959	3.033

e/f = Fitch Solutions estimate/forecast. Source: EIA, IEA, IRENA, Fitch Solutions

**TOTAL ELECTRICITY GENERATION DATA AND FORECASTS (COLOMBIA 2022-2027)**

Indicator	2022f	2023f	2024f	2025f	2026f	2027f
Generation, Total, TWh	87.1	91.0	94.8	97.0	98.2	99.1
Generation, Thermal, % of total generation	26.544	25.035	23.423	23.045	23.137	23.284
Generation, Coal, TWh	9.523	9.689	9.578	9.475	9.468	9.410
Generation, Coal, % y-o-y	0.740	1.740	-1.150	-1.070	-0.074	-0.610
Generation, Coal, % total electricity generation	10.935	10.650	10.098	9.770	9.640	9.500
Generation, Natural Gas, TWh	13.192	12.698	12.227	12.483	12.882	13.249
Generation, Natural Gas, % y-o-y	-2.187	-3.740	-3.710	2.090	3.198	2.848
Generation, Natural Gas, % of total electricity generation	15.147	13.958	12.891	12.872	13.115	13.375
Generation, Oil, TWh	0.402	0.388	0.411	0.391	0.375	0.405
Generation, Oil, % change y-o-y	-11.180	-3.474	5.874	-4.874	-4.048	8.000
Generation, Oil, % of total electricity generation	0.462	0.427	0.434	0.403	0.382	0.409
Generation, Nuclear, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Nuclear, % of total electricity generation	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Hydropower, TWh	60.144	63.748	68.112	70.067	70.777	71.139
Generation, Hydropower, % change y-o-y	5.130	5.992	6.846	2.870	1.014	0.511
Generation, Hydropower, % total electricity generation	69.058	70.072	71.812	72.250	72.059	71.817
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	3.830	4.452	4.520	4.563	4.719	4.852
Generation, Non-Hydropower Renewables, % change y-o-y	51.9	16.2	1.5	0.9	3.4	2.8
Generation, Non-Hydropower Renewables, % of total electricity	4.398	4.893	4.766	4.705	4.804	4.898

f = Fitch Solutions forecast. Source: EIA, IEA, IRENA, Fitch Solutions

**ELECTRICITY GENERATING CAPACITY DATA AND FORECASTS (COLOMBIA 2016-2021)**

Indicator	2016e	2017e	2018f	2019f	2020f	2021f
Capacity, Net, MW	16,939.4	17,357.3	17,701.3	17,930.4	18,357.3	19,916.4
Capacity, Net, % y-o-y	1.7	2.5	2.0	1.3	2.4	8.5
Capacity, Conventional Thermal, MW	5,060.0	5,310.0	5,461.1	5,510.8	5,626.0	5,793.1
Capacity, Conventional Thermal, % y-o-y	3.3	4.9	2.8	0.9	2.1	3.0
Capacity, Conventional Thermal, % of total capacity	29.9	30.6	30.9	30.7	30.6	29.1
Capacity, Nuclear, MW	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Nuclear, % of total capacity	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Hydropower, MW	11,606.4	11,725.6	11,744.5	11,759.5	12,059.5	13,311.5
Capacity, Hydropower, % y-o-y	0.9	1.0	0.2	0.1	2.6	10.4
Capacity, Hydropower, % of total capacity	68.5	67.6	66.3	65.6	65.7	66.8
Capacity, Non-Hydroelectric Renewables, MW	273.0	321.7	495.7	660.1	671.9	811.9
Capacity, Non-Hydroelectric Renewables, % y-o-y	5.0	17.8	54.1	33.2	1.8	20.8
Capacity, Non-Hydroelectric Renewables, % of total capacity	1.6	1.9	2.8	3.7	3.7	4.1

e/f = Fitch Solutions estimate/forecast. Source: EIA, IRENA, Fitch Solutions

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ELECTRICITY GENERATING CAPACITY DATA AND FORECASTS (COLOMBIA 2022-2027)						
Indicator	2022f	2023f	2024f	2025f	2026f	2027f
Capacity, Net, MW	20,925.2	22,273.1	22,377.5	22,468.0	22,533.8	22,660.0
Capacity, Net, % y-o-y	5.1	6.4	0.5	0.4	0.3	0.6
Capacity, Conventional Thermal, MW	5,951.8	6,058.3	6,111.0	6,181.1	6,211.9	6,303.3
Capacity, Conventional Thermal, % y-o-y	2.7	1.8	0.9	1.1	0.5	1.5
Capacity, Conventional Thermal, % of total capacity	28.4	27.2	27.3	27.5	27.6	27.8
Capacity, Nuclear, MW	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Nuclear, % of total capacity	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Hydropower, MW	13,311.5	14,511.5	14,526.3	14,541.5	14,562.4	14,570.6
Capacity, Hydropower, % y-o-y	0.0	9.0	0.1	0.1	0.1	0.1
Capacity, Hydropower, % of total capacity	63.6	65.2	64.9	64.7	64.6	64.3
Capacity, Non-Hydroelectric Renewables, MW	1,661.9	1,703.3	1,740.2	1,745.4	1,759.5	1,786.1
Capacity, Non-Hydroelectric Renewables, % y-o-y	104.7	2.5	2.2	0.3	0.8	1.5
Capacity, Non-Hydroelectric Renewables, % of total capacity	7.9	7.6	7.8	7.8	7.8	7.9

f = Fitch Solutions forecast. Source: EIA, IRENA, Fitch Solutions

## Electricity Consumption

We maintain our forecast that Colombia's total power consumption will expand at an average annual rate of 3.3% between 2018 and 2022. Looking ahead, we expect total power consumption to grow by an annual average of 4.1% between 2023 and 2027. The fall in global oil prices over the past quarters darkened our outlook for Colombia's economy, the expansion of which has driven fast growth in power consumption over the past years. Our Country Risk team estimates real GDP growth to come in at 1.8% in 2017 and forecasts growth to accelerate to 2.8% in 2018. An improvement in economic conditions over the long term prompts a higher forecast annual average growth of 3.6% between 2019 and 2027.

We highlight that our outlook for robust growth in power consumption over the coming decade remains in place. The mining sector is set to be a key driver for Colombian power consumption growth over our forecast period; however, the country's mining and industrial sectors remain vulnerable to oil price fluctuation which has held an overall upward trend since 2016. This poses a downside risk to our forecast for electricity consumption growth as the mining and industrial sector account for a large portion of the country's overall consumption.

TOTAL ELECTRICITY CONSUMPTION DATA AND FORECASTS (COLOMBIA 2016-2021)						
Indicator	2016e	2017e	2018f	2019f	2020f	2021f
Consumption, Net Consumption, TWh	59.8	61.7	63.8	65.7	67.9	70.3
Consumption, Net Consumption, % y-o-y	3.9	3.1	3.4	3.0	3.3	3.4
Consumption, Net Consumption, KWh per capita	1,230.0	1,257.7	1,290.3	1,318.9	1,352.8	1,389.3

e/f = Fitch Solutions estimate/forecast. Source: EIA, Fitch Solutions

TOTAL ELECTRICITY CONSUMPTION DATA AND FORECASTS (COLOMBIA 2022-2027)						
Indicator	2022f	2023f	2024f	2025f	2026f	2027f
Consumption, Net Consumption, TWh	72.7	75.2	78.2	81.3	84.9	88.7
Consumption, Net Consumption, % y-o-y	3.4	3.5	4.0	4.0	4.5	4.5
Consumption, Net Consumption, KWh per capita	1,427.0	1,467.1	1,516.0	1,567.1	1,628.1	1,692.0

f = Fitch Solutions forecast. Source: EIA, Fitch Solutions

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## Transmission And Distribution, Imports And Exports

**Key View:** Colombia's power transmission and distribution sector offers high investment potential as government pushes forward with plans to diversify its power sector through the development of non-electric renewables. The majority of Colombia's highest solar and wind potential zones remain out of reach of the existing grid infrastructure, and will require significant investment in the near future. The country will maintain its status as a net exporter of electricity, boosting export capacity through the development of new regional power interconnections.

### Latest Updates

- Colombia's Ministry of Energy and Mining (UPME) will continue to upgrade and expand its power transmission network under its 2031 expansion plan. This plan includes the connection of new projects, greenfield developments in unconnected areas, expansion of substations and investigation and the possible development of new interconnections with Ecuador. Documentation on the 2031 expansion plan here are no fewer than 34 projects which received approval for construction in 2016 and are expected to become operational between 2019 and 2023, illustrating the relatively high number of projects undertaken each year in the Colombian power transmission system.
- We maintain our cautiously optimistic outlook on Colombia's power transmission and distribution sector, forecasting overall losses from the system to decrease from 10.5% of total output in 2018 to 9.0% in 2027. This will be driven by the execution of UPME's annually revised expansion plans which prioritise the national power grid as a point for investment.
- Increasing electricity generation and decreasing transmission and distribution losses are expected to outpace domestic power demand between 2018 and 2027. For this reason we anticipate that Colombia will remain a net exporter of electricity throughout the coming decade. We note that this view relies on the completion of the Hidroituango hydroelectric dam project by the year 2023 and the stability of normal levels of rainfall. Further delays in bringing online the Hidroituango project or the impact of severe drought pose the greatest risk to our forecast.

