

SAARC Dissemination Workshop for the Study on "SAARC Energy Outlook 2030"

Presentation 1: SAARC Energy Outlook 2030: Introduction

Presenter: CRISIL Research

Scope of the report

Terms of reference of the study:

- Country-wise profiling, detailing factors impacting the energy sector:
 - Population, GDP, industrial activity, and availability of energy sources
 - Overview of the existing regulatory and policy framework in the energy sector
 - Overview of the existing energy mix and assessment of end-use sectors driving demand
- Existing cross-border energy trade (global and intra-SMSs, including SAARC framework agreement for energy co-operation)
- Development of energy outlook until 2030
 - Country-wise assessment of key factors expected to drive energy demand, including:
 - Macro-economic indicators (GDP, population growth, per capita income, etc.)
 - Growth of end-use industry (transportation, power generation)
 - Country-wise assessment of demand, supply growth and deficit/surplus scenario
 - Assess the requirement for future cross-border energy trade

Approach and Methodology

5-step framework towards energy outlook 2030



Data collection

Annual government data, energy reports for multilateral funding agencies, press releases



Long-term demographic and economic trends

Economic and demographic forecasts and impact on energy requirement due to impending changes



Sector deep dives: Power, residential, industrial, transport

Demand outlooks and forecasts, underlying factors leading to change



Fuel supply outlook

Domestic production and import of fuels, changing fuel mix owing to supply constraints, price rises, government policies



Recalibrating unconstrained demand in line with fuel supplies

Changing fuel mix, matching demand with constrained supply



Data-driven bottom-up and top-down approach, to derive demand and supply outlook of SAARC member-states until 2030



Energy Outlook of SAARC Member States (SMS)

Primary Energy Consumption in SMS: Review and Outlook

Country	Total Primary Energy in 2012/ FY13 (MTOE)	Total Primary Energy in 2017/ FY18 (MTOE)	Total Primary Energy in 2023/ FY24 (MTOE)	Total Primary Energy in 2030/ FY30 (MTOE)
Afghanistan	5.7	4.3	6.7	9.3
Bangladesh	25.7	37.5	60.6	85.3
Bhutan	0.6	0.7	0.9	1.5
India	651.2	816.8	1,102.7	1,391.3
Maldives	0.4	0.5	0.8	1.2
Nepal	10.0	13.5	16.3	21.2
Pakistan	57.7	74.6	108.6	147.3
Sri Lanka	9.6	11.4	12.9	16.2
Total	760.9	959.3	1,309.5	1,590.5

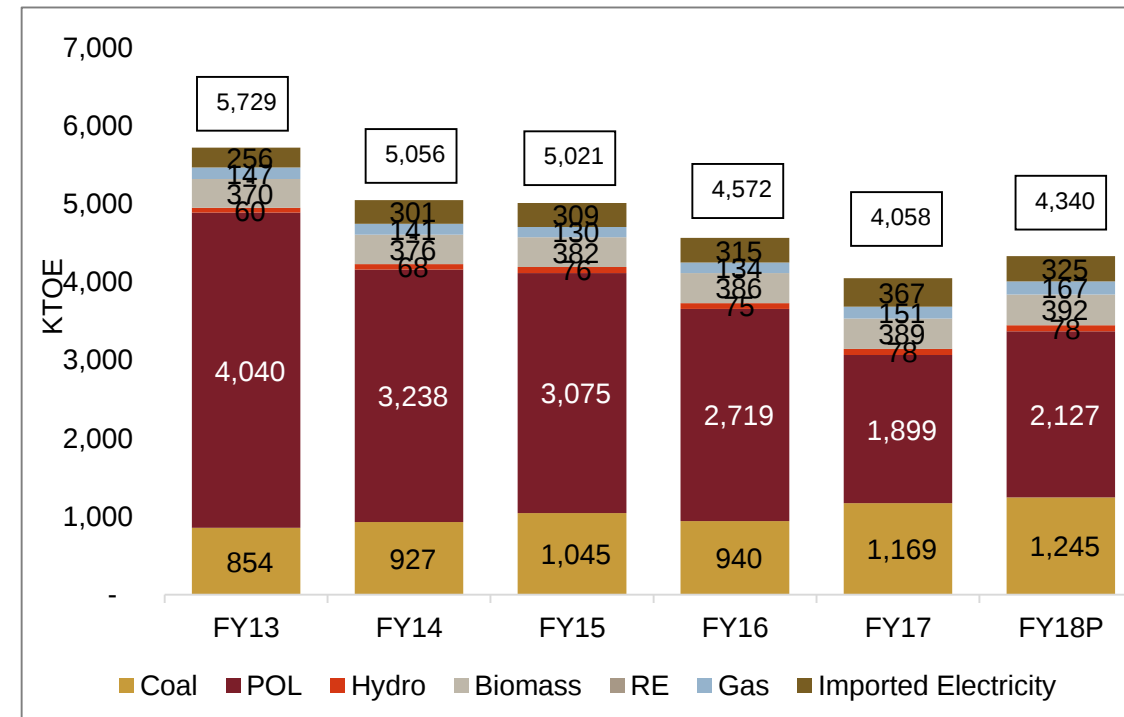
Afghanistan: Introduction

COUNTRY OVERVIEW

- Afghanistan development has been hindered by years of armed conflict and war;
- With a per capita income of \$1,824, the country is amongst the lowest in the world;
- Increasing political stability and international aid flowing in to revive the war-ravaged nation, economic growth is expected to rebound.

ENERGY SECTOR OVERVIEW

- Primary energy consumption in Afghanistan is low. More than 75% of power and 100% of POL requirements are imported
- Lack of access to affordable energy has resulted in high usage of biomass as primary energy (~9% as of fiscal 2018)
- Despite high gas and coal deposits and large RE potential, the country's electrification rate is low and a majority of population lack access to energy
- Primary energy consumption in the country has reduced from 5.73 MTOE in fiscal 2013 to 4.34 MTOE in fiscal 2018 at CAGR of 5%, owing to sizeable fluctuation in POL demand, led by changing demand from the government and coalition forces.



Afghanistan: Power Demand-Supply Position

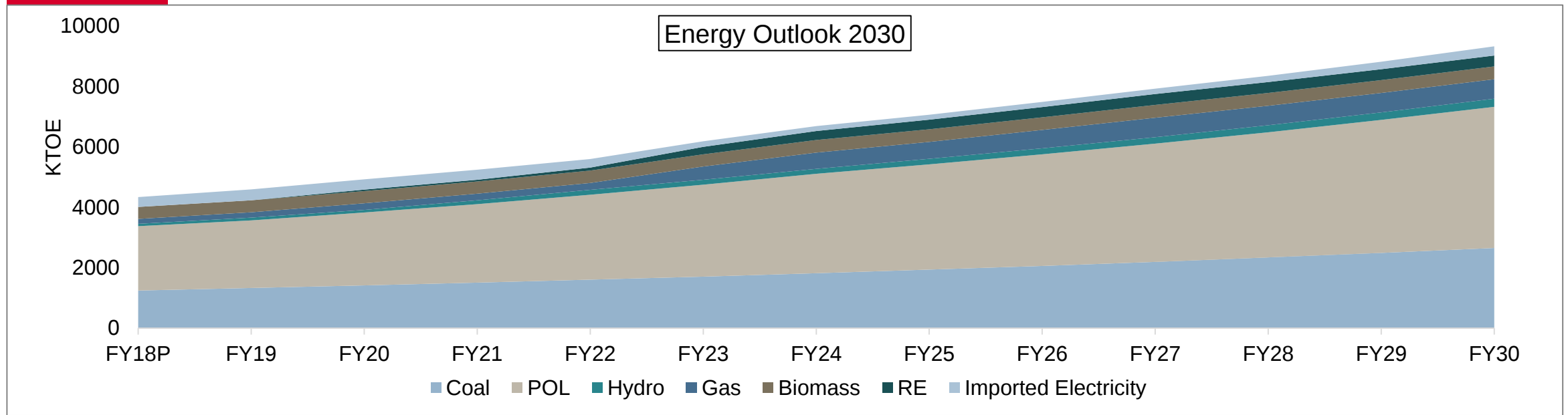
POWER DEMAND SUPPLY REVIEW

- Only ~9% of the rural population and 30% of the urban population have access to electricity
- Constrained demand has grown from 3,953 MUs in fiscal 2013 to 4,981 MUs in fiscal 2018, at CAGR of 8.9%.
- As much as ~80% of total power requirement is imported from Central Asian republics (CARs), such as Tajikistan, Uzbekistan and Turkmenistan, and Iran. As of fiscal 2018, imports from Tajikistan and Uzbekistan comprised 27% and 23% of total power requirement.
- Domestic power plants, with a cumulative capacity of ~623 MW installed in the country, generated 1,076 MUs in fiscal 2018.
- There are at present 14 Hydro Power Plants (HPPs), 14 diesel power plants, and two oil-based plants operating in the country. Hydropower accounted for ~86% of total power produced in the country in fiscal 2018.