### Structural Trends

Colombia's electricity transmission system consists of two major grids: one serving the Atlantic coast and the other serving the interior region, with numerous interconnectors running between the two. There are two leading companies in the power transport business: the state-controlled grid operator **ISA** and **Transelca**. ISA's affiliate **XM** operates the national interconnected system (SIN) and administers the wholesale energy market (MEM).

One of our views for power markets in Colombia has long been that the country will offer significant business opportunities for engineering, procurement and construction (EPC) companies active in the power transmission sector. A number of dynamics make Colombia fertile ground for business demand for power transmission lines and related infrastructure.

Firstly, the country will register strong growth in power consumption as a result of their growing economic activity; we forecast that the country's total power consumption will grow by an annual average of 3.7% between 2018 and 2027. This will require new power-generation assets to be put into operation - with the result that new power transmission lines will have to be built to connect conventional and renewable energy plants to the grid and support a much greater amount of electricity through the network.

In addition, the governments will also extend the power transmission grid to areas that are currently still left out of the country's main power network. According to data from the Inter-American Development Bank (IDB), around 60% of the country's territory is not connected to the power grid. This means that the government cannot currently harvest energy from some regions with the best natural potential for wind and solar power generation. Until new power transmission lines enable the development of utility-scale wind and solar power plants, we reiterate that the distributed generation sector will offer the biggest opportunities in the country.

According to the UPME, transmission and distribution infrastructure is a priority under the government's 2031 expansion plan, boosting power supply and the ability to develop new clean power capacity in regions which have not been connected to the

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national grid. In April 2018, the UPME conducted a webinar which highlighted 22 calls for tenders on transmission and distribution projects which were to be awarded. In it, the UPME stated an estimated total cost of over USD1.3bn for all 22 projects which are spread throughout the country, including regions which were previously excluded from the national grid. This offers an upside risk to our forecast as the government encourages the development of transmission infrastructure in regions which have high-yield potential for solar and wind power generation, which may result in higher clean energy output within our forecast period.

**TRADE DATA AND FORECASTS (COLOMBIA 2016-2021)**

Geography	Indicator	2016e	2017e	2018f	2019f	2020f	2021f
Colombia	Total Net Imports, TWh	-1.8	-4.0	-4.3	-2.6	-2.9	-4.6

e/f = Fitch Solutions estimate/forecast. Source: EIA, Fitch Solutions

**TRADE DATA AND FORECASTS (COLOMBIA 2022-2027)**

Geography	Indicator	2022f	2023f	2024f	2025f	2026f	2027f
Colombia	Total Net Imports, TWh	-6.0	-7.1	-7.7	-6.6	-4.3	-1.4

f = Fitch Solutions forecast. Source: EIA, Fitch Solutions

**ELECTRIC POWER T&D LOSSES DATA AND FORECASTS (COLOMBIA 2016-2021)**

Indicator	2016e	2017e	2018f	2019f	2020f	2021f
Electric power distribution losses, TWh	6.7	7.6	8.0	7.7	7.9	8.2
Electric power distribution losses, % of output	9.8	10.4	10.5	10.2	10.0	9.9

e/f = Fitch Solutions estimate/forecast. Source: EIA, Fitch Solutions

**ELECTRIC POWER T&D LOSSES DATA AND FORECASTS (COLOMBIA 2022-2027)**

Indicator	2022f	2023f	2024f	2025f	2026f	2027f
Electric power distribution losses, TWh	8.4	8.7	9.0	9.1	9.0	9.0
Electric power distribution losses, % of output	9.7	9.6	9.5	9.4	9.2	9.0

f = Fitch Solutions forecast. Source: EIA, Fitch Solutions

## Industry Risk/Reward Index

### Latin America Power RRI: LNG Terminal Propels Panama, Economic Crisis Weighs On Nicaragua

#### Key View

- Latin America's growing need for new power generation and transmission infrastructure over the coming decade will offer long-term business opportunities to investors, vendors and project developers.
- These opportunities are distributed unequally across the region, depending on market size, economic growth, political trends and the attractiveness of a country's business environment.
- Our power sector Risk/Reward Index shows where opportunities are concentrated and what risks they should be weighed against. This quarter we highlight developments in Panama and Nicaragua.

Chile Remains Distant Regional Outperformer  
Latin America Power - Risk/Reward Index Heat Map



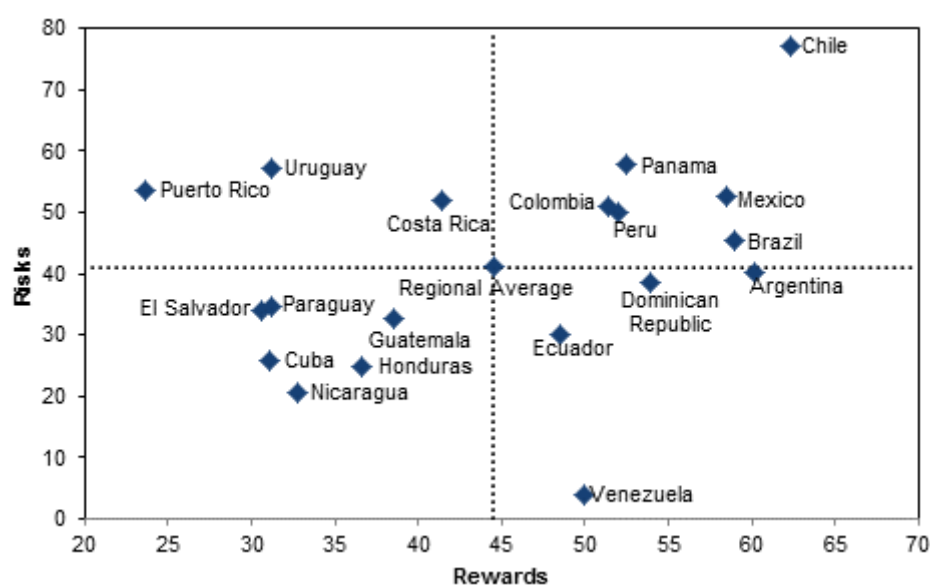
Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Power Risk/Reward Index.

## Main Regional Features And Latest Updates

- Latin America's average score in our Power sector Risk/Reward Index (RRI) reflects the presence of both global hot spots and underperformers in terms of business opportunities for power industry investors, vendors and project developers. The region's score is below that of the global average, as it is dragged down by the low scores of most Central American and Caribbean countries, which are characterised by a small power market and an unattractive business environment
- This quarter **Chile** remains the highest scoring country in Latin America by a wide margin, due to a mix of relatively low risks and high rewards, including a stable government and robust economic growth (see '*Strong Fundamentals And Fiscal Expansion Will Support Long-Term Growth In Chile*', September 27). **Mexico** and **Brazil** - which score second and fourth in the RRI this quarter - also support Latin America's average RRI score as a result of their large markets and vast pipeline of new projects planned and under construction.
- Nicaragua** dropped to the bottom of our Latin America ranking due to a deterioration in its political and economic outlook amid widespread protests against the government of President Daniel Ortega (see '*Political Crisis To Push Nicaragua Into Recession In 2018*', August 8). **Argentina** also lost two positions in our RRI and now ranks fifth within the region, as the country's economic crisis has reduced business opportunities in the power sector - planned power auctions have been cancelled - and hurt investors' confidence in the market.
- Conversely, **Panama**'s score in our RRI saw a notable improvement this quarter, with the country now ranking third within Latin America and having gained 11 positions globally. This reflects an upside revision to our power capacity forecasts for the country, as a result of the completion of the first liquefied natural gas (LNG) import terminal in Central America.
- Overall, Latin America's large need for new power generation and transmission infrastructure over the coming decade will offer long-term opportunities to investors. We maintain that these opportunities will be available across the region - particularly in the non-hydro renewables and power transmission sectors – although, these will be accompanied by a varying level of Country and Industry Risks depending on the market under consideration.

### Diversified Mix Of Opportunities And Risks

Latin America - Power Risk/Reward Index



Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Power Risk/Reward Index.

## Top Of The Chart: Attractive Business Environment, Economic Growth And Market Size

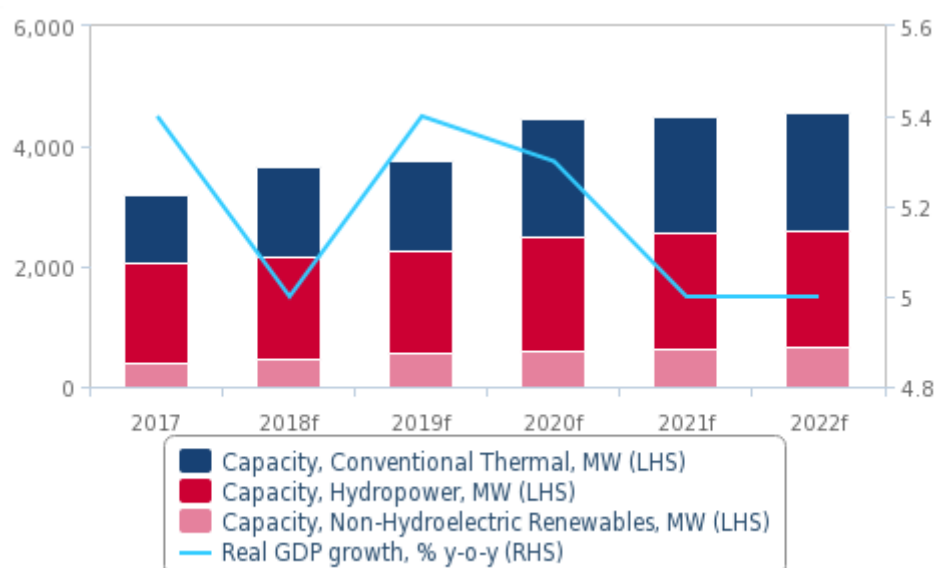
The upper section of our Latin America power sector RRI ranking includes both countries with a large population and power markets, and smaller countries with an attractive business environment and strong economic growth. Mexico and Brazil belong to the former group, while Chile and Panama to the latter.