POWER DEMAND SUPPLY OUTLOOK

- Gross demand is expected to grow to ~11,028 GWH in 2030. Grid electrification levels are expected to reach ~52% by fiscal 2030, from current levels of 35%, thereby bringing an additional 1.15 million households onto the power grid.
- Installed capacity in the country is expected to reach 2,377 MW by fiscal 2030, thereby increasing domestic power generation to 5,020 MU from current levels of 1,076 MU.
- Reliance on imports will continue throughout the period, albeit to a lower extent. The transmission line network is expected to expand with additional interconnections and cross-border infrastructure
- 15 HPP, eight solar power plants, and three wind power projects are expected to come up by fiscal 2030. Also, new gas-based plants at Mazar-i-Sharif and Sheberghan are expected to be set up in fiscals 2020 and 2022, respectively, which will utilise domestic gas.

Afghanistan: Energy Outlook 2030



- Overall energy requirement in Afghanistan shall rise from 4,340 KTOE in fiscal 2018 to 9,324 KTOE in fiscal 2030
- **Hydro** to remain the major contributor in power generation; its contribution expected to rise 3.4 times by fiscal 2030
- Electrification expected to reach ~52% by fiscal 2030 from 35% now, thereby improving primary energy usage
- **Gas** usage to rise as ~650 MW gas-based power plants are expected to be set up
- **Coal** usage to increase as additional 2,000-3,000 tonne per day (TPD) of cement capacities come on stream
- End-use LPG demand and transport sector growth to result in strong **POL** growth of ~7.2% CAGR
- Consumption of **biomass**, which is used extensively by households, for heating and cooking will continue to rise due to strong rural usage as power supply is intermittent

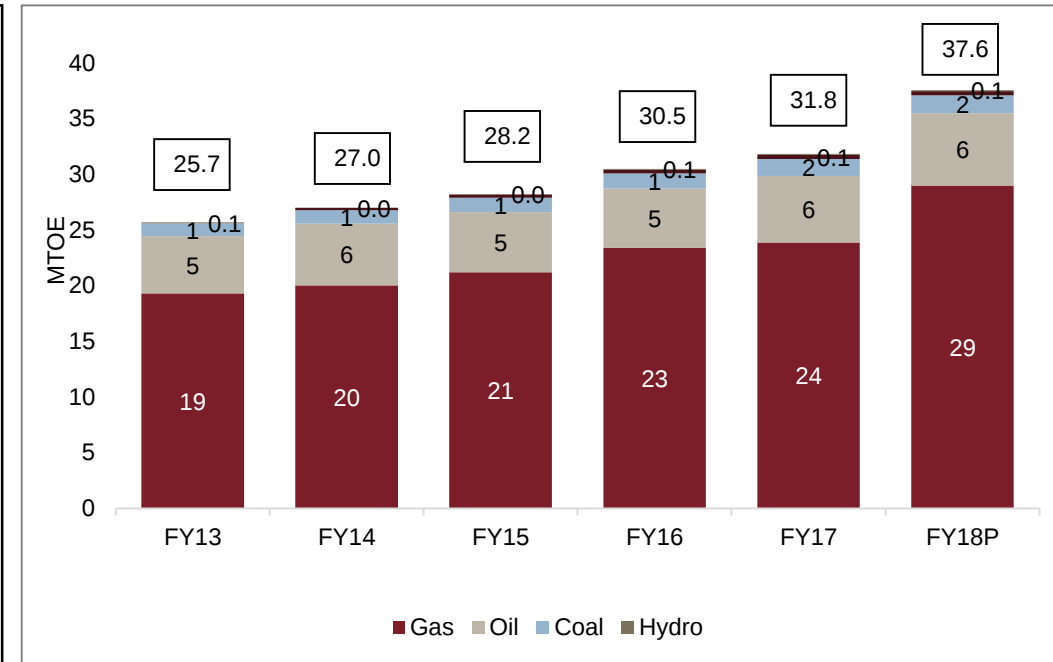
Bangladesh: Introduction

COUNTRY OVERVIEW

- Bangladesh is one of the fastest-growing economies in South Asia, clocking a CAGR of 6.6% fiscal 2013 onwards.
- The government aims to achieve the status of a middle-income country by 2021 and a high-income country by 2041, which means the country would need to achieve consistent economic growth, poverty eradication, infrastructure development and energy security.

ENERGY SECTOR OVERVIEW

- Rapid urbanisation and social development have steadily increased energy demand in Bangladesh.
- Through long-term power generation plans and power system master plan 2016, the country is planning capacity additions and fuel diversification.
- Gas, which constitutes around two-third of the nation's primary energy, is facing depletion. Efforts have been put in place to enhance domestic gas production in addition to installing LNG terminals for augmenting gas imports.
- The country is implementing a massive electrification program to bring every household into the grid.
- Overall, the nation's primary energy demand has grown from 25.7 MTOE in fiscal 2013 to 37.6 MTOE (provisional) in fiscal 2018 at a CAGR of 7.4%.



Bangladesh: Power Demand-Supply Position

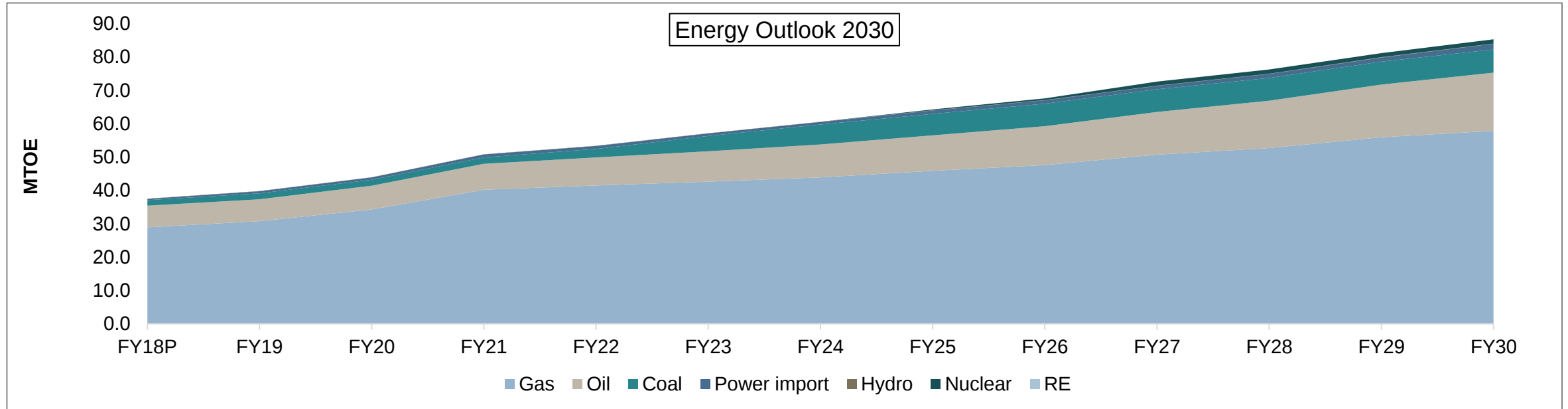
POWER DEMAND SUPPLY REVIEW

- Gross power demand has grown from 37,441 MU in fiscal 2013 to 64,990 MU in fiscal 2018 at a CAGR of 11.7%.
- With the government's thrust and sound monitoring, more than 72% of rural areas have already been added to the electricity grid. Under the 'upazila-wise 100% electrification' programme, the REB aims to provide 100% electricity to 460 upazilas under its jurisdiction by 2021.
- The total installed capacity in the country as of fiscal 2018 stands at 15,559 MW, of which BPDB holds the highest ownership (~5300 MW).
- More than 70% of the gross power generation is from gas-based plants with thermal (coal + oil)-based power accounting for only 20% of the total. The total gross energy generation in fiscal 2018 was 62,925 GWH (provisional), ~9.8% higher than the previous year.
- Around 4,656 GWH of power was imported from India by connecting Bheramara and Tripura.

POWER DEMAND SUPPLY OUTLOOK

- The power demand will continue to show strong growth until 2022 as the country is expected to be 100% electrified by then, in line with the government's 'Electricity for all by 2021' vision.
- Gross power demand is expected to reach 95.88 billion units in fiscal 2024 and 123.9 BUs in fiscal 2030 growing at a CAGR of 5.5%.
- On the supply side, majority of the additions will be coal-fired plants (~6,000 MW) with at least eight new projects in the pipeline.
- With domestic gas production expected to deplete, new LNG-based plants will come up, taking power generation from LNG to ~11% of the total power mix.
- Gross electricity generation from domestic sources is expected to reach 79.8 BUs in fiscal 2024 and 101.2 BUs in fiscal 2030 with the remainder expected to be imported from neighboring countries such as India, Bhutan and Myanmar.

Bangladesh: Energy Outlook 2030



- Overall energy requirement in the country shall rise from 37.6 MTOE in fiscal 2018 to 85.3 MTOE in fiscal 2030.
- **Gas**, which accounts for about two-thirds of the primary energy consumption in fiscal 2018, to remain the mainstay going forward; depleting domestic production to be substituted through LNG imports.
- **Coal** usage will grow manifold to ~12 million tonne by fiscal 2030 owing to massive buildup of coal-fired thermal plants in the country (~6,000 MW).
- Increased transportation activity to boost **POL** demand by a healthy 6.4%.
- **Renewable energy (RE)** usage to remain small; no new large-scale hydro projects planned; distributed solar and wind power projects negligible.

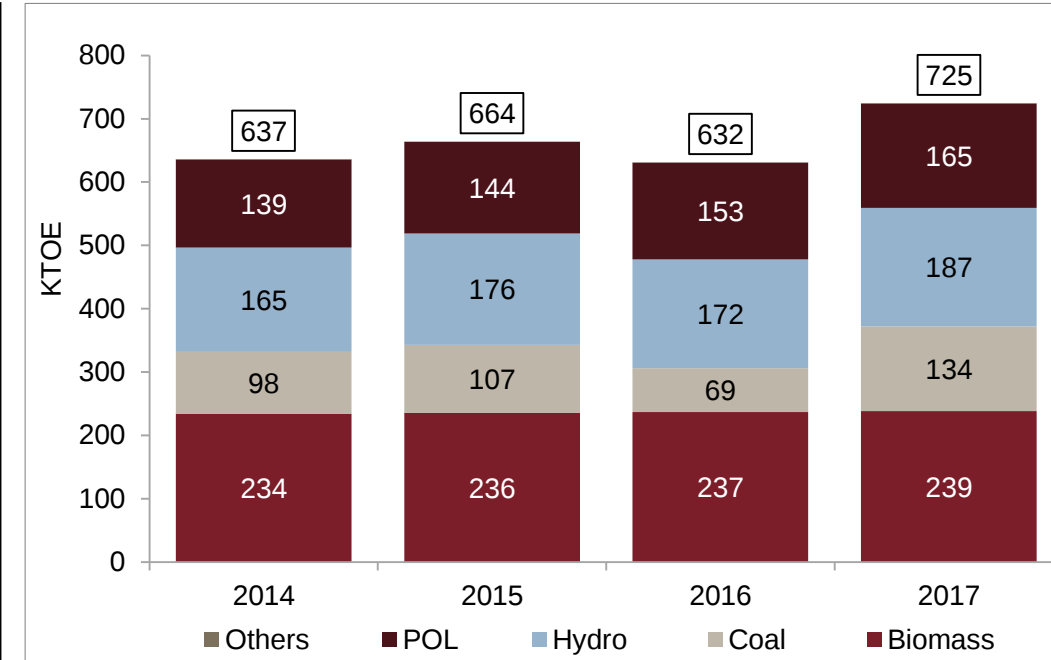
Bhutan: Introduction

COUNTRY OVERVIEW

- The Kingdom of Bhutan, a small landlocked country between China and India, spreads over 38,394 square km, of which approximately 70% is covered with forests.
- Bhutan's GDP over the past has grown at ~6% CAGR from 2012 to 2017 led primarily by investments in construction, mining and quarrying. In 2016, agriculture, construction, electricity and water supply and manufacturing accounted for more than 50% in the GDP of the country.

ENERGY SECTOR OVERVIEW

- Bhutan's overall energy consumption grew steadily at ~4.6% CAGR from 2005 to 2014 after which the growth slowed down marginally to ~4.4% CAGR from 2014 until 2017.
- Overall primary energy consumption of Bhutan was ~725 KTOE in 2017 with building (including residential consumption) and industrial sectors cumulatively accounting for ~79% of it. The balance 21% was consumed mainly by the transport sector.
- Biomass, primarily fuel wood, forms the major source of primary energy.
- Hydropower is the main resource of electricity, which is mostly consumed by the industrial and building sectors.
- The country also imports petroleum oil products, mostly from India, which is used by all the sectors of the economy



Bhutan: Power Demand-Supply Position

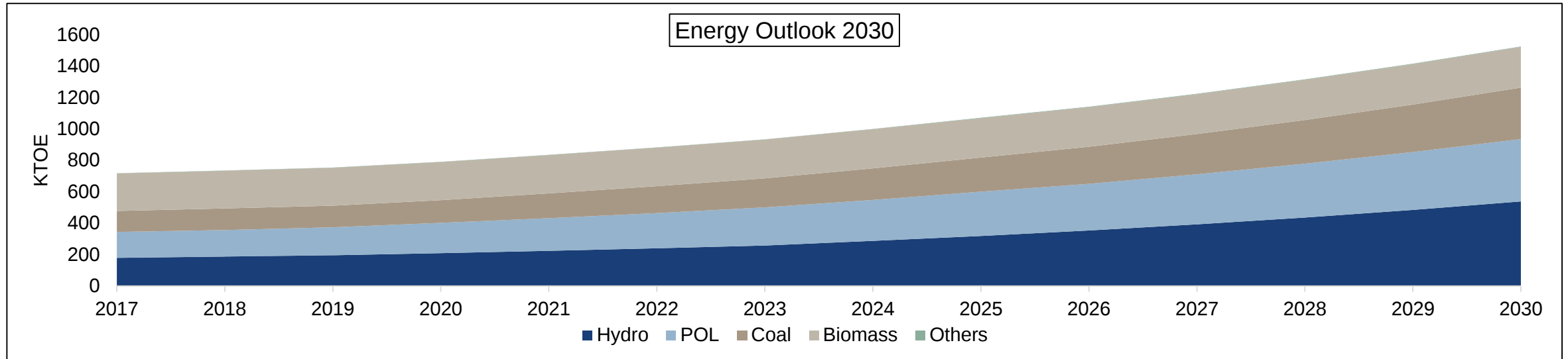
POWER DEMAND SUPPLY REVIEW

- Overall power demand from the industrial, building and other sectors rose at a slower ~2.9% CAGR from 2014 to 2017. Power demand in Bhutan was ~2,186 MUs in 2017.
- The industrial sector is the single-largest consumer of electricity, accounting for ~78% of total power demand, followed by the building sector at ~20% share, and remaining being consumed by the agriculture sector and other areas.
- Bhutan had total installed capacity of ~1,623 MW in 2017, with hydro capacity constituting ~99% share
- Overall, the country's power capacity has increased only ~124.8 MW from 2014 to 2017, with the commissioning of 126 MW Dagachhu hydro power plant and slight reduction in diesel generator capacity.
- In 2017, Bhutan net exports were ~70% of the total electricity produced.

POWER DEMAND SUPPLY OUTLOOK

- Overall power demand is expected to increase at ~8.8% CAGR, from 2,186 MUs in 2017 to 6,572 MUs in 2030, led by power demand from the industrial and building sectors.
- Electricity demand in the industrial sector is expected to grow at ~9.3% CAGR from 2017 until 2030 while demand from the building sector is expected to grow at ~7.2% CAGR from 2017 till 2030 to ~1,100 GWH.
- Gross power demand is expected to reach 95.88 billion units in fiscal 2024 and 123.9 BUs in fiscal 2030 growing at a CAGR of 5.5%.
- The country is expected to add 3,658 MW of hydro power generating stations by 2027.
- Bhutan's total installed capacity is expected to reach 5,291 MW by 2030 resulting in an increase of net power exports by 213% over 2017.