This quarter Mexico and Brazil rank second and fourth in our Latin America index, respectively. Similarly to Mexico's ranking, Brazil's position is supported by its vast electricity market and a significant pipeline of thermal, hydropower and renewables projects under construction. However, higher political and economic risks weigh down Brazil's ranking in our index. Brazil will hold a presidential election in October 2018, and we see downside risk to its RRI score in case the election resulted in an outcome that damages Brazil's economic growth prospects and investor sentiment towards the country (see *'Brazil Election Primer: Eletrobras Privatisation And Power Auctions In Focus'*, September 18).

Panama rose to third place in our RRI ranking this quarter, as in August we revised up our forecast for installed power capacity in the country. This reflected the completion of the **AES Corp** 381MW natural gas-fired power plant and the development of the Martano 440MW combined cycle plant, which is expected to enter into operation in 2020. AES Corp's plant will connect to the 1.5mn tonne per annum (mtpa) Costa Norte LNG import terminal. The LNG-to-power project is the first of its kind in Central America and represented a USD1.15bn investment for AES Corp. and Panamanian private holding company, **Inversiones Bahía**.

In addition to these project developments, Panama's overall RRI score is underpinned by the very positive outlook we have for the country's economy. Our Country Risk team currently forecasts that Panama's annual real GDP growth will average at 5.1% between 2018 and 2022. As a result, Panama presents the highest score for the 'Real GDP Growth' sub-indicator in our Latin America index, and one of the highest globally.

Gas Power Projects And Economic Growth Boost Panama's RRI Score  
Panama - Power Capacity By Type And Economic Growth



e/f = Fitch Solutions estimate/forecast. Source: EIA, National Sources, ETESA, Fitch Solutions

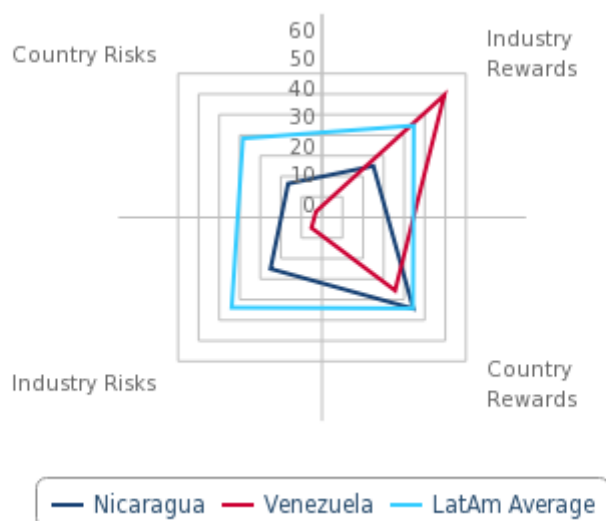


## Bottom Of The Chart: Small Power Markets And Heightened Political Risk

Countries in the bottom half of our Latin America RRI generally are characterised by high risks and limited opportunities for power sector investment. These markets present elevated legal risks, limited access to financing, economic weakness and, in some cases, political instability and security concerns.

In addition, the countries in this group have a small power sector, limiting the range of opportunities on offer even for more risk-tolerant investors. With a relatively large population, **Venezuela** is the exception in this group. However, the country's ongoing economic crisis and tense political situation, coupled with the dilapidated state of its power infrastructure, account for its poor performance in our RRI (see '*Venezuela's Political Crisis: Four Scenarios*', May 22). This quarter Venezuela ranks 17th out of 19 countries in the Latin America index.

High Risks Drag Venezuela And Nicaragua Scores Down  
Power Risk/Reward Index Indicators



Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Power Risk/Reward Index.

Nicaragua's Real GDP Growth and Short-Term Political Risk Index sub-indicators saw a sharp deterioration in our RRI, with the result that the country has slipped to last position in the regional RRI this quarter. In August, our Country Risk team revised down its outlook for the Nicaraguan economy in 2018 and over the next decade, as widespread protests ground economic activity to a halt across much of the country.

Protests started in April following a controversial reform of Nicaragua's social security system. As of early October, the country appears to have moved past the worst of the crisis, but Nicaragua's President Daniel Ortega remains highly unpopular and opposition protests continue, although at a smaller scale. In this context, risks to our forecast for the Nicaraguan economy are weighted heavily to the downside, as are our Political Risk Index scores. We acknowledge that the situation on the ground in the country is volatile and that there are downside risks to our view that the worst has passed.

LATIN AMERICA POWER RISK/REWARD INDEX									
Rewards	Industry Rewards	Country Rewards	REWARDS	Industry Risks	Country Risks	RISKS	RRI	Regional Rank	Global Rank
Chile	65.7	57.1	62.3	80.1	74.4	77.3	68.3	1	10
Mexico	63.8	50.4	58.4	58.7	46.6	52.7	56.1	2	41
Panama	52.2	53.0	52.5	57.6	57.8	57.7	54.6	3	43
Brazil	70.3	42.0	59.0	49.2	41.8	45.5	53.6	4	46
Argentina	70.0	45.5	60.2	46.2	34.1	40.2	52.2	5	52
Colombia	55.0	46.1	51.4	55.1	46.8	51.0	51.2	6	56
Peru	46.3	60.6	52.0	49.5	50.3	49.9	51.2	7	57
Dominican Republic	53.9	53.9	53.9	37.1	39.9	38.5	47.7	8	65
Costa Rica	39.0	45.0	41.4	53.8	49.8	51.8	45.6	9	73
Uruguay	32.3	29.5	31.2	56.5	58.0	57.2	41.6	10	86
Ecuador	48.1	49.2	48.5	27.6	32.8	30.2	41.2	11	90
Guatemala	33.4	46.3	38.6	40.7	24.9	32.8	36.3	12	98
Puerto Rico	25.6	20.7	23.7	60.3	47.1	53.7	35.7	13	99
Paraguay	27.4	36.9	31.2	39.0	30.1	34.5	32.5	14	104
El Salvador	24.8	39.4	30.6	40.7	27.2	33.9	32.0	15	105
Honduras	25.0	54.1	36.6	29.1	20.5	24.8	31.9	16	106
Venezuela	59.5	35.6	49.9	5.1	2.9	4.0	31.5	17	108
Cuba	31.3	30.9	31.1	22.9	28.8	25.9	29.0	18	111
Nicaragua	25.0	44.4	32.8	25.0	16.5	20.7	27.9	19	113
Global Average	50.0	50.0	50.0	50.0	50.0	50.0	50.0	~	~
Regional Average	44.7	44.2	44.5	43.9	38.4	41.2	43.2	~	~

Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Risk/Reward Index

LATIN AMERICA POWER INDUSTRY REWARDS						
Rewards	Electricity Capacity (MW)	Electricity Capacity (%)	Electricity Generation (TWh)	Electricity Generation (%)	Industry Rewards	REWARDS
Chile	69.8	68.1	67.2	57.8	65.7	62.3
Mexico	86.2	40.5	89.7	38.8	63.8	58.4
Panama	20.7	87.9	15.5	84.5	52.2	52.5
Brazil	94.8	50.0	94.0	42.2	70.3	59.0
Argentina	78.4	71.6	75.0	55.2	70.0	60.2
Colombia	58.6	43.1	64.7	53.4	55.0	51.4
Peru	54.3	30.2	56.0	44.8	46.3	52.0
Dominican Republic	25.9	80.2	34.5	75.0	53.9	53.9
Costa Rica	21.6	56.9	19.0	58.6	39.0	41.4
Uruguay	32.8	45.7	25.0	25.9	32.3	31.2
Ecuador	42.2	58.6	38.8	52.6	48.1	48.5
Guatemala	23.3	26.7	17.2	66.4	33.4	38.6
Puerto Rico	33.6	13.8	19.8	35.3	25.6	23.7
Paraguay	40.5	4.3	56.9	7.8	27.4	31.2
El Salvador	6.0	22.4	8.6	62.1	24.8	30.6
Honduras	10.3	49.1	10.3	30.2	25.0	36.6
Venezuela	72.4	35.3	69.8	60.3	59.5	49.9
Cuba	37.1	25.0	31.9	31.0	31.3	31.1
Nicaragua	4.3	42.2	2.6	50.9	25.0	32.8
Global Average	50.0	50.0	50.0	50.0	50.0	50.0
Regional Average	42.8	44.8	41.9	49.1	44.7	44.5

Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Risk/Reward Index

LATIN AMERICA POWER COUNTRY REWARDS						
Rewards	Real GDP Growth (%)	Labour Market Risk	Electricity Import Dependence	Population Growth (%)	Country Rewards	REWARDS
Chile	50.9	78.4	59.5	39.7	57.1	62.3
Mexico	35.3	71.6	33.6	61.2	50.4	58.4
Panama	80.2	29.3	27.6	75.0	53.0	52.5
Brazil	24.1	28.4	78.4	37.1	42.0	59.0
Argentina	25.9	44.0	63.8	48.3	45.5	60.2
Colombia	58.6	56.9	28.4	40.5	46.1	51.4
Peru	69.0	75.0	37.9	60.3	60.6	52.0
Dominican Republic	76.7	25.9	58.6	54.3	53.9	53.9
Costa Rica	59.5	37.9	35.3	47.4	45.0	41.4
Uruguay	31.9	33.6	22.4	30.2	29.5	31.2
Ecuador	13.8	55.6	57.8	69.8	49.2	48.5
Guatemala	60.3	12.1	30.2	82.8	46.3	38.6
Puerto Rico	0.9	64.7	1.7	15.5	20.7	23.7
Paraguay	72.4	11.2	0.0	63.8	36.9	31.2
El Salvador	23.3	12.9	87.1	34.5	39.4	30.6
Honduras	62.9	6.9	69.0	77.6	54.1	36.6
Venezuela	0.0	19.0	60.3	62.9	35.6	49.9
Cuba	3.4	55.6	44.0	20.7	30.9	31.1
Nicaragua	33.6	10.3	77.6	56.0	44.4	32.8
Global Average	50.0	50.0	50.0	50.0	50.0	50.0
Regional Average	41.2	38.4	46.0	51.5	44.2	44.5

Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Risk/Reward Index

LATIN AMERICA POWER INDUSTRY RISKS							
Risks	Competitive Landscape	Financial Barriers	Energy Policy	Legal Risks	T&D Losses	Industry Risks	RISKS
Chile	74.6	78.4	77.6	76.7	93.1	80.1	77.3
Mexico	64.2	62.9	77.6	46.6	42.2	58.7	52.7
Panama	47.4	75.9	77.6	49.1	37.9	57.6	57.7
Brazil	64.2	47.4	77.6	32.8	24.1	49.2	45.5
Argentina	47.4	19.0	45.7	23.3	95.7	46.2	40.2
Colombia	64.2	95.7	20.7	42.2	52.6	55.1	51.0
Peru	47.4	61.2	45.7	43.1	50.0	49.5	49.9
Dominican Republic	47.4	25.0	45.7	34.5	32.8	37.1	38.5
Costa Rica	47.4	53.4	62.1	51.7	54.3	53.8	51.8
Uruguay	64.2	36.2	77.6	55.2	49.1	56.5	57.2
Ecuador	26.7	29.3	20.7	21.6	39.7	27.6	30.2
Guatemala	26.7	64.7	62.1	15.5	34.5	40.7	32.8
Puerto Rico	47.4	74.1	20.7	59.5	100.0	60.3	53.7
Paraguay	47.4	23.3	31.9	31.0	61.2	39.0	34.5
El Salvador	26.7	28.4	45.7	25.9	76.7	40.7	33.9
Honduras	26.7	55.2	45.7	16.4	1.7	29.1	24.8
Venezuela	5.6	9.5	9.5	0.0	0.9	5.1	4.0
Cuba	13.8	46.6	20.7	12.1	21.6	22.9	25.9
Nicaragua	26.7	11.2	45.7	13.8	27.6	25.0	20.7
Global Average	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Regional Average	43.0	47.2	47.9	34.3	47.1	43.9	41.2

Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Risk/Reward Index

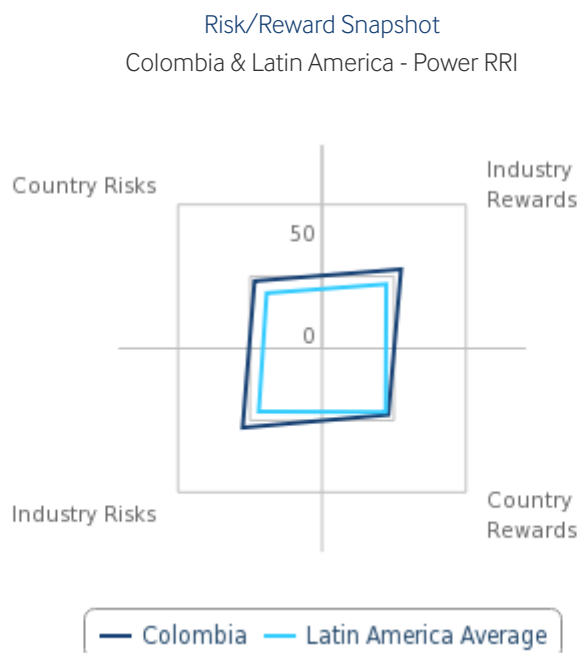
LATIN AMERICA POWER COUNTRY RISKS							
Risks	Long Term Economic Risk Index	Short Term Economic Risk Index	Long Term Political Risk Index	Short Term Political Risk Index	Operational Risk Index	Country Risks	RISKS
Chile	69.4	76.3	84.5	74.1	71.1	74.4	77.3
Mexico	62.9	65.1	40.5	23.3	44.0	46.6	52.7
Panama	68.1	54.3	59.9	59.1	52.6	57.8	57.7
Brazil	56.9	49.1	57.8	16.4	35.3	41.8	45.5
Argentina	37.1	16.4	43.1	35.8	36.2	34.1	40.2
Colombia	61.2	59.5	37.9	43.1	39.7	46.8	51.0
Peru	67.2	73.3	44.8	30.2	43.1	50.3	49.9
Dominican Republic	38.8	30.6	45.7	62.1	31.0	39.9	38.5
Costa Rica	49.1	45.3	68.1	41.4	47.4	49.8	51.8
Uruguay	56.0	52.6	74.1	65.1	50.0	58.0	57.2
Ecuador	50.9	43.1	13.8	14.7	37.1	32.8	30.2
Guatemala	48.3	48.3	12.9	5.2	17.2	24.9	32.8
Puerto Rico	47.4	51.3	33.6	28.0	61.2	47.1	53.7
Paraguay	33.6	40.5	41.4	25.4	19.8	30.1	34.5
El Salvador	37.9	22.4	38.8	10.3	26.7	27.2	33.9
Honduras	27.6	47.0	12.1	5.2	15.5	20.5	24.8
Venezuela	1.7	0.0	8.6	1.7	2.6	2.9	4.0
Cuba	19.8	8.2	19.0	79.3	23.3	28.8	25.9
Nicaragua	13.8	10.8	9.5	21.6	21.6	16.5	20.7
Global Average	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Regional Average	44.6	41.8	39.3	33.8	35.5	38.4	41.2

Note: Scores out of 100; higher score = more attractive market. Source: Fitch Solutions Risk/Reward Index



## Colombia Power Risk/Reward Index

**Key View:** Colombia ranks 56th in our Global Power Risk/Reward Index and sixth in the Latin American regional rankings this quarter. Strong economic fundamentals, increasing private sector participation in the power sector and elevated electricity generation growth contribute positively to power sector investment in the country. However, political risks have increased under President Ivan Duque, and an upswing in FARC militancy weighs on the country's overall RRI score. Slow policy reform in the power sector will leave the country vulnerable to deficits during periods of reduced rainfall.



Note: Scores out of 100; higher scores = lower risks. Source: Fitch Solutions

### Global And Regional Ranks

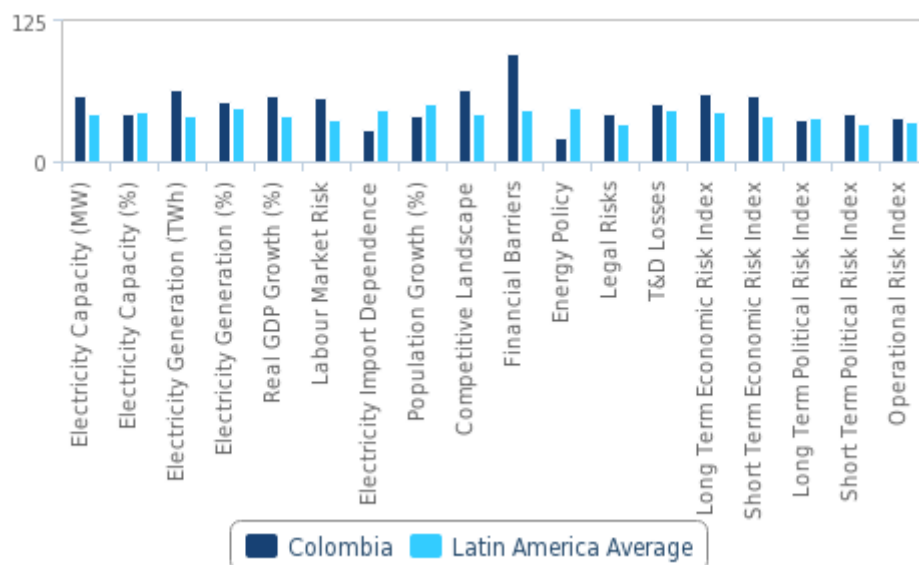
- Regional rank (out of 19): 6th
- Global rank (out of 117): 56th

### Key Features And Latest Updates

- Colombia significantly outscores Latin America's regional average in both the Risks and Rewards segments of our Risk/Reward Index.
- The relatively large size of Colombia's power sector coupled with robust growth in power generation boost the country's Industry Rewards score above that of both the global and the regional averages.
- The relatively low population growth rate and oversupply of electricity limits demand for investment in new power capacity, weighing somewhat on Colombia's overall Rewards score.
- The availability and low cost of finance on power projects in Colombia have contributed to higher levels of private sector participation in the market. These factors boost the country's scores on our Competitive Landscape and Financial Barriers sub-indicators; however, Colombia has been slow in implementing policy reform, weighing on its Industry Risks score.
- Colombia's growing economy and relatively strong economic fundamentals impact positively on its Country Risks score in our index; however, uncertainty over the country's political future under President Ivan Duque and the risk this poses to the FARC peace accord drags down its overall Country Risk score.