Bhutan: Energy Outlook 2030



- The total primary energy consumption of Bhutan is expected to grow at ~6.3% CAGR over 2018-2030 to 1,550 KTOE, led by energy consumption demand in the industrial and transport sectors.
- Biomass and electricity generated from hydro projects have around 60% share in the total primary energy consumption of Bhutan
- Power generated from **hydro** projects, which comprised more than 99% of the total installed capacity (1,614 MW) of the country in 2017, is expected to increase to 5,272 MW by 2030.
- **Biomass** demand is expected to grow at a rate of less than 1% to reach around 259 KTOE by 2030.
- Overall demand for **POL products**, which are mainly consumed by the transport sector, is expected to increase 2.4 times at a CAGR of around 7% from 2017 until 2030 with growing population of conventional vehicles.
- **Coal**, which is mainly consumed by sectors such as heavy cement and ferro-alloy-based industries, is expected to see an increase in demand from 284 kilo tonne in 2017 to around 744 kilo tonne in 2030, growing at 7.7% CAGR

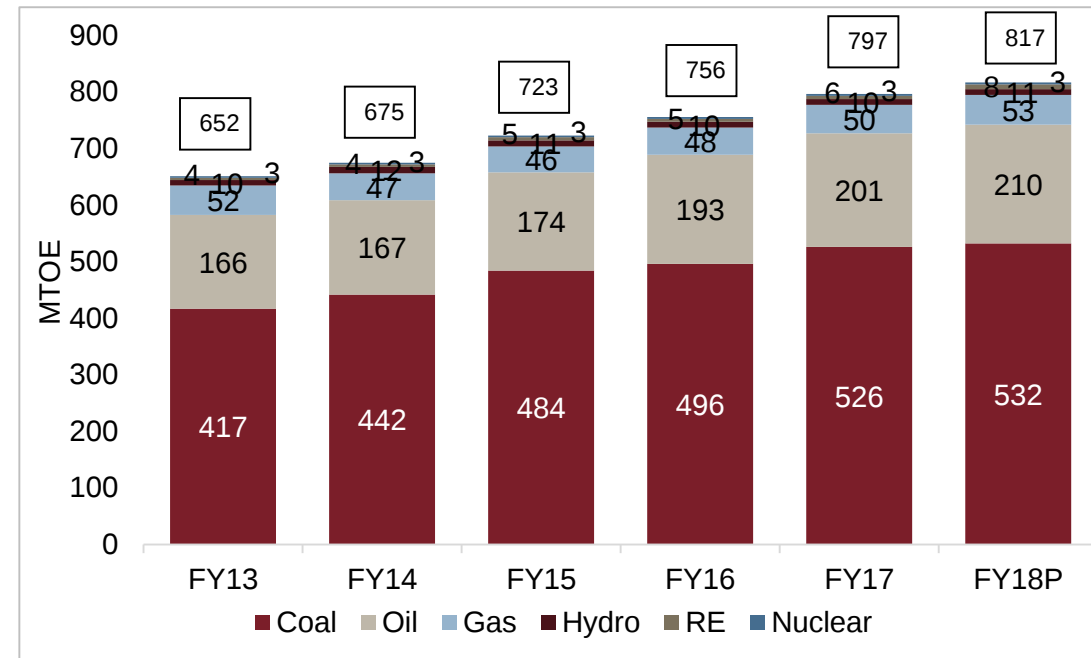
India: Introduction

COUNTRY OVERVIEW

- India, the largest economy among SAARC nations, has seen its economy grow at steady ~7% CAGR over the last five years.
- Rise in domestic consumer demand and surge in domestic and foreign investments have contributed to the country's growth momentum.

ENERGY SECTOR OVERVIEW

- The Indian energy sector has been evolving rapidly. More than 120 GW of power generation capacities have been added over the past five years, with thermal power contributing a majority share at ~73 GW.
- The government has set the renewable energy target at 175 GW by 2022.
- However, overarching dominance of fossil fuels continues to drive the energy basket of the country. Coal, oil and gas are the major contributors of primary energy.
- India's primary energy has grown steadily, from 652 MTOE in fiscal 2013 to 817 MTOE in fiscal 2018 (provisional), which is a CAGR of 4.6%.



India: Power Demand-Supply Position

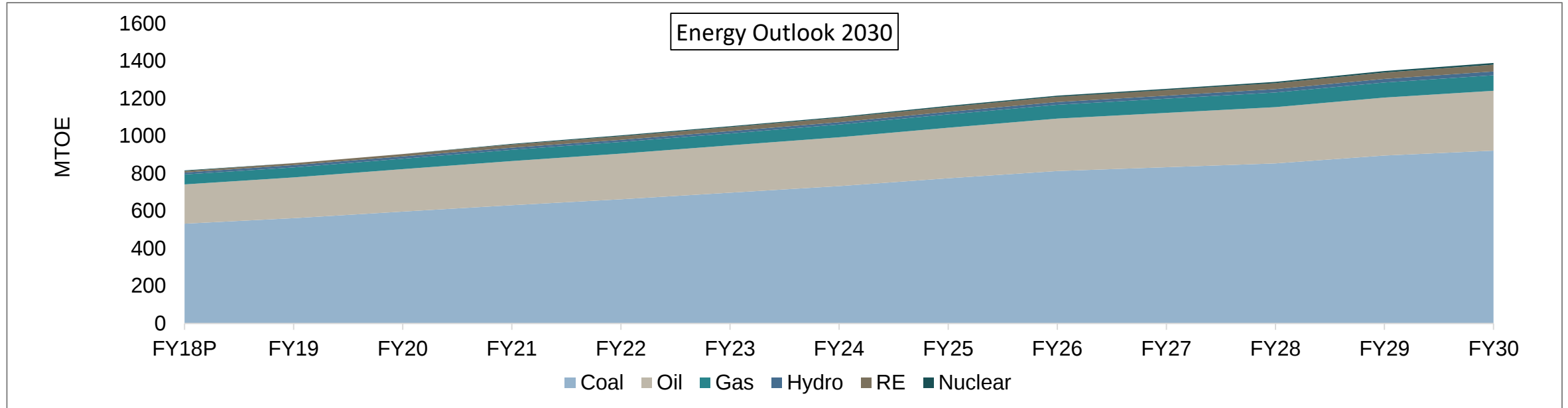
POWER DEMAND SUPPLY REVIEW

- Base demand (sum of actual consumption and T&D losses) for power rose at 5.2% CAGR to 1,230 BUs in fiscal 2018, from 953 BUs in fiscal 2013.
- Growth has been the fastest in the domestic segment, at a CAGR of 8% over fiscal 2013 to 2018 owing to strong electrification rates, rise in consumption and urbanisation. Industrial and agricultural consumption have grown at CAGRs of 4% and 6%, respectively.
- Power supply has increased to 1308 BUs from 963 BUs over a period of fiscal 2013 to fiscal 2018 at 5.6% CAGR with coal-based plants contributing to two-thirds of the total (73%).
- The total installed capacity in the country stood at ~342.7 GW as of fiscal 2018 with 56% of the plants being coal fired.
- RE penetration in the country improved from 13% in fiscal 2013 to ~20% in fiscal 2018 due to conducive policies, the government's push

POWER DEMAND SUPPLY OUTLOOK

- Power demand is expected to rise at ~6% CAGR between fiscals 2018 and 2030 led by the pick-up in industrial activity, rising disposable income and infrastructure growth.
- Demand drivers like electric vehicle penetration, expansion/new construction of metro rail projects and intensive electrification under Saubhagya scheme will improve electricity demand going forward
- India is expected to see ~327 GW of net capacity additions (new capacities minus retirement) from fiscals 2019 to 2030 with the majority coming from solar plant installations (~128 GW)
- Wind and hydro will also show strong additions with 73 GW and 34 GW, respectively
- Thermal-based projects will see strong capacity additions (~81 GW up to fiscal 2030). Gas-based plants will show bleak growth (~7.7 GW)

India: Energy Outlook 2030



- The overall energy requirement in India shall rise from 817 MTOE in fiscal 2018 to 1,392 MTOE in fiscal 2030.
- Demand for **coal**, which at present accounts for about 65% of the country's total primary energy needs, will continue to rise manifold; its usage in power is set to rise to ~1,220 million tonne by fiscal 2030.
- **Gas** demand in the country is expected to reach ~217 million metric standard cubic meter per day (mmscmd) by fiscal 2024 at a CAGR of 5% and ~252 mmscmd by fiscal 2030 at a CAGR of 2.5%, driven primarily by fertilizer and city gas distribution (CGD) sectors.
- Additional ~12 GW of **nuclear** plants expected to come up by fiscal 2030, increasing its contribution in the generation mix to 4.5-5.0% from the present 4.3%.
- **Petroleum product** consumption expected to log a subdued CAGR of 4.1% as demand gets crimped on account of rising substitution by CNG, ethanol blending, and greater focus on electric vehicles.