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RRI Matrix Breakdown  
Colombia & Latin America - Power RRI By Component



Note: Scores out of 100; higher scores = lower risks. Source: Fitch Solutions

# Market Overview

## Key Policies And Market Structure

### Regulation And Competition

Colombia has successfully implemented a wholesale electricity market which has been operating since 1995. Trade is carried out between generating companies, marketers and large consumers through medium-term bilateral contracts.

Since 2005 the energy transactions in the wholesale electricity market and the operation of the National Interconnected System (SIN) are managed by **XM**, a subsidiary of integrated utility **Interconexión Eléctrica** (ISA). XM also oversees and manages the energy derivative market and the fees associated with the use of the power grid.

Regulatory bodies overseeing the Colombian power sector include:

- The Mining and Energy Planning Unit (UPME), which is responsible for forecasting the overall energy requirements of the country and identifying ways to meet demand through the development of a reference expansion plan for the generation and transmission sectors.
- The Superintendence of Public Services, which supervises public service companies and can take control over electric utilities when their ability to provide their service is under question - including in cases of financial distress.
- The Commission for the Regulation of Energy and Gas (CREG) is an independent agency that establishes tariff structures for transmission and distribution companies, classifies which power consumers are subject to regulation and evaluates the efficiency of services provided.

The Colombian power sector includes a mixture of public and privately owned companies with more than 45% of generating capacity in private hands. Deregulation in the 1990s opened the sector to private investment and established a wholesale electricity market.

CREG maintains a division between generation, transmission and distribution activities to promote competition and to foster efficiencies, although it does allow some companies to continue with vertically integrated operations if they existed before the introduction of the electricity law in 1994. These companies are **Empresa de Energía del Pacífico** (EPSA), **Empresa de Energía de Bogotá** (EEB) and **Empresas Públicas de Medellín** (EPM).

The government has continued to reduce its stake in generating companies, most recently by selling its stake in utility **Isagen**.

### Sustainable Energy Policies

In August 2014, the Colombian government adopted a new renewable energy law (Law 1715) to mobilise investment in the country's nascent non-hydro renewables sector. The new legislation outlines plans to attract investment into the sector by offering a range of tax incentives to developers, opening up financing channels to provide funding for projects and tariff exemptions for imported renewable energy components.

In November 2015, the government published Decree 2143, which gives effect to Law 1715 and introduces tax incentives for renewable energy projects. The decree came into force in February 2016. The projects, using renewable energy sources, will benefit from four tax breaks: a 50% tax deduction on investment over five years, accelerated depreciation of assets, exemption of VAT on goods associated with the projects and exemption from import tariffs.

In March 2018, Colombia's energy and gas regulator, the Comisión de Regulación de Energía y Gas (CREG), pushed through the 030 Law. The law establishes regulations for small-scale solar power plants with a capacity less than 5MW to sell surplus electricity to the national grid. We expect that this regulation will result in an increased uptake of solar photovoltaic technology throughout the country and, to a lesser extent, contribute to the government's goal to diversify the country's power sector.

In August 2018, the Colombian Ministry of Mines and Energy (Ministerio de Minas y Energía) announced that it would hold the country's first large-scale renewable power auction in January 2019. This auction will offer public-private-partnership contracts on up to 1.5GW of solar, wind and biomass power projects of 10MW capacity or larger. The commercial operations deadline is set for December 2022. This development represents a key milestone in the development of non-hydropower renewables in the country, setting the precedent for future auction-style renewables investment which has proven successful in numerous markets globally.

## Pricing

Colombia has some of the highest energy prices in Latin America. While the country has significantly increased its electricity generation capacity in the last few years - and we forecast that it will continue to do so - Colombia's heavy reliance on hydropower (which we expect to continue over our 10-year forecast period) means prices are pushed markedly higher during dry weather conditions. For example, the fall in hydropower output caused by the El Niño weather phenomenon in late-2015 spiked Colombia's wholesale electricity prices in Q415, with prices rising to more than USD400/MWh from a historical average of approximately USD30-50/MWh.

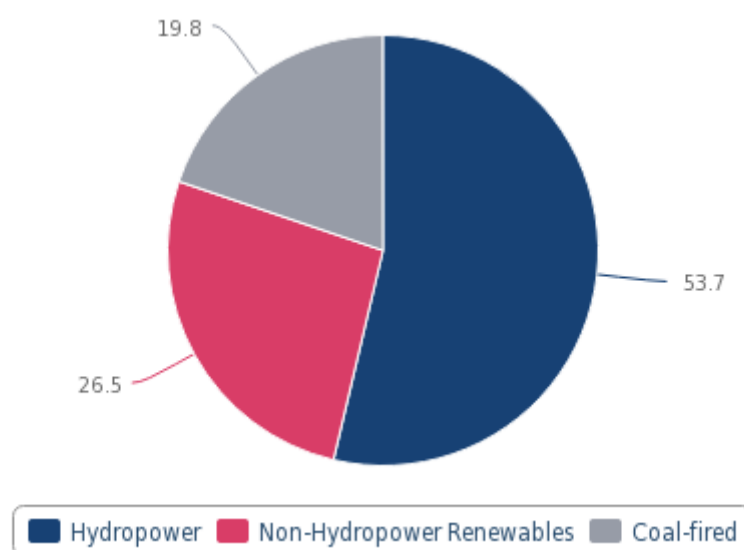
This problem is exacerbated by the pricing model set by the Energy Regulatory Commission. It sets a certain price level for electricity generation, transmission, distribution and marketing. On top of this, industrial users must also pay a 20% social contribution tax. The high costs are especially problematic for energy-intensive industries, such as cement and steel. Our Country Risk analysts believe the industrial sector will continue to struggle with the price of this input in the coming years. Moreover, one of the features of Colombia's electricity market is a system of subsidies, which sees more affluent end-users effectively subsidising the cost of electricity for those living in less affluent areas. Customers are classified into socioeconomic bands, and those in the lowest strata are eligible for subsidies. Those in Band I receive subsidies of up to 50% of their electricity tariff, those in Band II receive 40% subsidies and those in Band III receive subsidies of up to 15%.

To reduce power prices via an increase in competition in the power supply, CREG proposed the introduction of an annual energy auction scheme in August 2015 to encourage the entry of new generators in the market. At the time of writing, however, the proposal was still being discussed with the representatives of existing thermal power generators. One reservation is that such a scheme would reduce the reliability of the Colombian power system by penalising more expensive existing thermal power plants.

## Colombia Power Projects Database

Despite the risk that overdependence on hydropower poses in periods of drought like those brought on by El Niño, Colombia will continue to rely primarily on hydropower over the coming decade. Our view is reflected in our Key Projects Database (KPD) for Colombia, in which hydropower projects account for the majority of the total pipeline's capacity. We expect Colombia to bring three utility-scale hydropower plants online over the next 10 years: the 19.9MW San Andres run-of-river, and the 352MW Porvenir II and 2,400MW Ituango power plants.

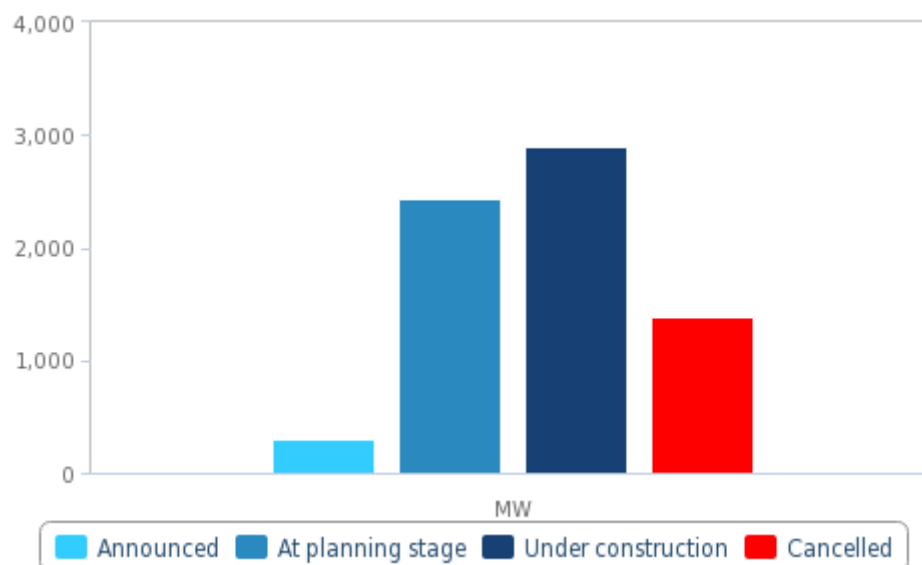
Heavy Dependence On Hydropower To Continue  
Colombia - Power Project Pipeline, Share Of Total By Technology (MW)



Source: Fitch Solutions

These three plants also account for the large amount of capacity currently marked as under construction or at planning stage in our KPD for Colombia. The country has a significant pipeline of non-hydropower renewable and hydropower projects at planning stages, underpinning our positive growth outlook for the market despite the current supply issues. The presence of cancelled projects in our KPD highlights the risk posed by popular opposition on social or environmental grounds to large-scale hydropower projects.

Large Project Pipeline Underpins Positive Growth Outlook  
Colombia - Power Project Pipeline By Stage Of Development (MW)



Source: Fitch Solutions

The relatively large number of non-hydro renewable projects equivalent to a cumulative capacity of 1,513.51MW in our KPD suggests Colombia has significant potential in the sector. However, most of the large-scale projects are at the preliminary stage of development, and the lack of traction in their implementation until now supports our view that Colombia's renewables sector will remain underdeveloped relative to its potential over the coming years. We note that the implementation of large-scale non-hydropower renewables auctions is set to begin from January 2019 which represents a significant step towards boosting the industry. As a result, we remain cautiously optimistic in terms of the prospect for sizeable non-hydropower renewables growth in Colombia over the next decade.



## COLOMBIA - MAJOR POWER PROJECTS

Project Name	Value (USDmn)	Size (MW)	Companies	Time Frame Start	Time Frame End	Status	Fuel Type	Fuel Type
Ituango Hydroelectric Dam Project, Cauca River, Antioquia	5,000+	2,400	Inter-American Development Bank[Financier] {United States}, KfW IPEX-Bank [Financier] {Germany}, Alstom[Equipment] {France}, Coninsa & Ramon H and Construccin CF[Construction] {Colombia}, Ferrovial Agroman[Construction]{Spain}, Empresas Publicas de Medellin[Operator]{Colombia}, Sainc Ingenieros Constructores [Construction]{Colombia}, Camargo Correa [Construction] {Brazil}	2011	2020-2023	Under construction	August 2018: reparation, boring and assessment works underway.	Hydropower
La Luna Ultra-Supercritical Power Plant, El Paso, Cesar	1,600	1,125	Sloane Energy Group[Owner] {United Kingdom}	2019	2023	At planning stage	October 2018: plans announced in July, three units of 375MW each will be constructed in two phases (1 = 750MW, 2 = 375MW) next to Sloane's coal mine. EPC contracts expected to be awarded before the end of 2018 and financial close expected in early 2019.	Coal-fired
Celsia Camelias Wind Farm, Uribia	na	250	Celsia[Operator]{Colombia}	na	na	Under Construction	July 2018: project underway.	Non-hydropower renewables

Project Name	Value (USDmn)	Size (MW)	Companies	Time Frame Start	Time Frame End	Status	Fuel Type	Fuel Type
Parque Eolico Windpeshi, Maicao, La Guajira	313	200	Enel Green Power[Operator] {Italy}	na	2020	Announced	October 2018: project awaiting approval.	Non-hydropower renewables
Carrizal Wind Project, La Guajira	305	195	Jemeiwaa Ka I[Operator] {Colombia}	na	na	At planning stage	June 2015: economic feasibility yet to be undergone; environmental authority to carry out an impact study soon; prior consultations have to be carried out in order to progress the construction.	Non-hydropower renewables
Casa Electrica Wind Project, La Guajira	na	180	Jemeiwaa Ka I[Operator] {Colombia}	na	na	At planning stage	June 2015: economic feasibility yet to be undergone; environmental authority to carry out an impact study soon; prior consultations have to be carried out in order to progress the construction.	Non-hydropower renewables
Piedra Del Sol Hydroelectric Plant, Santander	na	153	ISAGEN[Operator]{Colombia}	na	na	At planning stage	July 2018: ANLA rejected appeal for a construction license on environmental grounds after first rejection of license application in	Hydropower

Project Name	Value (USDmn)	Size (MW)	Companies	Time Frame Start	Time Frame End	Status	Fuel Type	Fuel Type
Miel II Hydroelectric Plant Expansion Project, Caldas	250	120	Caldas Department of Colombia [owner] {Colombia}	2019	2022	At planning stage	2016. July 2018: the Caldas Department is expanding its run-of-river Miel Hydroelectric Dam in a 36-month second phase.	Hydropower
Parque Eolico Egpurraichi-Chemesky	na	100	Enel Green Power [Operator] {Italy}	na	na	Announced	July 2018: Enel Green Power is planning to build a 100MW wind-power station in Uribe municipality, La Guajira department. Project includes 220kV transmission lines.	Non-hydropower renewables
Irraipa Wind Project, La Guajira	na	99	Jemeiwaa Ka I [Operator] {Colombia}	na	na	At planning stage	June 2015: economic feasibility yet to be undergone; environmental authority to carry out an impact study soon; prior consultations have to be carried out in order to progress the construction.	Non-hydropower renewables

Note: Top 10 projects by capacity. na = not available. Source: Fitch Solutions

## Competitive Landscape

The Colombian electricity sector contains a mixture of public and privately owned companies. Deregulation in the 1990s opened the sector to private investment and established a wholesale electricity market. A push towards the development of the country's non-hydroelectric power capacity has attracted new investment in wind and solar power projects, as well as the transmission infrastructure needed to support the development thereof.

The Colombian Commission for the Regulation of Energy and Gas (CREG) largely maintains a strict division between generation, transmission and distribution activities - although it does allow some legacy companies to maintain vertically integrated operations. In the generation sector, the major players are **Emgesa** (controlled by Italy-based power group **Enel**), **Empresas Públicas de Medellín** (EPM), **Isagen** and **EPSA**. Emgesa is the largest, controlling about 3,469MW of capacity in Colombia.

The largest electricity distributing company in Colombia is **Codensa** which serves more than 1mn customers in Bogotá and the surrounding areas. There are 11 transmission companies and 32 distributors of electricity in total. While many companies own different parts of the grid, the largest holder is **Interconexión Eléctrica** (ISA) which controls about 70% of the system. It was formerly wholly owned by the government which has reduced its stake to 51%; the rest is held by private investors.

As part of its liberalisation plans, the government has continued to reduce its stake in generating companies, most recently by selling its 57.7% stake in Isagen.

### Emgesa

Emgesa is the local subsidiary of Chile-based utility **Enerdis** which is owned by Italy-based power group Enel. Emgesa owns 3,509MW of operating power plants (12 hydropower and two thermal). The company has reportedly earmarked USD1bn for investment in Colombia until 2020.

### Interconexión Eléctrica

ISA's affiliate **XM** operates the National Interconnected System (SIN) and administers MEM, the wholesale electricity market. ISA is the only transmission operator with national coverage. Its controlling shareholder is the government with 51.41% participation. The private sector controls 38.42%, and the remaining shares are controlled by other state investors. With over 12,000km of circuit infrastructure, ISA owns more than 70% of the National Transmission System. ISA also administers and maintains international interconnections with neighbouring countries Ecuador and Venezuela.

### Empresas Públicas De Medellín

Empresas Públicas De Medellín (EPM) is a public company owned by the city of Medellín. It provides electricity, drinking water, sanitation and a gas network to the municipalities where it operates. The company is currently building a large-scale hydroelectric facility in Ituango (near Medellín) which is scheduled to begin operations in two phases between 2020 AND 2024. EPM also holds a 10.166% share in ISA.

## Isagen

Established in May 1995, Isagen is Colombia's third largest generator. The company operates seven power generation plants and has a total installed capacity of 3,032MW - 2,732 MW being hydropower and 300MW thermal. The company generates about 23% of the electricity used in Colombia. More than 80% of the company's generation is sold under long-term contracts with distribution companies and industrial customers.

In January 2016, the government sold its 57.6% stake in the company for USD2bn to **Brookfield Colombia Investments LP**, a subsidiary of Canada-based investment fund **Brookfield Asset Management**. Brookfield Colombia Investments was the only bidder in a public auction and agreed to pay about USD1.38 per share for a majority stake in Isagen. The price matched the minimum set by the Colombian government.

## Codensa

Codensa is responsible for the distribution and commercialisation of electrical power in Bogotá and in the 96 municipalities of Cundinamarca. The company has both public capital (**Empresa de Energía de Bogotá**, EEB) and foreign private capital (Endesa, Enersis and **Chilectra**) which represents nearly 50% of the company's capital. Codensa is Colombia's largest power distribution company, handling 22% of total domestic demand.