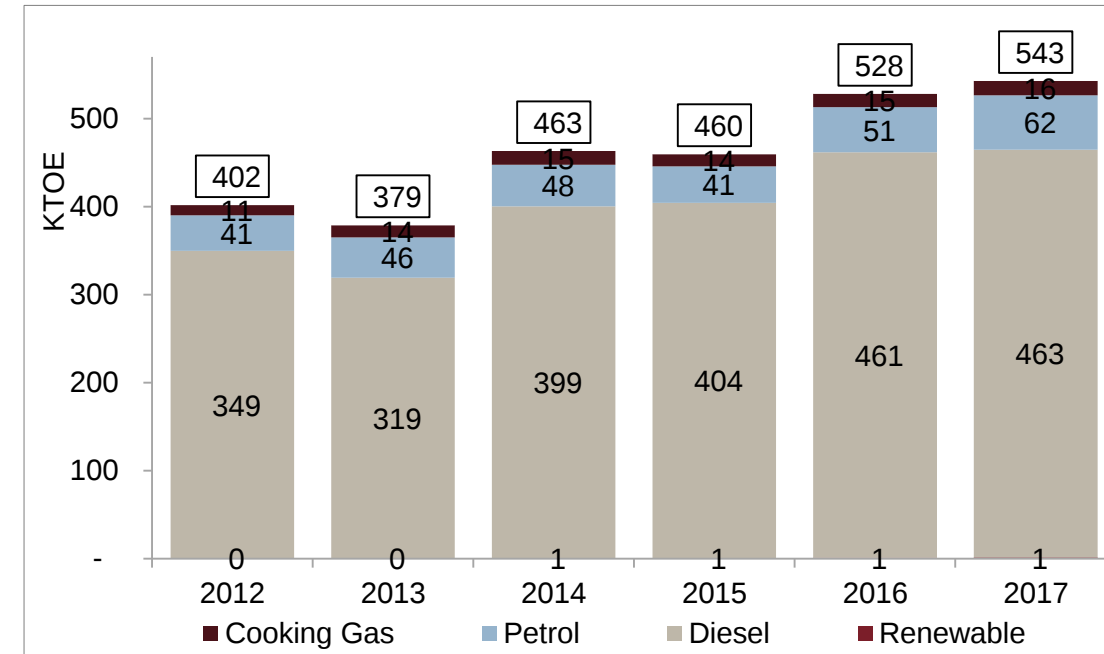
Maldives: Introduction

COUNTRY OVERVIEW

- Maldives is an island nation comprising 1,192 dispersed tropical islands grouped into 26 geographical atolls, spread over an area of 115,300 sq km and occupying 224 km with an estimated population of 352,795 in 2016.
- The real GDP of Maldives witnessed clocked 6% CAGR from 2012 to 2017 to reach MVR 66,000 million (\$4,281 million), primarily led by the construction sector growth.

ENERGY SECTOR OVERVIEW

- Maldives' energy requirement, driven by a strong GDP growth of 6% CAGR, has risen from 401 KTOE in 2012 to 542 KTOE in 2017 (excluding aviation gas), or at 6.2% CAGR.
- At present, the energy mix of Maldives comprises oil as the single largest source of energy, which includes consumption of POL products (diesel, petrol and cooking gas), with insignificant contribution from RE
- Among POL products, diesel forms the single largest energy source, accounting for ~85% of energy supply in 2017.
- The power sector is the largest consumer of diesel, with no other power generating sources in the country.



Maldives: Power Demand-Supply Position

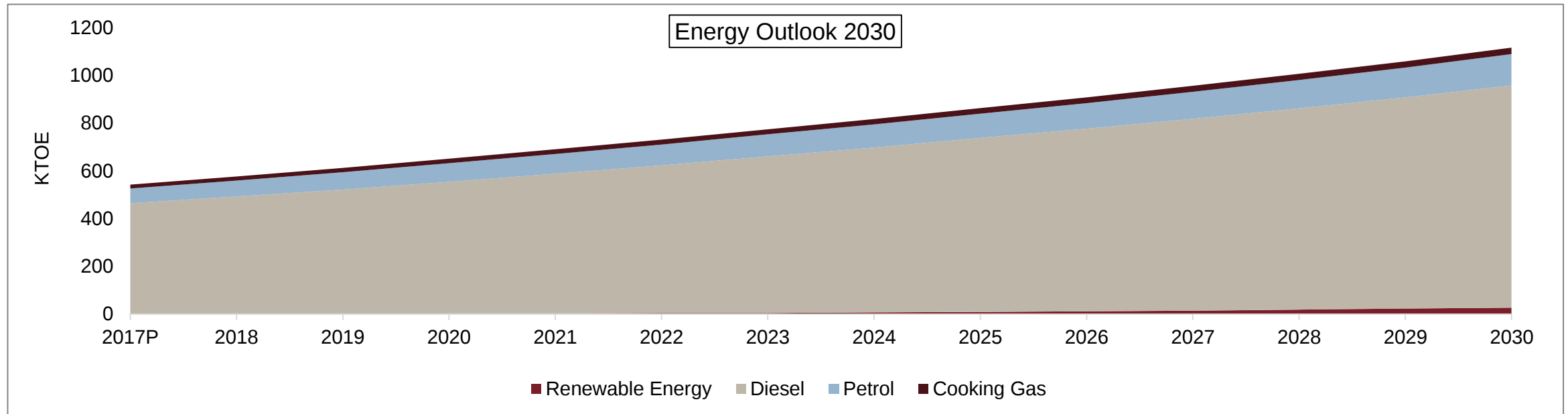
POWER DEMAND SUPPLY REVIEW

- Maldives, unlike other SAARC nations, has the distinction of having achieved provision of 24 hours electricity supply throughout the country by 2008. However, till date, diesel continues to serve as the singular source of power generation.
- Electricity generation and consumption, like the nature of the islands, happens in a dispersed manner. The country capital Malé (Malé, Villingili, and Hulhumale) is the single largest electricity producing and consuming region.
- It is estimated that the power demand for Maldives has grown at 6.8% CAGR, from 1,010 MUs in 2012 to 1,400 MU in 2017.
- The total installed capacity of the inhabited islands of Maldives stood at 223 MW in 2016, including 214 MW of diesel-based capacity and 6.7 MW of renewable energy capacity.

POWER DEMAND SUPPLY OUTLOOK

- it is estimated that power demand will grow at 6.5-7% CAGR to reach 3,171 MUs in 2030 from 1,400 MUs in 2017.
- Power generating capacity from RE plants is expected to reach 140-150 MW by 2030.
- The remaining power demand is expected to be met from diesel-based power generation which is expected to reach 930 MW.
- Electricity demand in the industrial sector is expected to grow at ~9.3% CAGR from 2017 until 2030 while demand from the building sector is expected to grow at ~7.2% CAGR from 2017 till 2030 to ~1,100 GWH.

Maldives: Energy Outlook 2030



- The overall energy demand in Maldives is expected to rise at 6% CAGR, from 543 KTOE in 2017 to 1,116 KTOE in 2030.
- **Diesel** is expected to remain the primary fuel for meeting the country's power demand. It is estimated that in addition to 214 MW of centralized installed diesel-based power capacity in inhabited islands, tourist resorts cumulatively have 260 MW of diesel-based captive power capacity.
- Demand for **cooking gas** is expected to rise, with the fuel effectively replacing kerosene as the primary energy source for cooking
- Only 10% of total electricity demand is estimated to be met from **RE** sources by 2030.