## Empresa De Energía De Bogotá

Empresa De Energía De Bogotá (EEB) is a stock company incorporated as a jointly owned public-utility company. Its core businesses are electricity transmission and investment portfolio management. It is currently the second largest electricity transmission company in Colombia and its market share is 12.5%. At the time of writing, EEB has 1,504km of lines and assets as well as 17 substations.

## Company Profile

### Interconexión Eléctrica SA

#### SWOT Analysis

<b>Strengths</b>	<ul style="list-style-type: none"> <li>• Dominant transmission portfolio.</li> <li>• Regional diversification.</li> <li>• Stock exchange listing.</li> </ul>
<b>Weaknesses</b>	<ul style="list-style-type: none"> <li>• Lacking integration.</li> </ul>
<b>Opportunities</b>	<ul style="list-style-type: none"> <li>• Expansion of domestic market.</li> <li>• Further diversification in Central America, Mexico and South America.</li> </ul>
<b>Threats</b>	<ul style="list-style-type: none"> <li>• Limitations of national energy policy (majority state-owned).</li> </ul>

#### Company Overview

ISA operates in Colombia, Brazil, Peru, Bolivia and Central America. Through its affiliates and subsidiaries, it works in the design, construction, administration and operation of linear infrastructure systems in the fields of electricity and the telecommunications connectivity.

In the electricity sector, ISA controls the following companies: TRANSELCA and XM-Compañía de Expertos en Mercados in Colombia; ISA Perú, Red de Energía del Perú, TransMantaro and Proyectos de Infraestructura del Perú in Perú; ISA Bolivia; Compañía Interligação Elétrica Norte e Nordeste; and the subsidiaries CTEEP and Interligação Elétrica Pinheiros in Brazil.

ISA is Latin America's largest energy transmitter, operating more than 41,885km of high-voltage circuits for energy transmission, and having access to over 48,886km of fibre-optic cables in Latin America. It operates and maintains a high-voltage transmission network in Colombia, Peru, Bolivia Brazil and Chile as well as international interconnections between Venezuela and Colombia, Colombia and Ecuador, and Ecuador and Peru.

With a 12,135km circuit infrastructure, ISA owns over 70% of the National Transmission System. ISA offers market agents energy transport services through the National Transmission System and connection to the National Interconnected System (SIN) for energy trading. It also manages the interconnection of regional power transport systems.

#### Strategy

ISA's strategy includes the strengthening of infrastructure assets, the expansion of the transmission system to meet growing power demand and supply, the development of transmission assets linking regional countries and within regional countries, diversification into related forms of transport, and strengthening its position in neighbouring Latin American markets.

We believe ISA is well positioned to take advantage of the significant investment opportunities offered by the expanding Peruvian power transmission sector. ISA has also expressed interest in entering the Mexican power sector, which is currently undergoing a process of unbundling and liberalisation. In light of our positive outlook for the Mexican electricity market, we believe such a move would be positive for ISA's future growth.

In Brazil, the companies in which ISA subsidiary CTEEP has a shareholding operate almost 5,000km of circuits and 11,000 megavolt-

amperes of transformer capacity. In May 2017, CTEEP exercised its preferential right for the acquisition of the entire stake of Interligação Elétrica Norte and Nordeste, a public service concessionaire for the energy transmission, with the main objective of integrating the SIN and to increase the energy interconnection capacity between the north and the north east. This concession comprises 500kV transmission lines, with a total of 720km, and expires in 2038.

ISA has an 11.11% share in the Empresa Propietaria Red, which operates the Electric Interconnection System for Central American Countries. This system comprises a transmission line of 1,800km used by the Regional Electricity Market.

According to its December 2017 Integrated Management Report, the ISA reached and surpassed its 2020 target to triple turnover. The corporation generated 5.3 times its 2012 turnover, reaching a net income of COP1.4tn (USD462mn). The same year, ISA purchased 75% of Brazilian transmission services concessionaire Interligação Elétrica Norte e Nordeste in a BRL101.6mn (USD32mn), as well as 41.6% shares of the control block of Transmisora Aliança de Energia Eletrica (TAESA) at USD309mn.



## Regional Overview

### Latin America Renewables: Three Markets To Watch

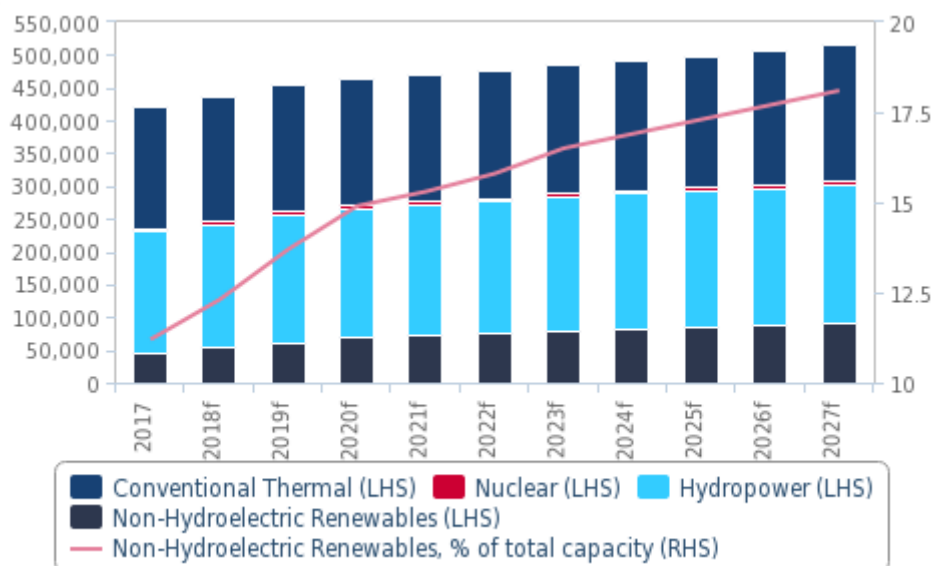
#### Key View

- Non-hydropower renewables' installed capacity will almost double in Latin America over the next 10 years, with supportive policies, such as long-term energy auctions, driving growth across the region.
- Opportunities and risks for renewables sector investors will be spread unequally across Latin America, depending on industry, political and economic trends.
- We highlight Colombia, Argentina and Brazil as markets to watch over the coming quarters because of the opportunities and risks they will present.

**We hold a positive growth outlook for Latin America's non-hydropower renewables sector.** As we have long maintained, renewables - and particularly wind and solar projects - will be a core growth driver of the region's electricity sector, from Mexico down to Chile, over the coming decade (see '*LatAm Renewables: Key Trends & Markets To Watch*', March 12).

We forecast that installed non-hydro renewables capacity will expand from 53.7GW in 2018 to 93.1GW by 2027. This growth will mean that the share of non-hydro renewables in the aggregate regional power generation mix will rise from 10.8% in 2018 to 14.1% by the end of our 10-year forecast period. Renewables' share of Latin America's total installed power capacity will grow from 12.3% to 18.1% over the same period.

Renewables To See Significant Growth In Latin America  
Latin America - Installed Power Capacity By Sector (MW) & Renewables Share Of Total Capacity (%)



e/f = Fitch Solutions estimate/forecast. Source: EIA, National Sources, Fitch Solutions

Rapidly growing energy needs, supportive government policies such as long-term energy auctions, and a favourable natural environment for the development of every type of non-hydro renewables projects, all support our view that Latin America will offer significant business opportunities for renewables investors. These opportunities, however, will be unequally concentrated across the region, due primarily to political and economic idiosyncrasies.

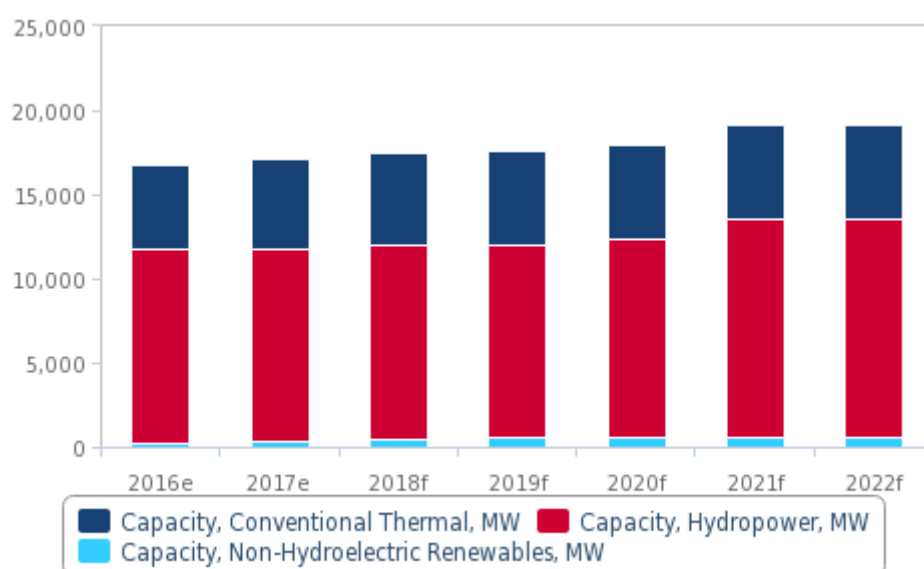
We highlight below a number of countries that over the coming quarters will be of particular interest to renewables industry players, and provide our views for these markets:

- **Colombia - Power auction in 2019 could kick-start industry growth:**

With a power sector almost exclusively reliant on hydropower and thermal power generation, Colombia has been a laggard for non-hydro renewables development in Latin America. The market could however offer opportunities over the coming months, as the government plans to hold an auction to award power purchase agreements (PPAs) to wind, solar and biomass projects on January 2 2019. According to the information released so far by Colombia's energy and mining planning agency (Unidad de Planeación Minero Energética, UPME), the auction will award PPAs to projects with at least 10MW of capacity, for up to 1.5GW of total capacity. Winners in the auction will obtain 10-year PPAs and will have to start supplying power on December 1 2022.

Slow progress on previous government initiatives for the renewables sector suggests caution towards this new development, explaining our currently conservative forecast for the Colombian renewables sector (see '*Renewables: Bearish Short-Term Outlook, Notable Long-Term Potential*', April 3 2017). That said, the fact that the government is taking concrete steps towards holding the auction creates upside risk to our forecast for the market.

2019 Auction Poses Upside Risk For Renewables  
Colombia - Installed Power Capacity By Sector, MW



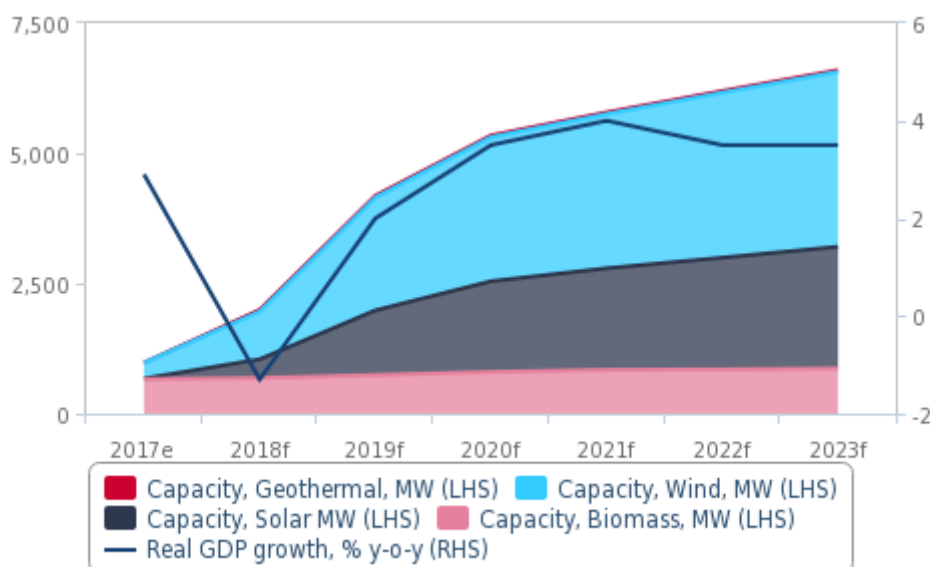
e/f = Fitch Solutions estimate/forecast. Source: EIA, National Sources, Fitch Solutions

- **Argentina - Economic headwinds undermined significant potential:**

Years of underinvestment in the power infrastructure, coupled with rising energy needs and favourable natural resources, make Argentina a potential outperformer for renewables growth in Latin America. Indeed, when the reforms adopted by the Macri government in 2016 seemed to open the way for fast economic growth and strengthening investor sentiment, we highlighted Argentina as a hot-spot for renewables business opportunities (see '*Strong Power Potential Despite Small RRI Deterioration*', March 14). Nevertheless, the currency sell-offs that have repeatedly affected Argentina since April 2018 have made the outlook for investment in the market much less attractive. Argentina now has sky-high interest rates and a very elevated inflation rate, and we expect the economy to contract in 2018 before likely returning to growth in 2019 (see '*Q&A: Argentina Crisis Resets Economic Outlook*', September 21).

In light of the structural strengths of the Argentine renewables sector, we maintain that the country will offer long-term opportunities for risk-tolerant investors. However, we have revised down our growth forecast for the market since the government has announced that it will not hold a new power auction in 2018 and 2019 amid the economic issues mentioned above. Renewables growth is likely to remain below the targets set by the government until the Argentine macroeconomic context improves and investor sentiment towards the market recovers.

Economic Crisis Weighs On Renewables Growth Outlook  
Argentina - Renewables Capacity By Sector And Real GDP Growth



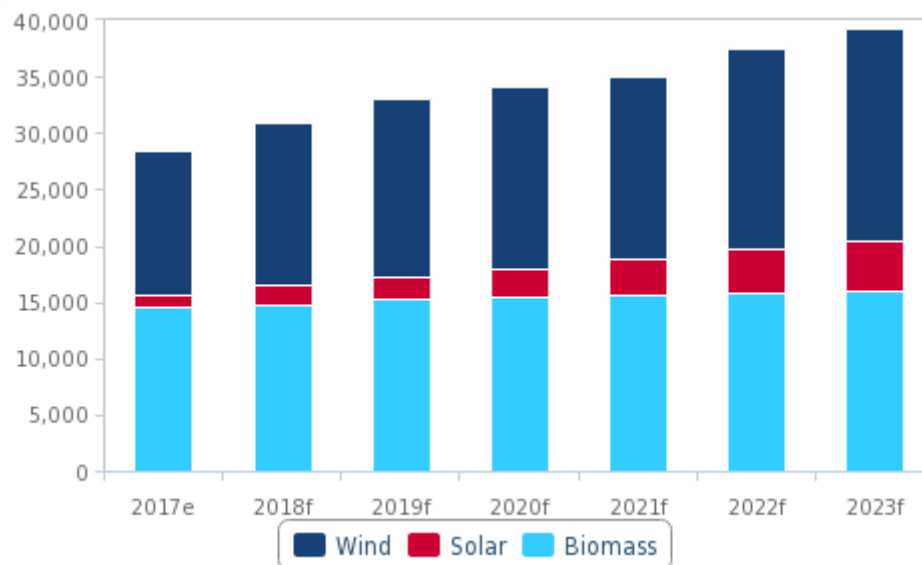
e/f = Fitch Solutions estimate/forecast. Source: EIA, National Sources, Fitch Solutions

#### • Brazil - Power auctions to continue under likely Bolsonaro presidency

Brazil will hold the second round of its presidential election on October 28 2018. The new president is set to affect the country's renewables industry via the impact that the election will have on Brazil's economic growth, as well as on investor sentiment towards the market (see '*Brazil Election Primer: Eletrobras Privatisation And Power Auctions In Focus*', September 18). How the economy performs over the next four years will be crucial in guiding the number and size of auctions that the government holds to contract future power supply - by extension impacting renewables growth prospects. Steady growth in power demand is needed for holding auctions on a regular basis, and the stronger the country's economic growth, the faster power consumption is likely to rise. Auctions have been a key driver of renewables' growth in Brazil, with total non-hydro renewables installed capacity expected to reach 30.9GW by the end of 2018.

Our Country Risk team's core view is that right-wing populist Jair Bolsonaro will win the election, after he obtained 46.0% of the valid vote in the first round on October 8 (see '*Brazil Elections: Bolsonaro Set For Second-Round Win*', October 9). Under this scenario - to which we attach a 70% probability - we expect the Brazilian economy to rebound in 2019, boosting power consumption and ensuring that energy auctions continue to be held. This would be supportive for renewables growth. That said, we believe that a Bolsonaro presidency will do little to foster economic growth in Brazil over a multi-year perspective, as he is likely to under-deliver on the structural reforms that the economy needs to grow faster.

Auctions Would Keep Driving Renewables Growth Under Bolsonaro  
Brazil - Non-Hydropower Renewables By Type, MW



e/f = Fitch Solutions estimate/forecast. Source: EIA, MME, EPE, Fitch Solutions

We see greater risk to Brazil's power demand and investor sentiment under our alternative presidential election scenario. A victory by a leftist candidate Fernando Haddad would trigger a drop in financial markets and business sentiment, which would likely push the economy back into recession heading into 2019. A slow-down in industrial and commercial activity would cut power demand growth and potentially reduce the government's need to hold new power auctions for some time.

That said, if a curtailment to power auctions were to occur, it would be only temporary. Over a multi-year period, market pressures and the constraint of a weak Congressional coalition would likely lead the administration to pursue a more pragmatic agenda than what was announced during the electoral campaign. As a result, investor sentiment would bottom out and economic activity would begin to recover. Nevertheless, lack of structural reforms would limit long-term investment and economic growth, creating downside risk to our current forecasts for Brazil's economic activity and power consumption growth - which are based on our core election scenario.

## Power Glossary

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

## Power Methodology

### Industry Forecast Methodology

**Fitch Solutions'** 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.

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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. **Fitch Solutions** selects the best model according to various different criteria and tests, including but not exclusive to:

- R2 tests explanatory power; adjusted R2 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.

**Fitch Solutions'** 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

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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.

**Fitch Solutions'** 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, as well as data from the EIA and IRENA. 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

**Fitch Solutions** 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

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well as local energy ministries, officially released company figures, national and international bodies and associations and news agencies.



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