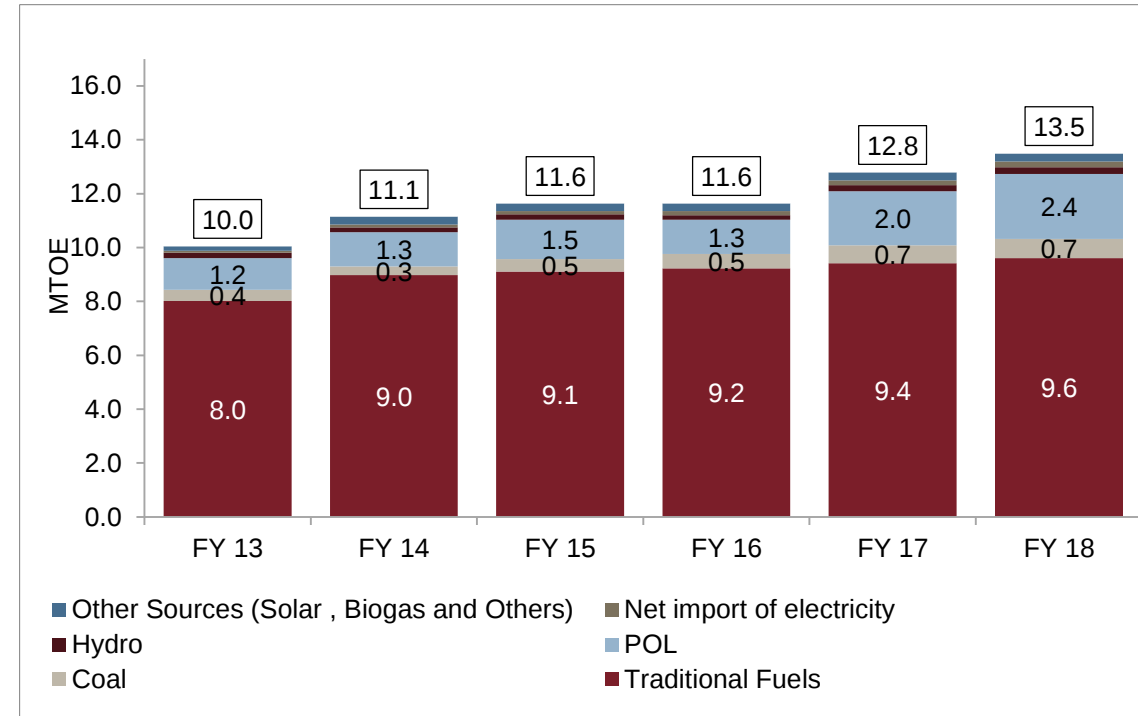
Nepal: Introduction

COUNTRY OVERVIEW

- Landlocked between India and China, Nepal's area measures ~147,181 sq km. Its population has grown at ~1.7% CAGR between fiscals 2013 and 2017. In this period, GDP has grown ~ 4.3% CAGR.
- Nepal's economy saw significant rebound from a growth rate of 0.4% in fiscal 2016 to ~7% in fiscal 2019 (provisional).

ENERGY SECTOR OVERVIEW

- Nepal's per capita energy consumption grew at ~4.5% CAGR between fiscals 2013 and 2017, to ~0.44 TOE.
- The energy supply is dominated by traditional fuels such as fuelwood, animal dung, and agricultural residue.
- Overall primary energy consumption demand grew ~7.7% CAGR between fiscals 2013 and 2015, to ~11.6 MTOE.
- Consumption stagnated in fiscal 2016. This was mainly owing to a decline in POL product imports and consumption, owing to road blockage issues. Subsequently, consumption picked up to grow at ~5.5% in fiscal 2018 on-year.



Nepal: Power Demand-Supply Position

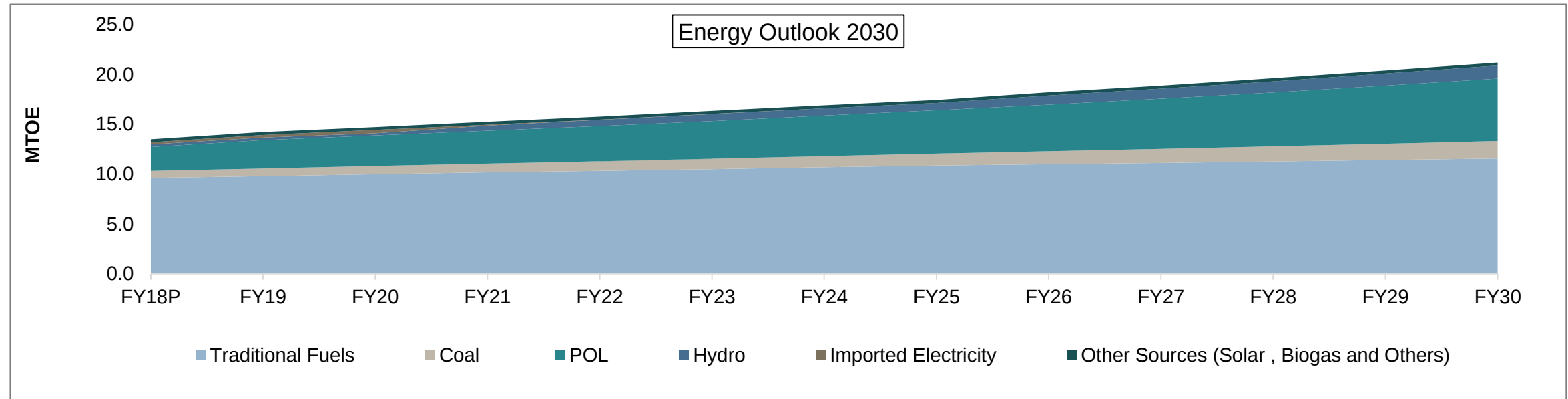
POWER DEMAND SUPPLY REVIEW

- Electricity sales in Nepal have grown ~12% CAGR between fiscals 2013 and 2018 (estimates). About 5,557 MU were sold in fiscal 2018, with residential and industrial categories accounting for ~45% and ~36% share, respectively, in the total power sales.
- Hydro stations are the key source for electricity supply, accounting for ~95% of the total power installed capacity of the country.
- In addition to hydro, solar (0.1 MW) and oil-based thermal power plants (53.4 MW) also contribute to total electricity production in Nepal
- Nepal's total power installed capacity stood at 1074.14 MW. At present, Nepal has an installed capacity of 1,020.6 MW of hydro power stations. IPP hydro power plants contribute to 512.6 MW of hydro capacity

POWER DEMAND SUPPLY OUTLOOK

- Power demand is expected to increase from ~5,557 MUs in fiscal 2018 to ~15,836 MUs in fiscal 2030, driven by rising demand from residential and industrial sectors.
- As against the total demand of ~15,836 MUs in fiscal 2030, total domestic power supply (minus system losses) is estimated at ~15,646 MUs, with total installed power capacity of ~4,457 MW
- About 3,256 MW of new hydro capacity is expected to be commissioned by Nepal by fiscal 2030. Hydro power plants to contribute ~96% share in the total installed capacity
- Present installed hydro capacity is only ~2% of the country's total potential of 43,000 MW. Development of more hydro plants will not only help Nepal meet the increasing power demand from existing consumers, but also help supply to consumers who do not have any access to electricity (which was ~40% of the population in 2017)

Nepal: Energy Outlook 2030



- The country's overall primary energy consumption is expected to reach ~21.2 MTOE by fiscal 2030, an increase of 1.6 times as compared with fiscal 2018.
- **Traditional fuels**, which met around 71% of total primary energy requirement of Nepal in fiscal 2018, are expected to see their share decline to 54% by fiscal 2030 with the share of cleaner fuels rising.
- Power supply, which is dominated by **hydro** power plants, is expected to grow by around 4.1 times to 4,457 MW during the period, mainly driven by the addition of new hydel plants.
- Growth in industrial activities is expected to increase the total **coal** demand by around 2.5 times to 2,993 kilo tonne by fiscal 2030 compared with 1206 kilo tonne in fiscal 2018.
- Consumption of **POL** products is expected to grow at a CAGR of 8.3% between fiscals 2018-2030 to reach ~6 million tonne, mainly driven by strong growth in the transport and industrial sectors led by a GDP growth of 4.5-5.0%.

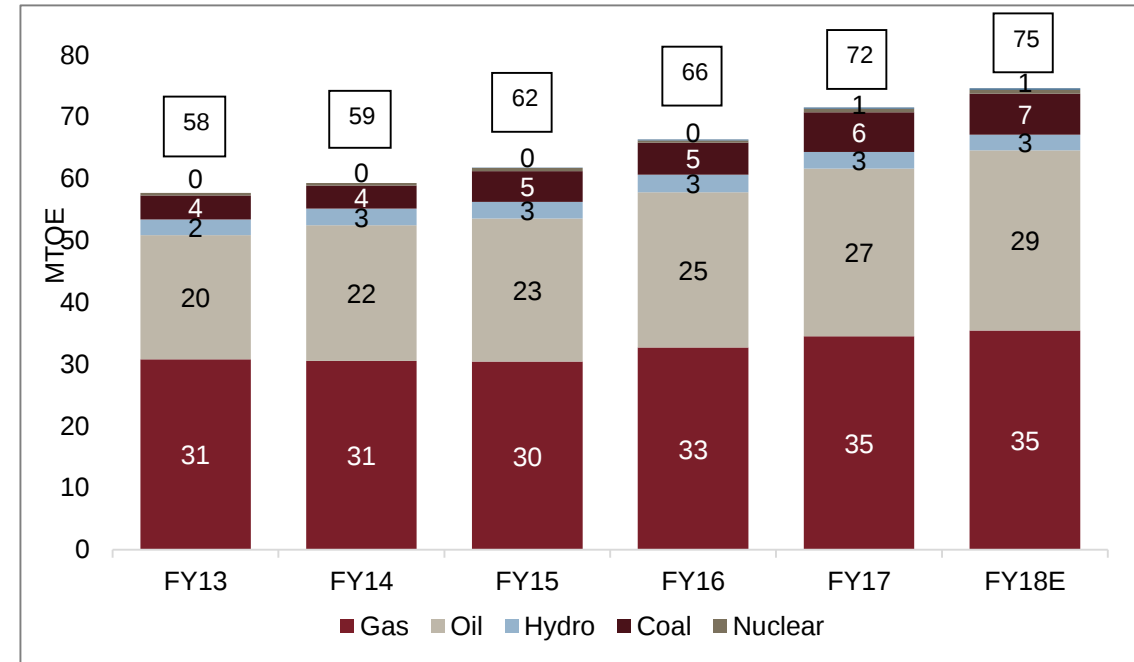
Pakistan: Introduction

COUNTRY OVERVIEW

- Pakistan has witnessed strong growth among South Asian economies, most of it is fuelled by foreign debt.
- Overdependence on fossil fuel imports has led to a weakening of its domestic currency, thereby increasing its current account deficit from 1.1% of GDP in fiscal 2013 to 2.4% of GDP in fiscal 2017).

ENERGY SECTOR OVERVIEW

- Pakistan's primary energy requirement has steadily grown from 58 MTOE in fiscal 2013 to 73 MTOE in fiscal 2018 at 5.2% CAGR.
- Domestic gas, the most significant energy source, is on the decline, making the country increasingly dependent on LNG imports to curb deficits. Pakistan has signed a 15-year agreement with Qatar to import up to 3.75 million tonne of LNG annually.
- The country is also heavily dependent on fossil fuel imports (85% of the nation's crude oil and petroleum products are imported), thereby exposing itself to global price and supply shocks.
- The country's abundant renewable energy sources continue to be unexploited with installed capacity of only ~1400 MW against a potential of >120 GW.



Pakistan: Power Demand-Supply Position

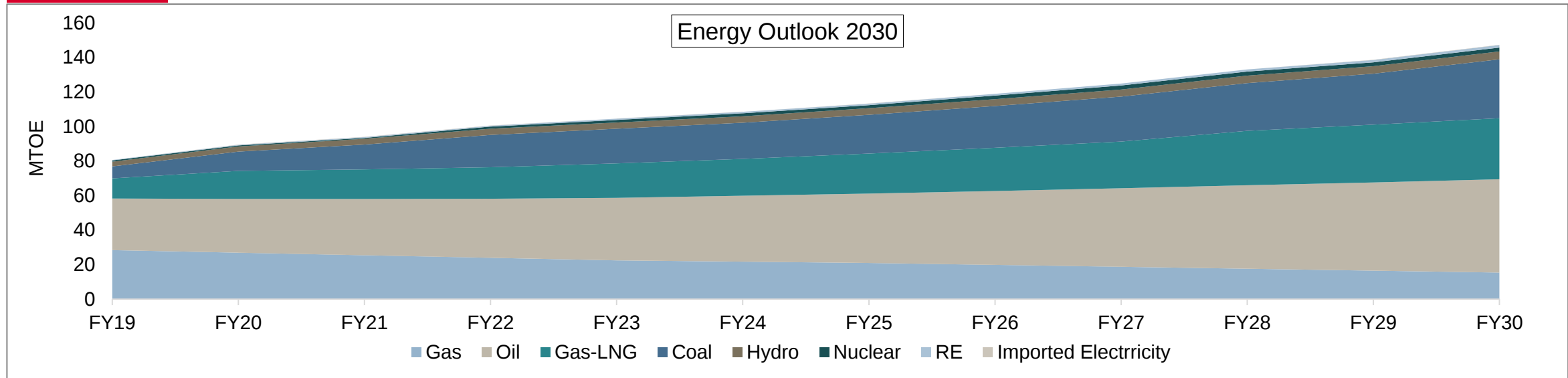
POWER DEMAND SUPPLY REVIEW

- Power demand has grown from 96,496 MUs in fiscal 2013 to 120,392 MUs in fiscal 2018 at a CAGR of 4.52%.
- A majority of power consumers (85%) belonged to the domestic category, and 12.2% to the commercial category as of fiscal 2018.
- The total installed capacity of Pakistan stood at 29,573 MW as of February, 2018 and is expected to reach 32,027 MW by the end of fiscal 2018.
- The country has significantly added fuel oil (FO) and nuclear-based power plants whereas gas-based capacity additions have remained slow. Natural gas and FO are the major fuels presently contributing ~29% each to the total mix.
- Overall annual generated electricity reached ~119,416 MUs in fiscal 2018.

POWER DEMAND SUPPLY OUTLOOK

- Overall gross power demand is expected to grow to 191,546 MUs in fiscal 2030 at a CAGR of 4%.
- Coal-based power plants are expected to contribute the maximum to new capacity additions with as many as 10 plants with a combined capacity of ~8000 MW to come up by fiscal 2030.
- ~4,700 MW of gas-based plants are expected to come up over the next decade.
- RE-based power is expected to increase six times from fiscal 2018 levels while electricity imports are expected to rise to ~1000 MUs annually

Pakistan: Energy Outlook 2030



- The overall energy requirement in Pakistan shall rise from 73 MTOE in fiscal 2018 to 147 MTOE in fiscal 2030.
- Demand for **coal** has been growing steadily to 11.58 million tonne in fiscal 2018. With more than 10 new coal-fired power plants coming up, which would utilize produce from the Thar block, the usage of the fuel is expected to grow by 4.5 times to 60 million tonne in fiscal 2030.
- **Gas** requirement (constrained) will increase marginally from 5,174 million cubic feet per day (mmcf) in fiscal 2019 to ~5,900 mmcf in fiscal 2030 on the back of power production, domestic and industrial use.
- Three new **nuclear** plants are expected to come up in the next decade, increasing power generation from 7,897 million units (MUs) in fiscal 2019 to ~27,850 MUs in fiscal 2030.
- **POL** demand will grow at a healthy 5.2% CAGR driven mainly by the transportation segment and improved economic activity.
- An additional ~8,000 MW of **solar, wind and biomass**-based power projects are expected to come up, improving RE's share in power generation to ~9% in fiscal 2030 from 2% in fiscal 2018.

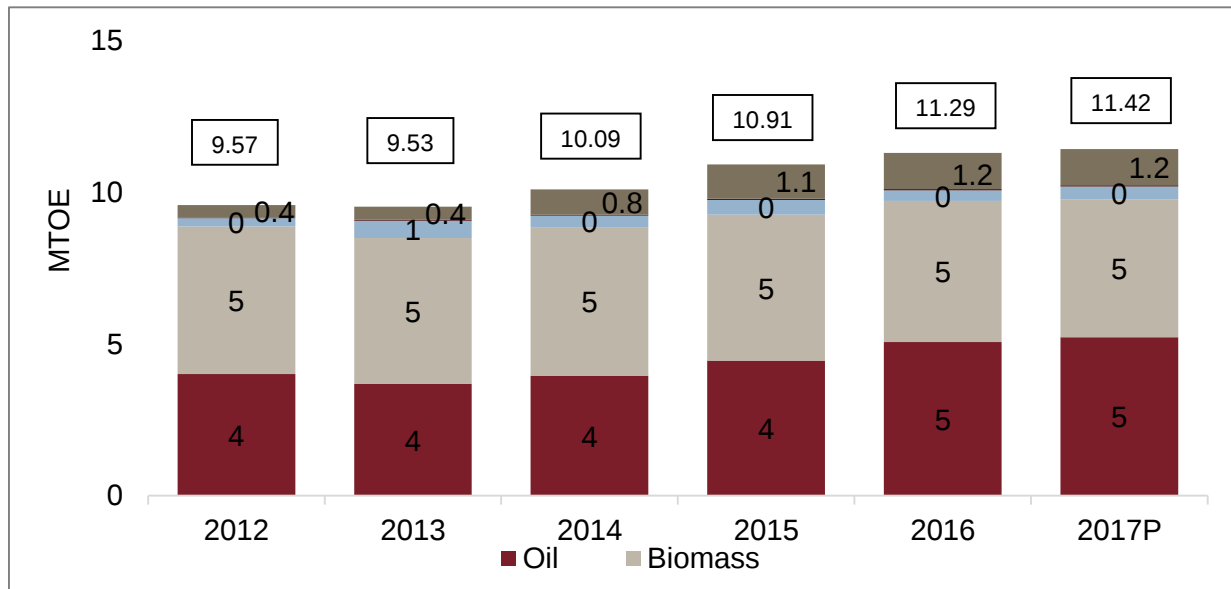
Sri Lanka: Introduction

COUNTRY OVERVIEW

- Sri Lanka is a small island nation, off the southern tip of India. The country's GDP has been growing steadily at a CAGR of 4.1% from 2013 to 2017.
- Like any other developing nation, the country's energy requirement has been rising steadily.

ENERGY SECTOR OVERVIEW

- The country is majorly dependent on imports to meet the primary energy requirement.
- On the demand side, per-capita energy use has grown from 434 TOE in 2013 to 510 TOE in 2017, a CAGR of 4.12%, which is in line with the real GDP growth of 4.15% during the same period.
- Sri Lanka's primary energy requirement has steadily grown from 9.57 MTOE in 2012 to 11.42 MTOE in fiscal 2018 at 3.6% CAGR.



Sri Lanka: Power Demand-Supply Position

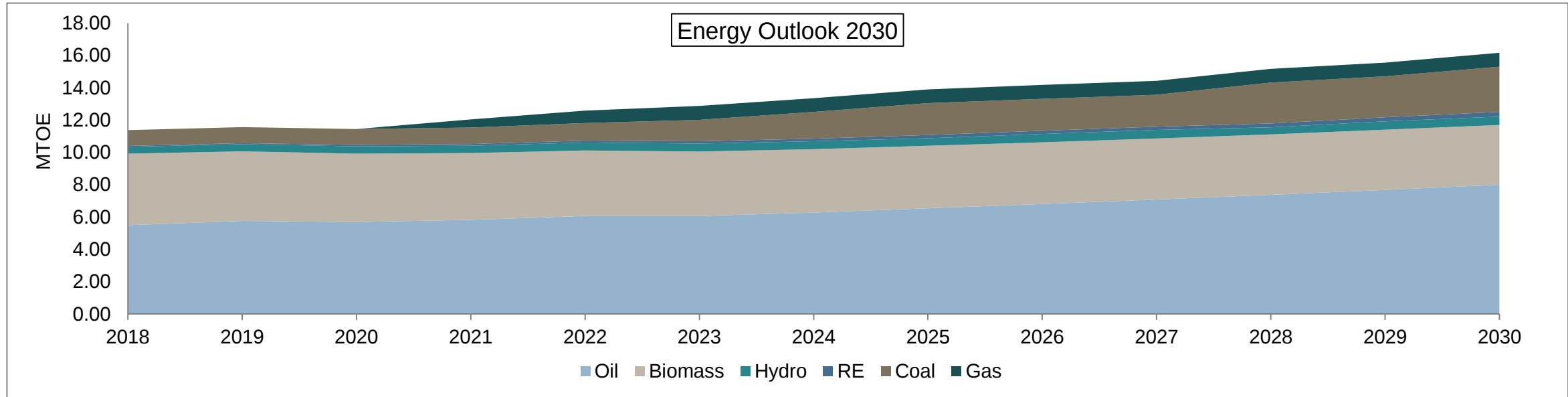
POWER DEMAND SUPPLY REVIEW

- The demand load curve grew from 11,898 MUs in 2012 to 15,258 MUs in 2017 at 5.1% CAGR.
- Sri Lanka's total installed capacity was 4,109 MW (including 50 MW of net-metered power projects) as in 2017.
- Sri Lanka transitioned from being a hydropower nation to a hydrothermal nation. However, the country has been lowering its oil-fired thermal generation from 2013 given rising global oil prices and lack of domestic oil production.
- RE generation is small in the country, with ~500 MUs produced in 2017.
- Overall, power generation rose at 5.1% CAGR from 11898 BUs in 2012 to 15239 BUs in 2017.

POWER DEMAND SUPPLY OUTLOOK

- Demand load is estimated to grow at 28,188 MUs by 2030, at a healthy 4.9% on-year.
- On the supply side, more than 3,500 MW of net installations are expected by 2030. Coal-fired thermal power will likely grow significantly, with an additional 1,000 MW of committed plants.
- Renewable generation will increase to ~12% of the generation mix by 2030 from the current 3%. Gas-based plants of ~1,000 MW will come up, with the country planning to set up import facilities, domestic storage, and regasification unit of 1.4 MTPA LNG.
- Hydro generation will improve significantly up to 2024, beyond which growth would be slow.

Sri Lanka: Energy Outlook 2030



- The overall energy requirement in Sri Lanka would rise from 11.4 MTOE in 2017 to 16.2 MTOE in 2030.
- With the entire country being electrified and no significant outages, power supply is not expected to grow significantly. Most of the electricity is sourced through hydro and gas.
- Owing to more than 1000 MW of coal fired power plants expected to come up, **coal** usage is expected to rise to ~4.91 million tonnes in fiscal 2030 from 2.08 million tonnes in 2017.
- **Natural gas** usage is expected to reach ~37.5 bcf by FY30 on the back of ~1000 MW of new gas based power plants.
- **Hydro power**, the main stay for Sri Lanka, accounted for ~33% of total generated power in 2017, however significant future growth is unlikely.
- The country is a very big consumer of **bioenergy** with ~12 million tons of bio fuel used in 2017. However, due to expected drawdowns in household and commercial use, cumulative biofuel usage will drag to ~9.7 million tonnes by fiscal 2030.

Conclusion

Energy Outlook of SMS

- Energy production in the SAARC region is predominantly sourced from fossil fuels. Coal will dominate energy production in India and Pakistan whereas Bangladesh will continue to rely on natural gas.
- Bhutan, Nepal and Sri Lanka do not produce any significant quantities of fossil fuels and hydro power is the only domestically produced energy source.
- Maldives solely relies on imports to meet its energy needs. Afghanistan (as well as Pakistan) continue to have poor energy access despite being endowed with ample renewable energy potential

Need of concerted efforts to tap RE potential and indigenous oil, gas reserves

- Efforts are being made to shift the energy mix towards cleaner fuels. With the SAARC region being rich in hydropower and renewable energy, there is ample scope for extraction of this untapped potential
- Although, discoveries of gas have been made in India, Sri Lanka and Bangladesh, more cross country engagement is required to assess commercial viability and resource exploration
- Improved sub regional energy ties through technology development, resource sharing, building energy infrastructure can enhance energy trade manifold
- Legal, policy and regulatory risks emanating from cross-border trade may be dealt with by setting up a common framework among the nations
- A regional trade treaty will help promote long-term energy cooperation. A sub regional policy agenda may be developed keeping in view future energy needs and sustainable development goals



Thank You